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INSECT CONTROL GUIDE



Shown above, southern red mite eggs overwintering on Japanese holly. Above right, are boxwood leafminer adults. These emerge in April, a good time to spray. Immediately right is an Eastern Spruce Gall Adelgid with eggs.



...are needed to provide an adequate level of control. All control scales having more than one generation per year (pine needle sawfly and white bark scale) should always be controlled.

Landscape trees and shrubs constitute a major investment and add significantly to the beauty and value of residential and commercial properties. Landscape managers need to be familiar with woody plants, their requirements for survival and vitality, and their pest problems to implement effective insect control programs.

Most native trees and shrubs on undisturbed sites suffer only rarely from ravages of insect pests. However, trees growing in landscapes are commonly stressed by lack of water (or too much water if there is poor drainage), high temperatures, compacted soils, and other factors that reduce the tree's ability to either repel or withstand insect attack without suffering decline.

Most major pests of trees and

shrubs, including various weevils, borers, scale insects, and other insects, are readily controlled with a variety of conventional insecticides or with the bacterium, *Bacillus thuringiensis*, which is commonly known as

present, whether or not it has reached a potentially damaging population level, and spot-spraying only infested plants. This approach is cost effective in terms of landscape beauty and longevity and environmental quality.

Dormant period (November-March)

Some insect and mite pests are vulnerable to control tactics after trees and shrubs have become acclimated to winter temperatures.

In the South, woody ornamentals may not become dormant until late December. Landscape managers can capitalize on this vulnerability by conducting pest control activities when other maintenance activities are not competing for their time.

...which they excrete serves as a substrate for a black sooty mold fungus that reduces the aesthetic appeal of the plant and reduces its ability to manufacture food. Many species overwinter as eggs.

Cooley spruce gall adelgid overwinter as young nymphs on the underside of branches on spruce or on the lower leaf surface of Douglas fir, the alternate host of the Cooley gall adelgid. Pine bark adelgid overwinters as eggs, nymphs and adults in bark cracks and crevices on white pine.

Adelgids can be controlled on all hosts any time after spruce galls open in late summer until just prior to bud break the following spring. Horticultural oil may reduce the overwintering population. Sevin (carbaryl) or lindane can also be used in a thorough-coverage, hydraulic spray, making sure to cover the underside of spruce branches and Douglas fir needles. A wetting agent may be useful to help penetrate the fluffy wax covering

Woody Ornamental Insect Control

by Dr. D. G. Nielsen, professor of entomology, Ohio State University, Wooster, OH and Dr. J. R. Baker, extension entomologist, North Carolina State University, Raleigh, NC

shrubs are probably opportunists that exploit hosts that have been altered by their physical environment.

Landscape managers can take advantage of the information in this article to develop strategies for controlling insect pests of woody plants. The information is organized according to seasonal insect activity. The time or times an insect is vulnerable to a direct control tactic and up-to-date insect control recommendations are provided.

Control strategies

In the past, cover sprays were often used to control any insect pests that may be present on the property, because the detrimental side effects of some pesticides were not yet known and landscape managers were not familiar enough with local pests to develop target spray programs. Many times, all trees on a property were sprayed when only a few of them harbored pest species.

Today, conscientious tree care specialists use insecticidal sprays only after determining which pest(s) is

Horticultural spray oils can be used safely on many woody plants to control overwintering eggs of spider mites and aphids and immature forms of adelgids and soft scales.

New information from Cornell University indicates that currently available horticultural oils can be used throughout the year when the temperature is above freezing. However, four cautions should be considered before using these products:

- 1 read the label to make sure the product is not phytotoxic to plants on which you intend to use it;
- 2 do not use oils at the dormant season rate in the fall before plants have become winter-hardy;
- 3 oil sprays should not be used on plants under moisture stress or when temperatures are high with high humidity;
- 4 do not apply oil sprays to tender new growth in spring.

Spruce gall and pine bark adelgids

—Adelgids are small, soft bodied insects that commonly cause pineapple-like galls to form on their spruce host(s). Eastern spruce gall adelgid and

on the insect, especially for the pine bark adelgid.

Spider Mites—Spider mites, including spruce spider mite on coniferous evergreens and southern red mites on broadleaf evergreens, suck plant juices and deposit silk and waste material on their hosts, causing foliage to become dull and bronze colored.

These mites tend to feed in spring and fall but usually die out in very hot or very cold weather. They overwinter in the egg stage which is susceptible to control with horticultural oil.

Aphids—Aphids are small, soft-bodied insects that insert their mouthparts into the phloem of leaves and stems to suck out sap. Aphids excrete honeydew, a sweet liquid which coats infested plants when they feed in groups of large numbers.

Some species (melon aphid, apple aphid) feed on the most succulent part of the plant. Other species (giant willow aphid, giant bark aphid, *Cinara* aphids) feed on stems.

High aphid populations can cause leaves to yellow and fall prematurely.



INSECT CONTROL GUIDE

Honeydew they excrete serves as a substrate for a black sooty mold fungus that reduces the aesthetic appeal of the plant and reduces its ability to manufacture food.

Many aphids overwinter as exposed eggs on conifer needles or on stems and buds of other woody plants. If a damaging aphid population was detected 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 spring and summer.

Soft Scales—Soft scales are another kind of sucking insect that hurts a tree's vitality by removing energy and reducing the tree's ability to manufacture food. They also suck sap from the phloem and produce honeydew; some of them seriously weaken or kill their hosts. Heavily infested trees and shrubs often become blackened with sooty molds.

Some overwinter as immature forms (cottony maple, cottony maple leaf, magnolia, pine tortoise, and Fletcher scales) that are vulnerable to horticultural oils used at the dormant application rate.

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 during spring is one of the most important tactics in a modern, rational insect control program. Newly expanding or expanded leaves should be checked for the presence of sucking insects, leafminers, and defoliators.

Tree limbs and trunks should be inspected to determine presence of active borer galleries. Early detection will permit time for learning the identity of the pest and determining if a spray program is justified.

Defoliators—Eastern tent caterpillar, fall cankerworm, whitemarked tussock moth, and pine sawflies are among the first defoliators to begin feeding in spring.

Eastern tent caterpillar is obvious and readily detectable because it forms a silken tent in tree crotches, especially flowering fruit and nut trees. During years of high caterpillar numbers, entire trees may be defoliated.

Sawflies are much more difficult to see since they blend in with their pine needle hosts. They often reach maturity before defoliation is noticed.

The tent caterpillars and their rela-

tives, including mimosa webworm, fall webworm, bagworm, and gypsy moth, are readily controlled with a number of conventional insecticides or with the bacterium, *Bacillus thuringiensis*, commonly known as B.t.

Sawflies are related to bees and wasps and are highly susceptible to Sevin. Orthene (acephate) is also labeled for this use.

Elm leaf beetle larvae and adults consume foliage. There are two generations each summer. Sevin, Orthene, or Turcam/Dycarb (bendiocarb) can

Spider mites are most common and damaging on plants under water stress and during droughts. They complete many generations throughout the summer.

be used when trees leaf out in spring. A second generation may require a second application in July.

Armored Scales—Armored scales are soft-bodied sucking insects that suck juices from leaves and stems but do not produce honeydew. They are called armored scales because after the first stage molts, later stages are covered by cast skins and tough wax. Consequently, armored scales are vulnerable to contact insecticides only during the crawler and settled first nymph stages.

Armored scales overwinter as eggs (pine needle scale, oystershell scale), as mated females (euonymus and white peach scales), or in more than one stage (hemlock and tea scales). As indicated, all of them are most easily controlled with crawler sprays.

Species that overwinter as eggs can usually be controlled with a single application of an insecticide, if thorough coverage is achieved. If timing of the application is not precise, a systemic insecticide like Metasystox-R (oxydemetonmethyl) or Orthene should be used.

Species like euonymus scale require more than one crawler spray, since the first hatching crawlers molt before the last spring generation eggs are laid. Three thorough-coverage, hydraulic sprays at 10 to 14 day inter-

vals are needed to provide an adequate level of control.

All armored scales having more than one generation per year (pine needle, euonymus and white peach scales) should always be controlled during the spring crawler hatch. This is because the hatching period is shorter at that time, so fewer sprays are required to provide control.

Horticultural oils are effective for armored scale control, but use the summer rate only after new plant growth has emerged and hardened off a little.

Aphids—Aphid populations can explode in a short time, since a new generation can be produced every 10 to 15 days in the North and even faster in the South.

In the North, aphids are often at high population density during summer droughts, or just after a drought period, and should be controlled before they cause premature leaf drop.

In the South, aphid populations are often high in early spring before lady beetles and other predators become active. However, crape myrtle aphid populations often become damaging later the growing season.

Mistblower application is excellent against free-living aphids.

Adelgids—Remember, overwintering forms can be controlled by using a hydraulic application of lindane or Sevin, stressing coverage to the underside of branches and leaves, before bud break. After bud break, adelgids on spruce are protected as their galls form. They become vulnerable again in fall after their galls open.

Leafminers—Birch, boxwood, and holly leafminers are highly specialized insects that in the larval stages damage trees and shrubs by destroying tissue within the leaf.

Birch leafminer is a sawfly (closely related to bees and wasps) that emerges as adults in May. Foliage can be protected by spraying when the adult sawflies are actively mating and feeding on birch trees. Sevin, malathion, and lindane are effective before eggs are laid within leaf tissue.

After egg laying has begun or mines have begun to form, a systemic insecticide should be used. Metasystox-R, Orthene, and Cygon (dimethoate) are labeled for this use.

There are several generations per year, but the first two generations seem to be most destructive.

Holly leafminer is a true fly that has only one generation per year. Spring application of Metasystox-R or Orthene after the new plant growth has hardened off is necessary

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to achieve control.

Boxwood leafminer is a gall midge which also has one generation per year. A mid to late spring application of Cygon will adequately control boxwood leafminer.

Spider Mites—Spider mites are also most common and damaging on plants under water stress and during droughts. They complete many generations throughout the summer.

Kelthane (dicofol), Mavrik (fluvalinate), or another miticide should be used before mites cause foliage to turn bronze. A hydraulic sprayer must be used to maximize coverage, especially on plants with dense foliage, including foundation plantings, conifers, and other evergreens.

Two sprays must be used at a 7 to 10 day interval, since most miticides do not kill eggs. A single application will usually not be effective against spider mites.

Root Weevils—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 girdle larger roots, sometimes causing death of foundation plants, including rhododendron, azaleas, and yews (taxus).

Spray foliage with Orthene or Turcam/Dycarb in mid-June, followed by repeat applications at three to four week intervals until August. Level of control is directly related to the degree of coverage, so use a hydraulic sprayer to control root weevils. Drenching soil beneath host plants may help reduce larval populations.

Borers—Clearwing moth borers are common in lilac, ash, dogwood, rhododendron, oak, and flowering cherries. Flatheaded borers (adults are called metallic wood borers) are common in white-barked birches, oaks, and other stressed hardwoods.

Larvae do the damage by feeding beneath bark, disrupting movement of food and water, destroying the cambium (the growth layer of cells), and causing structural weakness. Clearwing presence and flight periods can be monitored with pheromone traps.

A single, thorough-coverage bark spray of Dursban (chlorpyrifos) or lindane, 10 to 14 days after first male moth capture, will provide season-long control of most clearwing moths. Three applications of bark/foliage sprays with Turcam/Dycarb, Dursban, or Lindane are required to control flatheaded borers.

Summer (July-September)

Defoliators—Mimosa webworm, bag-

worm, fall webworm, Japanese beetle adults, and second generation elm leaf beetles sometimes become common in early summer.

All of these pests should be controlled when larvae are small to minimize damage and maximize effectiveness of the insecticide. Caterpillars can be controlled with one of the B.t. formulations. Sevin, Orthene, Turcam/Dycarb, and several other common insecticides will also control these pests. Mistblower application may be most cost-effective but may result in unacceptable drift of insecticides, because they are not protected by cast skins. Sprays to control soft scales should always be applied after all eggs have hatched to minimize the impact of pesticides on lady beetles and other predaceous insects, to minimize insecticide usage, and to maximize control.

Monitoring trees and shrubs during spring is one of the most important tactics in a modern rational insect control program. Check new leaves for sucking insects, leafminers, and defoliators.

ticidal sprays, especially in windy weather.

Japanese beetle adults defoliate many kinds of woody plants and roses. They are most easily controlled with weekly sprays of Sevin or Turcam/Dycarb. Japanese beetle traps can be used to capture large numbers of beetles, but they do not reduce defoliation or control the beetle population. Grub control is much more effective for reducing numbers of Japanese beetle adults.

Second generation elm leaf beetles can cause significant defoliation if heavily infested trees are not sprayed.

Birch leafminer can be controlled, if trees are sprayed when second or third generation adults are mating and ovipositing.

Scales—Crawlers of several soft scales (Fletcher, cottony maple, cottony maple leaf, pine tortoise, wax and tulip tree) hatch in late June or early July (earlier in the South). crawlers and settled nymphs are susceptible to scalicides (Sevin, Orthene, Diazinon, Dursban, and Turcam/Dycarb) in early July. A single, thorough-coverage, hydraulic spray should provide control.

Settled nymphs and other nymphal stages are vulnerable to contact insecticides, because they are not protected by cast skins. Sprays to control soft scales should always be applied after all eggs have hatched to minimize the impact of pesticides on lady beetles and other predaceous insects, to minimize insecticide usage, and to maximize control.

Second generation pine needle scale, euonymus scale, and white peach scale crawlers hatch during July and early August. Two sprays at a 10-day interval may be required to control pine needle scale and white peach scale because crawlers hatch over a three week period. Summer generation euonymus scale crawlers hatch over a longer period, so three applications at 10-day intervals are required.

Aphids—Aphid populations should be controlled before they secrete copious amounts of honeydew or do irreversible damage to leaves. If aphids are allowed to build-up in high numbers, plant growth may be distorted and leaves may fall prematurely. Once sooty molds are established they may persist long after aphids have been controlled by pesticides or natural enemies. Aphids are vulnerable to contact sprays whenever they are active.

Spider Mites—Spider mites can be controlled whenever they are active by spraying twice with a 5-day (South) or 10-day (North) interval. If trees are receiving repeated applications of Sevin to control other insects, be especially watchful for build-up of spider mites. Sevin selectively kills natural enemies of mites, thereby contributing to increases in spider mite populations.

Root Weevils—The second and third applications of black vine weevil adulticides should be applied in July and August. In the South, Japanese weevils and Fuller rose beetles can be controlled with Orthene as a spray and drench during July. A single spring application will not control black vine weevils or other weevils mentioned earlier.

Borers—White-barked birches determined to be infested by bronze birch borer during the summer can be injected with Inject-A-Cide B (Bidrin) using microinjection procedures developed by the J. J. Mauget Company. Injection must be done by a skilled technician in early July or early August.

Infested trees should be watered weekly during summer and fall drought and fertilized in the fall after the first hard frost. The following year, bark/foliage sprays should be

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Insecticide Directory

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aspon	Aspon	Stauffer	251
Bt	Thuricide	Sandoz	252
	Dipel	Abbot Labs	253
	SOK Bt	Tuco/Upjohn	254
bendiocarb	Turcam	Nor-Am	255
carbaryl	Sevin	Union Carbide	256
chlorpyrifos	Dursban	Dow	257
diazinon	Diazinon Sarolex	Ciba Geigy	258
dicofol	Kelthane	Rohm and Haas	259
dicrotophos	Bidrin	Shell	260
dimethoate	Cygon	American Cyanamid	261
dinocap	Karathane	Rohm and Haas	262
dioxathion	Deltic	Nor-Am	263
dymet	Dymet	Mallinckrodt	264
ethoprop	Mocap Nematicide/ Insecticide	Rhone Poulenc O.M. Scott	265
			266
fenamiphos	Nemacur	Mobay	267
fembutatin-oxide	Vendex	Shell	268
fenvalarate	Pydrin	Shell	269
isofenphos	Oftanol	Mobay	270
malathion	Malathion	American Cyanamid	271
methiocarb	Mesuroil	Mobay	272
methomyl	Nudrin Lannate	Shell Du Pont	273
			274
methoxychlor	Marlate	Kincaid	275
naled	Dibrom	Chevron	276
oxydemeton-methyl	Metasystox	Mobay	277
phosmet	Imidan	Stauffer	279
oxythioquinox	Imidan	Stauffer	279
propoxur	Baygon	Mobay	280
trichlorfon	Dylox Proxol	Mobay TUCO/Upjohn	281
			282

mented as indicated earlier. Injection should not be used as an annual, preventive tactic.

Peachtree borer can be controlled with a single application of Dursban or Lindane in early July (in the North, late August in the South). The second application for control of lesser peach tree borer should also be applied at this time to infested flowering cherries.

Fall (September-October)

Defoliators—Mimosa and fall web-

worms reach their highest population density and cause most defoliation during late summer and early fall. They should be controlled as soon as first generation larval webs are detected in early summer.

However, both pests are susceptible to larvicides in late August and early September. If B.t. is to be used, it must be applied when larvae are small to achieve an acceptable level of control.

Scales—Magnolia scale crawlers hatch and tulip tree scales are born in

late August and early September. Infested magnolias should be sprayed when goldenrod is in full bloom (early September). A single, thorough coverage, hydraulic spray with Orthene or Sevin will provide excellent control. Magnolias and tulip trees may be killed by heavy infestations of these scales.

Gall Adelgids—Galls on spruce caused by eastern and Cooley spruce gall adelgids turn brown and open in August and September. After galls open, adelgids are vulnerable to contact insecticides. Remember, adelgids on spruce, Douglas fir, and pine remain vulnerable to insecticidal sprays until the following spring when new buds open.

Root Weevils—Attempts to control root weevil larvae should be made in early September and early October. Two drenches with Turcam/Dycarb have been effective against larvae established in soil surrounding roots of field plants. A single drench with Turcam/Dycarb, Orthene, or Furadan (carbofuran) controls larvae infesting containerized plants. Recent evidence indicates that overwintered larvae may also be susceptible to drenches in early spring.

Closing thought

Throughout this article we have stressed the importance of proper timing and thorough coverage for achieving a high level of insect control. Coverage and timing are often more important than the insecticide or miticide used. So, make sure of proper pest identification, determine when it is most vulnerable to control, and apply a pesticidal spray thoroughly to only infested trees following label directions.

All conventional insecticides are poisons, but they can be used safely and effectively by well-informed practitioners. **WT&T**

FOOTNOTE

1—Insecticides labeled for use against pests mentioned in this article are listed in two Extension Service Publications. The first is "Insect and Mite Control on Woody ornamentals and Selected Perennials," Ohio Cooperative Extension Service Bulletin #504. This manual is available for \$3.50 from Extension Publications Office, The Ohio State University, 2120 Fyffe Road, Columbus, OH 43210-1099. The second publication is the "1985 North Carolina Agricultural Chemicals Manual" which is available for \$7.50 from Agricultural Communications, Box 7603, Raleigh, North Carolina 27695-7603.

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L245 HC	21	3	Standard
L2250	21	3	Mechanical shuttle-shift (8x7)
L2550	23.5	3	Mechanical shuttle-shift (8x7)
L2850	27	4	Mechanical shuttle-shift (8x7)
L345	29	4	Standard
L355 SS	29	4	Hydraulic shuttle-shift
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L4150	40	5	

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PROBLEM SOLVERS

by Balakrishna Rao, Ph.D.

Help for white ash

Problem: I have a forty-foot white ash in my front yard. For the last three years, as the leaves develop in the spring, the ends of the leaves will curl up, turn brown and then completely fall off. New leaves then form. This year, the process has gone on longer than usual and it now covers the entire tree. Inside the fallen leaves where the brown portion is, there seems to be a web and some type of critter. Is the white ash worth saving? Can it be saved? What can I do other than to have an expensive spraying of a tree that size? Please advise of your recommendations. (North Carolina)

Solution: From the above description of symptoms on ash, it appears that you are dealing with a fungal disease and possibly an insect-related problem. The leaf distortion, discoloration and defoliation you have described appears to be related to a fungal leaf spot or blotch anthracnose disease caused by *Gloeosporium* sp. This disease is widespread in the United States. Areas of leaves, primarily along the edge, turn brown and premature defoliation can result.

Since the disease was prevalent the past three years, if moist spring conditions occur in your area this year, the disease may reoccur. Therefore, consider applying either zineb or Benlate fungicides starting at bud break, and repeated twice at 7-to 10-day intervals to manage the disease.

If the tree defoliates prematurely, collect and destroy the leaves. This practice is usually sufficient to keep leaf spot disease at a minimum. As far as the possible insect problem, it is difficult to identify the causal insect and give recommendations with the information we have now. Therefore, if it happens again this year, send samples to your local extension agents for proper diagnosis and recommendations.

I do feel that it would be worth saving the ash tree and it can be saved from the above disease. Usually, because of repeated disorder and defoliation, the tree will become weak and begin to decline. Therefore, keep this plant under good care by proper watering and fertilizing as needed by soil testing to improve its vitality.

In addition to the recommended fungicides, spraying should help manage the problem in the future.

Borer control on dogwood

Problem: We have a problem of controlling borers on dogwood. Would you please give recommendations to control these? (New York)

Solution: Wherever dogwoods are being grown, borers are usually a major problem. Reports indicate that there are at least seven kinds of borers that can attack dogwoods. The most destructive among these are the flat-headed borer, *Chrysobothris femorata*, and the dogwood borer, *Synanthedon scitula*.

To control these, treat the trunk and lower branches with insecticides, such as Dursban, Thiodan or lindane during early May, and repeat applications three times at 3-week intervals. Read the label and follow the directions for best results. Keep the plants under good care by watering and fertilizing as needed to improve vitality.

Don't stress plants

Problem: Last year, we have treated a number of large commercial sites with Embark growth regulator during early spring. To our surprise, its effect did not last longer than three to four weeks after application. To save time, we have applied Embark along with broadleaf herbicides and fertilizer. Do you think this might have affected the result? What did we do wrong? I'd appreciate your comments. (New York)

Solution: An application of Embark growth regulator, along with fertilizer and broadleaf herbicides, would be stressful to plants and can affect the result of Embark. Although your approach is good for a time saving purpose, it is usually not done that way. The fertilizer stimulates growth and maintains color, while the growth regulator will do the opposite. Thus, they are working against each other. This would reduce the effectiveness of Embark from six weeks to three weeks.

Ideally, apply fertilizer when the turf is actively growing, wait for two weeks to let the turfgrass grow, then apply Embark to get good results.

Dry lime application best

Problem: We have a problem of maintaining large trees in a zoo area with low pH soil. Would you please comment on how to apply lime to increase pH in this situation? Can we use liquid lime and inject it around trees? (Missouri)

Solution: Although not impossible, it would be a difficult job to apply lime around trees. Surface applications of dry formulations of ground agricultural lime and postwatering to move the material would be the best approach. Liquid lime needs good agitation and may require lots of water to get good results. Injecting this around trees is a good idea; however, I am not familiar with any published research on this subject.



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Questions should be mailed to Problem Solver, Weeds Trees & Turf, 7500 Old Oak Boulevard, Cleveland, Ohio 44130. Please allow 2-3 months for an answer to appear in the magazine.