Woody Ornamental Insect, Mite, and Disease Management

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Agricultural Sciences

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INTRODUCTION

This guide summarizes insect, mite, and disease management practices and pesticide safety information for woody ornamentals and shade trees in Pennsylvania. Its use is intended primarily for arborists, nursery growers, landscape maintenance personnel, extension educators, and consultants.

The development and appearance of pests in Pennsylvania will vary depending on the location (north, south, elevation, etc.) where the woody ornamental plants are growing. The treatment times in this manual are based on the best information we have now, but they may vary from year to year. It is imperative that you closely monitor pest activity each year.

Pesticides are regulated by state and federal laws that are designed to protect the applicator, the consumer, and the environment. This updated guide includes what is current and legal for sale and use in Pennsylvania based on information that was available to the authors during the preparation of the manuscript. The pesticide suggestions are subject to change at any time due to constantly changing pesticide labels and product registrations. Not all products have been evaluated for each pest listed. If any information in these suggestions disagrees with the pesticide specimen label, the suggestions in this guide must be disregarded. The user of this information assumes all risks for personal injury, plant damage, or property damage. The listing of a pesticide or the absence of a material herein does not constitute an endorsement or criticism of a material by the authors or by The Pennsylvania State University.

Created by Penn State Cooperative Extension specialists, this manual offers the latest on most of the key insects, mites, and diseases of key woody plants in Pennsylvania, current listings of chemical compounds labeled for effective management of these pests, integrated pest management (IPM) considerations for many of these pests, environmentally friendly alternatives in pest management, and information on growing degree days (GDD). Our goal is to present the management options available to the user. It is up to the user of the guide to select those management strategies most appropriate to the plants, pests, and growing conditions prevailing at the site.

To find contact information for the Penn State Cooperative Extension office in your county, go to **extension.psu.edu/counties** and click on your county on the map.

INSECTS AND MITES

PEST IDENTIFICATION

Most people do not recognize one insect from another and consider many insect and mite species to be harmful. If a plant has damage and there is an insect or mite close to that damage, people conclude that the insect or mite present is the causal organism. Most insects do not cause economic or aesthetic damage to woody ornamental plants. Unless the causal organism is accurately identified, we cannot be sure that the insect or mite is destructive. All too often, a beneficial insect has been sprayed because it was thought to be harmful. Once we know the correct identity of an insect or mite, we can investigate important facts regarding its life cycle in Pennsylvania. For example, we would be able to determine whether it is beneficial or harmful, whether it has chewing or piercing-sucking mouthparts, which stages are destructive, what it prefers to eat, where it lives, and the number of generations it has each year. All of this information is vital to any effective woody ornamental pest management program.

An essential step in an effective insect or mite pest management program is the correct identification of the pest in question. When in doubt, deliver or send several specimens to your county Penn State Cooperative Extension horticulture extension educator or to the authors of this publication. Include the following collection information: (1) name, address, telephone number, and e-mail address of the collector, (2) name of the plant being damaged, (3) date collected, and (4) city or county where the damage occurred. Any additional information about the infestation would be helpful. Small insects should be placed in small containers filled with 70 percent rubbing alcohol. Larger specimens may be sent dry packed between tissue or other protective material. Place vials and/or dry specimens in a cardboard box or mailing tube with packing material and either send them or take them to your county Penn State Cooperative Extension Office (see **extension.psu.edu/counties** for your county office's contact information). You may send the samples directly to the Insect Identification Laboratory, Department of Entomology, The Pennsylvania State University, 501 ASI Building, University Park, PA 16802.

INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is not a new arthropod (i.e., insects, mites, and their relatives) management strategy. Some components of IPM have been practiced for over 100 years. The current philosophy of IPM has been around for about 40 years. Researchers sometimes refer to IPM as "intelligent pest management." A new description of IPM, sometimes called plant health care (PHC), has been discussed in some trade journals. PHC examines the basic causes of stress to a plant and suggests corrective measures that promote plant health.

IPM is a pest population management system that utilizes all suitable techniques (biorational, chemical, cultural, fertilization, irrigation, monitoring with sex pheromone traps, resistant plant varieties, etc.) and information to reduce or manipulate pest populations that are maintained at tolerable levels (i.e., a few pests will still be present) while providing protection against hazards to humans, domestic animals, and the Earth's environment.

Guidelines for Establishing an IPM Program

1. Acknowledge that pesticides are not the only or best solution to every problem.
2. Retain a properly trained IPM manager.
3. Be able and willing to develop and maintain IPM-related records.
4. Develop excellent lines of communication among scouts, managers, growers, field technicians, clients, etc.

Diagnosing Arthropod Problems

1. Be familiar with the host plant(s).
2. Have expertise in identifying pest damage.
3. Have expertise in identifying the key pest on the key host.
4. Implement a management strategy that may or may not include application of conventional pesticides.
5. Evaluate management strategies to determine if the one selected is appropriate.

Use of Symptomatology

A symptom of arthropod injury to a woody ornamental plant may be defined as the damage that's evident on the host plant as a result of successful attack by the pest. Some examples of symptoms of arthropod injury include chewed foliage or blossoms; stippled, yellowed, or bronzed foliage; distortion of plant parts; and dieback of plant parts.

A sign is defined as the presence of the pest or pest-related products that may remain on the woody ornamental host plant. Examples of signs of arthropod activity include honeydew/sooty mold, fecal specks, tents or webs, spittle, pitch tubes, waxy material, and cast exoskeletons or skins.

Sampling/Monitoring Arthropod Pests and Their Natural Enemies

1. Methods of sampling include counting the number of arthropods on plant parts, fecal pellet (frass) collections, physical removal of arthropods on a white substrate, timed counts of life stages of arthropods, and the use of sex pheromone traps.
2. The detection of the presence or absence of a key pest on a key host is the major objective of sampling; beneficial arthropods should also be noted.
3. A management decision will have to be made concerning the need to implement a particular control tactic.

Decision to Implement a Management Strategy

In deciding whether to implement a management strategy, you may need to consider variables such as population numbers (increasing or decreasing abundance), the species and location of the key host plant, and the species of arthropod present.

Methods of Control

Control methods include biological, biorational, chemical, cultural, physical, and other management tactics.

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GROWING DEGREE DAYS

Effective woody ornamental pest management depends our ability not only to accurately diagnose the causal organism but also to predict when the vulnerable life stage of a pest will be active. Insect and mite development sometimes varies from one year to the next by several days or even weeks. It is important for pest managers to consider additional methods to better time their management strategies. The use of the calendar method and experience is helpful, but when applying management materials with a short residual life, you need to more precisely determine when a pest will be in a vulnerable stage.

The development of arthropods, like many other organisms on Earth, is affected by temperature. Insects and mites begin development when the temperature of their environment exceeds a lower developmental threshold or base temperature. The rate of their development increases as the environmental temperature exceeds the threshold temperature and decreases as the temperature declines. For example, arthropod development will occur more quickly during warmer growing seasons and is slower during cooler growing seasons.

The concept of growing degree days (GDD) is an arithmetical conversion of daily temperature records to heat units. While the concept has been recognized for many years, the base or threshold temperature is known for just a few of our key woody ornamental pests. The threshold or base temperature varies from one insect or mite species to another. Organisms that are active when temperatures are cool usually have a lower threshold temperature than those that become active during warmer months of the growing season. For the sake of consistency, a threshold or base temperature of 50°F has been adopted by most woody ornamental pest managers. Several equations such as the average, triangulation, and sine can be used to calculate GDD based on minimum and maximum temperature. A simple method that is often used involves averaging the daily maximum and minimum temperatures and subtracting the base or threshold temperature from the daily average as described below:

Formula for calculating GDD:

$$\frac{\text{Maximum + minimum daily temperature}}{2} - \text{threshold temperature} = \text{GDD}$$

Examples:			Total GDD Accumulated
March 1:	$\frac{52°F + 48°F}{2} =$	$\frac{100}{2} = 50 - 50°F = 0$ GDD	0
March 2:	$\frac{56°F + 50°F}{2} =$	$\frac{106}{2} = 53 - 50°F = 3$ GDD	3
March 3:	$\frac{60°F + 50°F}{2} =$	$\frac{110}{2} = 55 - 50°F = 5$ GDD	8
March 4:	$\frac{51°F + 49°F}{2} =$	$\frac{100}{2} = 50 - 50°F = 0$ GDD	8
March 5:	$\frac{62°F + 48°F}{2} =$	$\frac{110}{2} = 55 - 50°F = 5$ GDD	13

If this system is to work, you will need to collect the maximum and minimum temperatures each day from March 1 through September 30. You also will need to keep a record of the total accumulated GDD for your landscape. If the average temperature is below the threshold or base temperature for the day, enter a zero for that day. The total accumulated GDD in the early season will occur slowly. As daily temperatures increase during the growing season, GDD will accumulate more quickly from one day to the next. This information will help you determine when pest management actions should be applied. Remember to continue monitoring your landscapes to determine if treatment is indicated against a key pest population. Consult the table below for assistance in tracking growing degree days in your landscape or nursery.

Growing Degree Days (GDD) at a Threshold Temperature of 50°F

Use this table as you would use a department of transportation highway map mileage chart. For example, when the maximum air temperature was 70°F and the minimum air temperature was 50°F for a 24-hour period, the GDD indicated in bold text (10) is the number of GDD accumulated on that day.

⇓ MAXIMUM AIR TEMPERATURE (°F)	MINIMUM AIR TEMPERATURE (°F) ⇒													
	28	**30**	**32**	**34**	**36**	**38**	**40**	**42**	**44**	**46**	**48**	**50**	**52**	**54**
98	13	14	15	16	17	18	19	20	21	22	23	24	25	26
96	12	13	14	15	16	17	18	19	20	21	22	23	24	25
94	11	12	13	14	15	16	17	18	19	20	21	22	23	24
92	10	11	12	13	14	15	16	17	18	19	20	21	22	23
90	9	10	11	12	13	14	15	16	17	18	19	20	21	22
88	8	9	10	11	12	13	14	15	16	17	18	19	20	21
86	7	8	9	10	11	12	13	14	15	16	17	18	19	20
84	6	7	8	9	10	11	12	13	14	15	16	17	18	19
82	5	6	7	8	9	10	11	12	13	14	15	16	17	18
80	4	5	6	7	8	9	10	11	12	13	14	15	16	17
78	3	4	5	6	7	8	9	10	11	12	13	14	15	16
76	2	3	4	5	6	7	8	9	10	11	12	13	14	15
74	1	2	3	4	5	6	7	8	9	10	11	12	13	14
72	0	1	2	3	4	5	6	7	8	9	10	11	12	13
70	0	0	1	2	3	4	5	6	7	8	9	**10**	11	12
68	0	0	0	1	2	3	4	5	6	7	8	9	10	11
66	0	0	0	0	1	2	3	4	5	6	7	8	9	10
64	0	0	0	0	0	1	2	3	4	5	6	7	8	9
62	0	0	0	0	0	0	1	2	3	4	5	6	7	8
60	0	0	0	0	0	0	0	1	2	3	4	5	6	7
58	0	0	0	0	0	0	0	0	1	2	3	4	5	6
56	0	0	0	0	0	0	0	0	0	1	2	3	4	5
54	0	0	0	0	0	0	0	0	0	0	1	2	3	4
52	0	0	0	0	0	0	0	0	0	0	0	1	2	3
50	0	0	0	0	0	0	0	0	0	0	0	0	1	2
48	0	0	0	0	0	0	0	0	0	0	0	0	0	1
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INSECTS AND MITES DESTRUCTIVE TO WOODY ORNAMENTALS

A Guide to Host Plants and Common Insects as an Aid for Diagnosis

Alder
Fall webworm
Gypsy moth
Leafminer
Woolly alder aphid

Arborvitae
Arborvitae leafminer
Bagworm
Fletcher scale
Nuculaspis pseudomeyeri (armored scale insect)
Spruce spider mite
Tip dwarf mite

Ash
Aphids
Ash borer
Ash flower gall mite
Banded ash clearwing
Cankerworm
Emerald ash borer
European fruit lecanium
Fall webworm
Flatheaded appletree borer
Japanese maple scale
Oystershell scale
Plant bug

Azalea
Azalea bark scale
Azalea lace bug
Azalea leafminer
Azalea sawflies
Azalea stem borer
Black vine weevil
Cottony azalea scale
Mealybugs
Rhododendron borer
Southern red mite
Twobanded Japanese weevil
Whitefly

Barberry
Twobanded Japanese weevil

Basswood (linden)
Aphids
Basswood lace bug
Cankerworm
Gypsy moth
Hickory tussock moth
Japanese beetle
Leaf beetle
Oystershell scale
Whitemarked tussock moth

Beech
Beech scale
Cankerworm
Elm spanworm
Woolly beech aphids
Yellownecked caterpillar

Birch
Aphids
Bagworm
Birch leafminer
Bronze birch borer
Fall webworm
Gypsy moth
Hickory tussock moth
Japanese beetle
Leafhoppers
Oystershell scale
Whitemarked tussock moth
Yellownecked caterpillar

Boxelder
Boxelder bug

Boxwood
Boxwood leafminer
Boxwood psyllid
Boxwood spider mite
Indian wax scale

Catalpa
Catalpa sphinx
White peach scale

Chamaecyparis
Juniper scale
Nuculaspis pseudomeyeri (armored scale insect)

Cherry (flowering ornamental)
Eastern tent caterpillar
Fall webworm
Flatheaded appletree borer
Japanese beetle
Japanese maple scale
Lesser peachtree borer
Peachtree borer
San Jose scale
White peach scale
White prunicola scale

Cotoneaster
Hawthorn lace bug
Japanese maple scale
Mites
Pear sawfly
San Jose scale

Crabapple (ornamental nonedible flowering)
Aphids
Cankerworm
Calico scale
Eastern tent caterpillar
Fall webworm
Flatheaded appletree borer
Gypsy moth
Japanese beetle
Japanese maple scale
Leafroller
Mites
Oystershell scale
Pear sawfly
Roundheaded appletree borer
Yellownecked caterpillar

Cryptomeria
Cryptomeria scale
Spruce spider mite

Dogwood
Calico scale
Dogwood borer
Dogwood sawfly
Japanese maple scale
Leafhoppers
Oystershell scale

Douglas-fir
Bagworm
Cooley spruce gall adelgid
Pine needle scale
Spruce spider mite
White pine weevil

Elm
Bark beetles
Calico scale
Cankerworm
Elm leaf aphids
Elm leaf beetle
Elm spanworm
European elm scale
Fall webworm
Japanese beetle
Japanese maple scale
Leafhoppers
Spiny elm caterpillar
Whitemarked tussock moth
Yellownecked caterpillar

Euonymus
Aphids
Euonymus alatus scale
Euonymus caterpillar
Euonymus scale
Indian wax scale
Japanese maple scale
Twobanded Japanese weevil
Twospotted spider mite

Fir
Aphids
Bagworm
Cryptomeria scale
Elongate hemlock scale
Pine needle scale
Spruce spider mite

Forsythia
Fourlined plant bug

Hawthorn
Aphids
Eastern tent caterpillar
Fall webworm
Flatheaded appletree borer
Hawthorn lace bug
Hawthorn leafmining sawfly
Leafhopper
Mites
Oystershell scale
Pear sawfly
Roundheaded appletree borer

Hemlock
Bagworm
Black vine weevil
Cryptomeria scale
Elongate hemlock scale
Hemlock looper
Hemlock rust mite
Hemlock scale
Hemlock woolly adelgid
Nuculaspis pseudomeyeri (armored scale insect)
Spruce spider mite

Hickory
Aphids
Cankerworm
Elm spanworm
European fruit lecanium
Fall webworm
Flatheaded appletree borer
Gypsy moth
Hickory leafstem gall phylloxera
Hickory tussock moth
Mites
Twig girdler
Twig pruner
Yellownecked caterpillar

Holly
Cottony taxus scale
Indian wax scale
Inkberry leafminer
Native holly leafminer
Putnam scale
Southern red mite

Honeylocust
Bagworm
Calico scale
Honeylocust plant bug
Honeylocust pod gall midge
Mimosa webworm
Painted hickory borer
Spider mites

Honeysuckle
Aphids

Ivy
Aphids
Cottony taxus scale
Japanese beetle
Mites

Japanese pieris
Azalea bark scale
Lace bug
Putnam scale
Southern red mite

Japanese zelkova
Calico scale
Elm leaf beetle
Japanese maple scale

Juniper
Bagworm
Eriophyid mite
Juniper midge
Juniper scale
Juniper tip midge
Juniper webworm
Nuculaspis pseudomeyeri (armored scale insect)
Spruce spider mite

Larch
Bagworm
Larch casebearer
Larch sawfly
Woolly larch adelgid

Lilac
Fall webworm
Japanese maple scale
Lilac borer
Lilac leafminer
Lilac rust mite
Oystershell scale
White prunicola scale

Locust (black)
Locust borer
Locust leafminer

Magnolia
Japanese maple scale
Magnolia scale
Tuliptree scale

Maple
Aphids
Bagworm
Calico scale
Cankerworm
Cottony maple scale
Elm spanworm
European fruit lecanium
Fall webworm
Forest tent caterpillar
Gloomy scale
Greenstriped mapleworm
Japanese beetle
Japanese maple scale
Leafhopper
Maple callus borer
Maple gall mites (eriophyid)
Maple leafcutter
Maple petiole borer
Oystershell scale
Pear thrips
Whitemarked tussock moth
Yellownecked caterpillar

Mimosa
Mimosa webworm

Mountain ash
Aphids
European red mite
Japanese beetle
Mountain ash sawfly
Pear sawfly
Roundheaded appletree borer

Mountain laurel
Azalea bark scale
Mulberry whitefly
Redbanded leafhopper
Rhododendron borer
Rhododendron lace bug
Rhododendron stem borer
Southern red mite
Twobanded Japanese weevil

Oak
Aphids
Borers
Cankerworm
Elm spanworm
Fall webworm
Forest tent caterpillar
Gall midges
Gall wasps
Golden oak scale
Gypsy moth
Leafhopper
May/June beetle
Oak kermes scale
Oak lace bug
Oak skeletonizer
Obscure scale
Orangestriped oakworm
Spider mites
Twig pruner
Twolined chestnut borer
Yellownecked caterpillar

Pachysandra
Euonymus scale
Oystershell scale
Twospotted spider mite

Pear (flowering ornamental)
Aphids
Calico scale
Cottony maple scale
European fruit lecanium
Forest tent caterpillar
Japanese maple scale
Oystershell scale
Pearleaf blister mite

Pine
Aphids
Bagworm
Engraver beetle
Eriophyid mite
European pine shoot moth
Gypsy moth
Nantucket pine tip moth
Northern pine weevil
Pales weevil
Pine bark adelgid
Pine bark beetle
Pine needle midge
Pine needleminer
Pine needle scale
Pine oystershell scale
Pine root collar weevil
Pine tortoise scale
Pine tube moth
Pine webworm
Sawflies
Spittlebugs
Spruce spider mite
Striped pine scale
White pine weevil
Zimmerman pine moth

Privet
Privet rust mite
Privet thrips
Twobanded Japanese weevil
White peach scale
White prunicola scale

Purpleleaf plum
Globose scale
Pear sawfly

Pyracantha
Aphids
Globose scale
Hawthorn lace bug
Indian wax scale
Japanese maple scale
San Jose scale
Spider mites

Redbud
European fruit lecanium
Spider mites
Twig girdler
Twig pruner
Whitemarked tussock moth

Rhododendron
Azalea bark scale
Black vine weevil
Cottony azalea scale
Leafhoppers
Mealybugs
Putnam scale
Rhododendron borer
Rhododendron gall midge
Rhododendron lace bug
Rhododendron stem borer
Southern red mite
Twobanded Japanese weevil
Whitefly

Rose
Aphids
Black vine weevil
Bristly roseslug
Curled roseslug
European red mite
Fall webworm
Fourlined plant bug
Japanese beetle
Leafhoppers
Mossyrose gall wasp
Obliquebanded leafroller
Raspberry cane borer
Rose chafer
Rose midge
Rose scale
Roseslug
Thrips
Twospotted spider mite

Serviceberry
Aphids
Hawthorn lace bug
Pear sawfly

Spirea
Aphids
Twobanded Japanese weevil

Spruce
Aphids
Bagworm
Cooley spruce gall adelgid
Eastern spruce gall adelgid
Elongate hemlock scale
Gypsy moth
Pine needle scale
Sawflies
Spruce bud scale
Spruce needleminer
Spruce spider mite
White pine weevil

Sweetgum
Bagworm
Calico scale
Fall webworm
Gypsy moth
Sweetgum scale

Sycamore
Aphids
Bagworm
Fall webworm
Japanese beetle
Sycamore lace bug
Sycamore plant bug
Terrapin scale
Tussock moth

Tuliptree
Aphids
Tuliptree scale
Yellow poplar weevil

Viburnum
Aphids
Fourlined plant bug
Indian wax scale
Southern red mite
Twobanded Japanese weevil
Viburnum leaf beetle

Weigela
Fourlined plant bug
Japanese beetle
Twobanded Japanese weevil

Willow
Aphids
Eastern tent caterpillar
Gypsy moth
Japanese beetle
Imported willow leaf beetle
Japanese maple scale
Oystershell scale
Spider mites
Spiny elm caterpillar

Wisteria
Calico scale
Japanese beetle

Yew
Black vine weevil
Cottony taxus scale
Fletcher scale
Taxus bud mite
Taxus mealybug

PLANT PHENOLOGICAL INDICATORS

Phenology is the study of periodic occurrences in nature and their relation to weather. The growth of plants is, in part, a response to an accumulation of heat units. Some examples of growth stages of plants that can be correlated to heat units include bud swell, leaf emergence/expansion, stages of flowering, or elongation of new growth (conifers). Specific plant growth stages can be correlated to certain life stages of insects and mites. Length of day, other environmental factors, and different cultivars may affect specific events in a plant's development so that correlations of plant phenology are not as precise as the use of growing degree day information. Using plant phenological indicators is useful in establishing monitoring times and is more accurate than referring to calendar dates to time a particular management strategy. An example of the use of a plant phenological indicator would be the correlation of gypsy moth egg hatch with the bloom of shadbush or serviceberry (Amelanchier). Donald Orton's book *Coincide* contains many observations on relationships of plant phenology and some key arthropod pest life stages. It is available from Labor of Love Conservatory, 468 South President Street, Unit #103, Carol Stream, IL 60188, phone: 630-668-8597.

Data collection and observations of growing degree days and plant phenological indicators in Pennsylvania were conducted for 15 years by an applied group of arborists, nurserymen, landscape managers, and Penn State extension educators. This organization was originally known as the Southeast Pennsylvania IPM Research Group. The name of this group was changed to the Penn-Del IPM Research Group when cooperators from Delaware were included in this applied research effort. Information regarding this group's activities may be obtained by calling 814-865-3256.

BEE WARNING

Many insecticides are highly toxic to honey bees, bumble bees, and other native pollinating insects. Certain materials should not be applied any time during bloom, while many others should be applied only in the early morning hours and/or late evening when pollinators are not foraging. Avoid spraying materials on ornamentals that are surrounded by blooming flowers or weeds. Simple steps like removing (mowing) blooming clover from lawns or covering the plants that are in bloom prior to applying a treatment in a landscape should always be practiced before applying materials that are harmful to bees. Select the least hazardous material (if given the choice) when plants in the infested area are in bloom. Always read and follow label directions for bee safety.

INSECT TRAPS AND ATTRACTANTS

Insect monitoring traps can be useful tools for determining the activity of some key pests of trees and shrubs. They can also help determine the proper timing of an insecticide application to effectively manage an infestation of a pest. Some traps may even help reduce insect pest populations. Because these traps and their associated chemical attractants are not harmful to animals or humans and do not leave residues, they are suited to environmentally sound arthropod pest management programs in nurseries and landscapes. The effective use of these tools requires species-specific knowledge of the targeted pest's biology.

Insects use different semiochemicals (chemicals that carry messages either within a species or between species) that transmit messages between organisms. Pheromones (chemicals that are produced and detected by members of the same species) are one of these semiochemicals. Effective and practical use of pheromones in a woody ornamental pest management program requires that a specific active chemical be isolated and identified. A synthetically reproduced version of this compound must then be manufactured and made commercially available. Pheromones may be used in several ways—for example, as lures in insect monitoring traps, as lures in traps to remove individuals in a pest population, and to disperse a signal that may disrupt mating in a pest population.

Insect traps may be used to detect the presence of an invasive arthropod pest, get an estimate of the relative density of a key pest population, or determine the first emergence or peak flight of an insect pest in an area. The latter purpose is often used to time an effective insecticide application. One example is the use of clearwing borer pheromone-baited traps that assist a plant health care specialist in detecting when adult males are active in a nursery or landscape. When the first male of a particular clearwing borer pest species has been captured in a monitoring trap, application of a registered insecticide host plant should follow 7 to 10 days later.

Two examples of insect monitoring traps that are used in woody ornamental pest management programs include those used to detect new infestations of the gypsy moth, *Lymantria dispar*, and the large sticky traps that are use to detect the flight of the smaller European elm bark beetle, *Scolytus multistriatus*.

Listed below are some sources of insect monitoring traps and pheromones for landscape and nursery pests.

Bedoukian Research Inc.
21 Finance Drive
Danbury, CT 06810
Phone: 203-830-4000
www.bedoukian.com

Contech Inc.
7572 Progress Way
Delta, BC V4G 1E9
Phone: 800-767-8658
www.pherotech.com

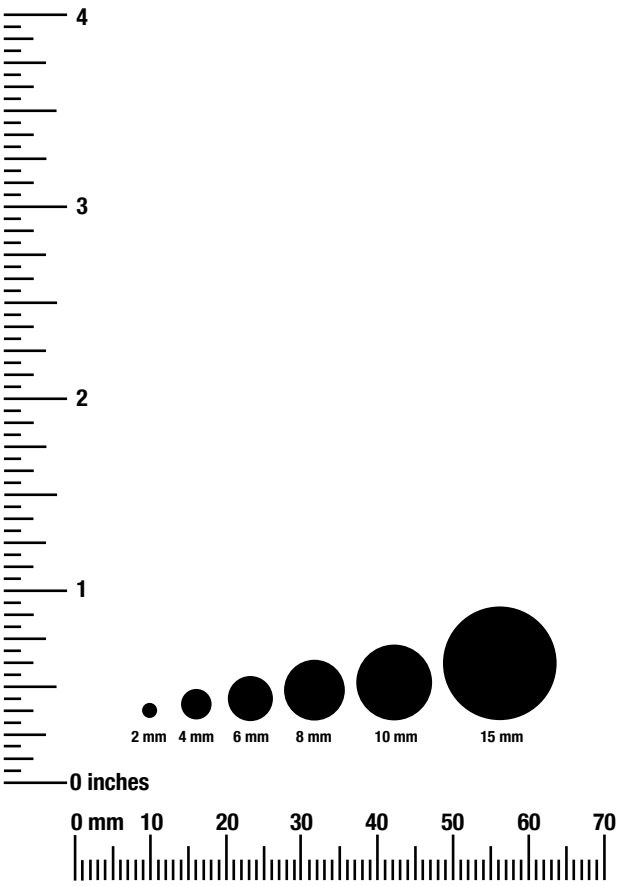
Gempler's
PO Box 44993
Madison, WI 53744
Phone: 800-382-8473
www.gemplers.com

Great Lakes IPM Inc.
10220 E Church Road
Vestaburg, MI 48891
Phone: 800-235-0285
www.greatlakesipm.com

Scentry Biologicals Inc.
610 Central Ave.
Billings, MT 59102
Phone: 800-735-5323
www.scentry.com

Trece Incorporated
7569 Highway 28 West
PO Box 129
Adair, OK 74330
Phone: 866-785-1313
www.trece.com

Measurements for Accurate Diagnosis



POISON CONTROL CENTERS

1-800-222-1222

poison center. Pennsylvania residents are

the Poison Control Center in Philadelphia.

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