Dr. Hugh Smith, Dr. Richard Cowles, and Rose Hiskes
Department of Entomology
The Connecticut Agricultural Experiment Station
123 Huntington Street, P. O. Box 1106
New Haven, CT 06504

Phone: (203) 974-8600
Fax: (203) 974-8502
Email: Hugh.Smith@ct.gov
Website: www.ct.gov/caes

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Scale Insect Pests of Connecticut Trees and Ornamentals

Scale insects are among the most difficult pests of woody ornamentals to manage. There are several types of scale insect, although the most common scale pests for Connecticut growers are armored scales (Diaspididae), soft scales (Coccidae) and mealybugs (Pseudococcidae). Armored scales tend to be smaller (2-3 mm) than soft scales (5-10 mm) and often appear as though they are part of the plant, making them difficult to detect. Armored scales secrete a hard covering that helps protect them from insecticides and natural enemies, and prevents them from drying out. This covering can be pried away from the scale body with the tip of a blade or an insect pin. Common armored scale pests in Connecticut include elongate hemlock scale on hemlock and fir trees, white prunicola scale on many hosts including almond, cherry, lilac and privet, and euonymus scale on euonymus, privet and other hosts. Soft scales produce a hard layer of wax on their outermost skin that provides protection. Unlike armored scales, this outer covering cannot easily be removed from soft scales. Common soft scale pests in Connecticut include the cottony camellia scale on holly, yew and euonymus, Fletcher scale on arbor-vitae and yew, and tuliptree scale on linden, magnolia and other hosts. Mealybugs are covered with cottony waxy filaments. Common mealybug pests of Connecticut ornamentals include the taxus mealybug on yew, and the apple mealybug and the Comstock mealybug, both of which attack many hosts. Common scale pests of Connecticut and their hosts are presented in Table 1.

Life cycle. Depending on the species, scale insects can overwinter as eggs, immatures, or adults. Females lay eggs beneath the scale covering or in a cottony mass. Some scale species have one generation per year; some species have a few or several generations per year. First stage immatures, called crawlers, emerge from eggs in spring and move to a feeding site. Crawler emergence usually lasts 2-4 weeks. For species with multiple generations per year, there are repeated emergences in the warmer weather. Once scale crawlers settle to feed, they become immobile. When the crawler molts into the second stage immature, it begins to produce the protective scale covering. Mealybugs are distinct from most other types of scale insect in that they remain mobile throughout their development. Adult male scales and mealybugs are delicate fly-like creatures that live a short time and are rarely observed.

Damage. Even low density scale and mealybug infestations cause aesthetic

damage and can make plants unmarketable. Scale insects have piercing-sucking, straw-like mouthparts which they use to feed on plant fluids. Heavy infestations can debilitate plants, causing yellowing of leaves, leaf die-back and death of the plant. Soft scales and mealybugs can produce copious amounts of honeydew, a sugar-rich excretion which makes plants sticky and serves as a substrate for sooty mold. In extreme cases, the sooty mold interferes with photosynthesis and trees shed the blackened leaves. Ants are attracted to honeydew, on which they feed. Certain ant species will tend and protect colonies of scales in order to make use of the honeydew. Because ants will move scales from infested to uninfested plants, and will protect scales from their natural enemies, the first step in managing honeydew-producing scales is to eliminate their associated ants. Armored scales are often associated with decline or dieback of their hosts, which may be triggered by their injection of toxic saliva while feeding. The beech scale causes long-term changes in the bark which leads to eventual fungal infection causing an often-lethal canker.

Monitoring. Incipient scale infestations can be monitored by visual inspection of the plant. Depending on the host and the behavior of the scale species, scales can be found in bark crevices, twig crotches, leaf veins or other locations on the plant. Black electrical tape can be placed around twigs or branches near a scale infestation in order to track the emergence of crawlers. Wrap the tape with the sticky side facing in and double back to expose the adhesive on the outer surface, then double the tape over on itself one last time to leave a small handle to permit unwrapping the trap to observe the trapped insects. Crawlers will appear on tape as yellowish, flattened insects about the size of a period on printed text. Beating foliage by hand onto a light-colored surface will dislodge crawlers and make them easier to detect. Plants and crawler traps should be checked at least once a week. A hand lens is useful for observing crawlers.

When scouting for scales insects it is important to look for evidence of natural enemies. Scales have many naturally-occurring enemies, including predators such as ladybird beetles and lacewings, and tiny parasitic wasps that lay eggs inside the scale. Ragged remnants of scales are good evidence of predation, while neat circular holes in the scale are evidence that a parasitoid emerged. While parasitic wasps are not often observed, it is not unusual to see ladybird beetles and other predators associated with scale infestations. Beating samples are useful for finding scale predators, parasites, and even scale crawlers. If scouting reveals the activity of natural enemies on scales, it is advisable to delay the application of insecticides, and to continue monitoring to determine if natural enemies will suppress the infestation. Options most compatible with integrating biological and chemical control of scales are (1) to apply a root- or trunk-absorbed systemic insecticide to limit the insecticide exposure of the beneficials, or (2) to apply a selective, insect growth regulator class of insecticide registered for control of scales (see below).

Management. *Cryptolaemus montrouzieri* and *Lindorus lophanthae* are species of ladybird beetle that are commercially available for the suppression of soft scales and mealybugs. Naturally-occurring and naturalized species of *Chilocorus* ladybird beetles will attack armored and other scale insects. Parasitic wasps are also available commercially for suppression of scales. However, naturally occurring populations of parasites usually will colonize sizable scale

populations without having to make artificial releases. Under favorable conditions, natural enemies can help keep scale populations below economically-damaging levels. Natural enemies purchased from commercial suppliers tend to work best in enclosed environments, such as greenhouses, and when pest populations are low. Natural enemies are easily decimated by many commonly used insecticides. Broad spectrum insecticides such as acephate, bifenthrin, carbaryl, chlorpyrifos, cyfluthrin, dimethoate and malathion are not compatible with an integrated approach to managing scales or other arthropod pests. Low density scale infestations that are being kept in check by natural enemies can flare out of control if insecticides are used inappropriately.

The crawler stage is most susceptible to insecticides because it lacks a well-developed protective scale cover. Furthermore, the mobility of crawlers can bring them into contact with insecticide residues on plant surfaces. For this reason it is crucial to time insecticide applications with crawler emergence and activity. Dormant stage horticultural oils are used to suffocate all stage of scale insect, and are typically applied in the late winter or early spring when plants are not actively growing. Dormant oils may discolor some species of evergreen tree, and should only be applied when temperatures are above 40° F (4.4° C). A partial list of insecticides that can be used in Connecticut to manage scale insects is presented in Table 2.

Properties of insecticides registered for managing scales

The contact insecticides, horticultural oil and insecticidal soap, are only effective when they thoroughly wet the surface of the scale insect. While horticultural oil will kill through suffocation any stage of scale that is adequately covered, insecticidal soap may only be effective against those scales that are less protected by a well-developed scale cover. Some armored scales are not adequately controlled with horticultural oil, possibly because there may be an air gap between the scale cover and the live insect, which would protect it from suffocation.

Residual broad-spectrum insecticides (carbaryl, chlorpyrifos, and malathion) are generally not compatible with integrated management of scale or mealybug populations, although they may be effective on their own. The very long residual pyrethroids, bifenthrin, lambda-cyhalothrin, and cyfluthrin are of special value because one thorough spray can disrupt a season of crawler activity. Cyfluthrin is especially disruptive to IPM programs because it kills spider mite predators while not being toxic to mites; as a result, use of this product by itself or in a mixture with imidacloprid is likely to cause rust mite and spider mite outbreaks.

Systemic organophosphate insecticides (acephate and dimethoate) have been supplanted by the neonicotinoid class of insecticides (acetamiprid, clothianidin, dinotefuran, imidacloprid and thiamethoxam). The organophosphates are much more toxic to the applicator, birds, and fish, and so the U.S. EPA has been gradually limiting their use. The neonicotinoids can be subdivided into two categories, based upon their degree of systematicity. Imidacloprid, clothianidin and thiamethoxam have limited mobility in plants, and should only be used to target those species of scales (and other sucking insects) that produce honeydew. Acetamiprid and dinotefuran have much greater solubility, and so they can be used to target armored scales. Dinotefuran has an unusual property allowing it to penetrate

bark following a bark spray and be translocated to the feeding site of armored scales; it is especially useful for targeting scales feeding in hidden locations on plants (such as Maskell scales on pines) or for reaching scales on hard-to-spray trees.

Buprofezin, fenoxycarb, and pyriproxifen are insect growth regulator insecticides, with varying impact on the predators and parasitoid natural enemies of scales. Buprofezin is reported to have minimal impact on ladybird beetles and parasitoids, while pyriproxifen has successfully been used in combination with parasitoids for integrated scale management.

Table 1. Primary scale pests of ornamentals in Connecticut and their hosts (Adapted from K. Welch and T. Abbey, Pesticide Guide Toward Integrated Pest Management for Connecticut Nurseries 2006)

Soft scales		
azalea bark scale	*Eriococcus azaleae*	*Pieris japonica, Populus, Rhododendron, Salix*
beech scale	*Cryptococcus fagisuga*	*Fagus*
calico scale	*Eulecanium cerasorum.*	*Pyracantha*
cottony camellia (taxus) scale	*Pulvinaria floccifera*	*Euonymus alatus, Ilex verticellata, Taxus*
cottony maple scale	*Pulvinaria innumerabilis*	*Acer, Celtis occidentalis Cornus, Crataegus, Euonymus, Fagus, Gleditsia tricanthus, Morus, Platanus occidentales, Populus, Rosa, Salix, Spiraea, Prunus persica, Pyris comunis, Quercus, Syringa, Tilia, Ulmus*
cottony maple leaf scale	*Pulvinaria acericola*	*Acer, Cornus, Lonicera, Nyssa sylvatica, Pieris japonica*
European fruit lecanium	*Parthenolecanium corni*	*Acer, Cercis canadensis, Populus, Quercus, Ulmus*
Fletcher scale	*Parthenolecanium fletcheri*	*Taxus, Thuja*
Greenhouse orthezia	*Orthezia insignis (an ensign scale)*	polyphagous
large hickory lecanium	*Eulecanium caryae*	*Betula, Carya, Celtis occidentalis, Fagus, Gleditsia tricanthus, Juglans, Malus, Morus, Platanus occidentalis, Prunus persica, Quercus, Salix*
magnolia scale	*Neolecanium cornuparvum*	*Magnolia, Wisteria*
pine tortoise scale	*Toumeyella parvicornis*	*Pinus*
spruce bud scale	*Physokermes piceae*	*Picea*
terrapin scale	*Mesolecanium nigrofasciatum*	*Betula, Cercis canadensis, Crataegus,Morus, Platanus occidentalis, Populus, Prunus amygdalus, Prunus, Tilia*
tuliptree scale	*Toumeyella liriodendri*	*Hypericula cistifolium, Magnolia, Tilia*
Armored scales		
circular hemlock scale	*Nuculaspis tsugae*	*Tsuga*
elongate hemlock	*Fiorinia externa*	*Abies, Picea, Tsuga*
euonymus scale	*Unaspis euonymi*	*Daphne, Euonymus, Ligustrum, Lonicera, Syringa*
fern scale	*Pinnaspis aspidistrae.*	*Filices*
juniper scale	*Carulaspis juniperi*	*Calocedrus, Chamaecyparis, Juniperus, Thuja*
oleander scale	*Aspidiotus nerii*	Many hosts, including *Buddleia, Cercis canadensis, Daphne, Elaegnus, Hypericum calycinum, Ligustrum, Nerium oleander, Taxus*
oystershell scale	*Lepidosaphes ulmi*	*Acer, Amelanchier, Calluna, Cotoneaster, Erica, Fraxinus, Hydrangea, Ilex, Malus, Populus, Spirea, Syringa, Viburnum*
pine needle scale	*Chionaspis pinifoliae*	*Picea, Pinus,*
Putnam scale	*Diaspidiotus ancylus.*	*Vaccinium*
San Jose scale	*Quadraspidiotus perniciosus*	Many hosts, including *Buxus, Cornus, Cotinus, Cotoneater, Crataegus, Juglans, Ligustrum, Morus, Populus, Pyracantha, Rosa, Sorbus, Tilia, Viburnum lentago*
scurfy scale	*Chionaspis furfura*	*Ribes*
walnut scale	*Quadraspidiotus juglansregiae*	*Acer, Betula, Celtis occidentalis, Cornus, Fraxinus, Gleditsia tricanthus, Gymnocladius, Hamamelis, Ilex, Juglans, Ligustrum, Liquidambar, Populus, Sorbus, Tilia, Ulmus*

white prunicola scale	*Pseudaulacaspis prunicola*	*Koelreuteria paniculata, Prunus amygdalus, Prunus*
Mealybugs		
apple mealybug	*Phenacoccus aceris*	*Acer, Castanea, Cinnamon, Cornus, Cotoneaster, Corylus, Crataegus, Diospyros, Kalmia, Lonicera, Magnolia, Malus, Morus, Myrica, Prunus, P. persica, P. serotina, Quercus, Tilia, Vaccinium*
Comstock mealybug	*Pseudococcus comstocki*	*Acer, Elaeagnus, Euonymus alatus, Ilex, Malus, Pinus, Populus, Ulmus, Viburnum, Weigelia, Wisteria*
grape mealybug	*Pseudococcus maritimus*	*Gingko biloba, Gleditsia tricanthus, Pyrus communis*
ground mealybug	*Rhizoecus falcifer*	roots of anemone, chrysanthemum, gladiolus, iris, other flowers, shrubs, and ornamental grasses
Mexican mealybug	*Phenacoccus gossypii*	Geranium
taxus mealybug	*Dysmicoccus wistariae*	*Taxus*

Table 2. Insecticides for management of scales and mealybugs, Connecticut, 2009
GH = Greenhouse Registration, N = Nursery Registration, L = Landscape Registration; R = Restricted Use, G =General Use.
(Adapted from K. Welch and T. Abbey, Pesticide Guide Toward Integrated Pest Management for Connecticut Nurseries 2006)

Insecticide	Trade name (examples)	Comments
acephate	Acephate Pro 75 (N, L), Orthene T, T and O Spray (N, L) G; Ace-Jet (L) G	not compatible with biocontrol
acetamiprid	TriStar 70 WSP (N, L), G	
azadirachtin	Azatin (N, L), Azatrol(N,L), Ornazin 3 EC (N) G	
buprofezin	Talus (GH), G	
carbaryl	Carbaryl 4L (N, L), G	not compatible with biocontrol
chlorpyrifos	Chlorpyrifos E Pro 4 (N), Chlorpyrifos 4 E (N, Christmas trees), R	not compatible with biocontrol
cyfluthrin + imidacloprid	Discus (N), G	
cyfluthrin	Decathlon 20 WP (GH, N), G	
dimethoate	Dimate 4EC (N, L), Dimethoate 267 (N, outdoor only), G	not compatible with biocontrol
dinotefuran	Safari 20 SG (N, L), G	
horticultural oil	Ultrafine oil (N, L), G	
imidacloprid	Marathon 1G, Marathon 60 WP, Marathon II (N) G	
	Ima-Jet (L), G	
insecticidal soap	M-Pede (N, L), G	
malathion	Check label for specific scales.	not compatible with biocontrol
methidathion	Supracide 2E (N) R	Scale crawlers
pyriproxifen	Distance IGR (N, L) G	See label for species controlled
thiamethoxam	Flagship 25 WG (GH, N, Christmas Tree) G	Soft scales and mealybugs only
Beauveria bassiana	Botanigard ES, WP (GH, N, commercial landscape)	mealybugs only
clothianidin	Celero 16 WSG (N, L), G	mealybugs only
fenpropathrin	Tame 2.4 EC (N),R	mealybugs only
permethrin	Permethrin 3.2 AG, 3.2 EC	mealybugs only, not compatible with biocontrol
phosmet	Imidan 70-W (N, L), G	mealybugs only, not compatible with biocontrol

Additional Resources

Antonelli, A. L. 2003. Scale Insects, Washington State University Cooperative Extension. http://www.puyallup.wsu.edu/plantclinic/resources/pdf/pls63scaleinsects.pdf

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Gilrein, D. Tipping the Scales. http://www.groundsmag.com/mag/grounds_maintenance_tipping_scales/

Hodges, G. Scale Insects. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, Fl. http://www.ent.uga.edu/peach/peachhbk/insects/scaleinsects.pdf

Johnson, W. T. and H. H. Lyon. 1994. Insects that Feed on Trees and Shrubs. Cornell University Press, Ithaca, New York.

Muegge, M. A. and M. Merchant. Scale Insects on Ornamental Plants. Texas Agricultural Extension Service. Texas A&M University. http://theurbanrancher.tamu.edu/retiredsite/bugs/b6097.pdf

Mention of a chemical or product is for informational purposes only and does not constitute an endorsement by The Connecticut Agricultural Experiment Station

This fact sheet is not a substitute for the pesticide label. The applicator assumes all responsibility for the proper use of any pesticide and must always thoroughly read, understand, and follow all label directions.

Some scale pests of Connecticut woody ornamentals

Photos by Rose Hiskes and Dr. Richard Cowles

Cottony Taxus scale

White prunicola scale

Lecanium scale; note exit hole of parasitoid.

Fletcher scale crawler

Parthenolecanium scale, settled crawlers

Mealybug female and ovisac

Red pine scale

Cryptomeria scale