



# **insects**

## **ON WOODY ORNAMENTALS-**

### **pests or non-pests ?**

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## FOREWORD

Insects which threaten the esthetic or economic value of a plant should be controlled as soon as they are detected. Bulletin 504, *Insect and Mite Control on Woody Ornamentals*, published by the Ohio Cooperative Extension Service, The Ohio State University, lists host plants, insect pests, times for treatment, and insecticides which may be used on woody ornamentals. Copies of this bulletin are available upon request from county agricultural extension agents or from the Department of Entomology at The Ohio State University, Columbus, or the Ohio Agricultural Research and Development Center, Wooster.

**On the Cover:** Top, oak leaf gall; inset in tree trunk at left, oak borer larva; inset at lower right, adult bronze birch borer.

Cover art by Newell H. Hartrum, graphic artist, OARDC. Photographs by Glenn L. Berkey, OARDC.

# Insects on Woody Ornamentals— Pests or Non-Pests?

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## INTRODUCTION

Many people, especially homeowners concerned about woody ornamentals, have the impression that insects on plants are always detrimental and should therefore be eliminated. However, many insects found on woody ornamentals are transients or at least do not cause permanent injury to the plant. Attempts to eliminate all insects cause unnecessary expense, often more than the dollar value of the planting. An additional concern associated with unneeded use of insecticides is the environmental hazard inherent in overuse of pesticides. The question is: which insects are pests and which insects do not pose a threat to the plant?

One problem in the past has been that in most cases it has not been determined whether or not an insect is causing economic injury or esthetic damage before recommending control measures. In fact, some entomologists were all too prone to recommend controls for all insects attacking ornamentals, regardless of the damage they were causing or were capable of causing.

It is now time to develop a better understanding of the term *pest*. It is also possible that the word pest should be redefined, if necessary, to protect and improve the quality of our environment.

A pest may be defined as an insect or pathogen which injures its host in such a way as to threaten its life or esthetic qualities. Before this definition can be used, more must be learned about insect-host plant relationships to determine if a given population level will significantly decrease host vigor. Hopefully, the nuisance factor will receive less emphasis in this new concept of the term *pest*.

Plant resistance to insect attacks and to subsequent injury is the rule in nature. Mechanisms of resistance include: 1) the plant does not attract the insect; 2) the plant contains chemical or physical properties which either act as feeding deterrents or are actually toxic to the insect; and 3) the plant can tolerate insect feeding without loss of vigor.

Few insects attack any given plant species. Of those which do attack a plant, even fewer have the potential to do permanent damage. When this potential is realized, then the insect may have reached pest

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**TABLE 1.—Woody Ornamentals Usually Susceptible to Insect Pests.**

Host	Kinds of Insects
Arborvitae	Weevils, Scales, Mites, Leaf Miner
Ash	Borers, Scales, Defoliators
Azalea and Rhododendron	Scales, Borers, Root Weevils, Mites, Leaf Miner
Birch	Borers, Leaf Miner, Aphids
Dogwood	Borers
Elm	Defoliators, Bark Beetles
Euonymus	Scale
Flowering Fruits	Borers, Scales, Aphids, Mites, Defoliators
Hawthorn	Borers, Scales, Leaf Miner, Lacebug
Hemlock	Scales, Mites, Defoliators
Juniper	Scales, Bagworms
Larch	Larch Case Bearer (Defoliator)
Lilac	Borers, Scales
Linden or Basswood	Defoliators, Borers
Maple	Mites, Scales, Aphids, Defoliators
Mountain Ash	Borers, Scales, Mites
Oak	Borers, Galls, Scales, Leaf Miner, Aphids, Defoliators
Pine	Scales, Aphids, Sawflies (Defoliators)
Service-Berry or Shadbush	Scales, Aphids, Mites
Spruce	Scales, Aphids, Mites, Defoliators
Willow	Defoliators, Mites, Scales, Borers

**TABLE 2.—Woody Ornamentals Relatively Insect-free.**

Amur Cork Tree	Goldenrain-tree
Barberry	Honeysuckle
Bayberry	Hornbeam
Bottle-tree	Ironwood
Boxwood	Japanese Pagoda Tree
Buckthorn	Katsura-tree
Cedar	Kentucky Coffee Tree
Cornelian Cherry Dogwood	Russian Olive
Cucumber-tree	Smoke-tree
Dawn Redwood	Stewartias
False-cypress	Sweetgum
Forsythia	Tallhedge
Fuchsia	Tree-of-Heaven
Ginkgo or Maidenhair Tree	Turkish Hazelnut
Glossy-privet	Viburnum
Goldenchain-tree	White Poplar

status. When this potential is not fully realized or when a plant is not infested, natural resistance is probably at work. Some of the most common woody ornamentals and their relative resistance or susceptibility to insect damage are presented in Tables 1 and 2.

Insect populations usually fluctuate within rather narrow limits around some average density. When environmental resistance breaks down, a pest population is generated. For example, the plant's defense mechanisms may be weakened during drought, allowing the insect population to multiply rapidly and damage the plant. A number of insects which will not damage a healthy plant may seriously injure a stressed plant. Even then, the pest population soon builds to a peak where natural enemies and population deterioration cause the population to fall below an economic or esthetic injury level. Damaging insect populations may also arise following chance introduction of an insect to a susceptible host plant. Thus, although there are hundreds of thousands of different insect species, only a few are really pests.

Homeowners and commercial growers of ornamental plants want their trees and shrubs to be insect-free. Nursery inspectors restrict sales of nursery stock which is infested with insects. In some instances the insect responsible for the restriction is common in both the growing area and the area of sale. Nevertheless, the plant cannot be sold until it is free of the insects. Therefore, the nurseryman must use more insecticide. This is reasonable if the consumer will not tolerate insects on nursery stock, but it may be unrealistic if the quality of the environment is to be improved by reducing the amount of pesticides used. Thus, both consumers and regulatory agencies need to re-evaluate and possibly re-define pests.

Although much work needs to be done before a new definition of pest can be implemented, it can be used to define the kinds of insect problems which are not a concern and which do not require control measures.

This publication considers several kinds of noticeable insects which rarely injure the host plant enough to require efforts to suppress the insect population. When possible, reasons for the non-pest status of the insect are given. Some insects classed as pests also are discussed in order to emphasize the differences between these two kinds of insect-host plant relationships.

## DAMAGE TO FOLIAGE

### Defoliation

Insects which consume photosynthetic (food-producing) areas of a plant (leaves or needles) are called defoliators. They include caterpillars and other larvae which actually consume parts of or the entire leaf. Included in this category are sucking insects which cause leaves to fall from the host prematurely.

Most trees have more foliage than required for normal growth and development. Some defoliation can occur without loss of host vigor. If defoliation is uniform throughout the canopy of the tree, 50 percent of the foliage can be consumed before it becomes noticeable. This much or more leaf destruction may not cause permanent injury to the tree if it occurs at certain times of the year. Of course, young saplings need the few leaves they possess.

Some deciduous trees can withstand three consecutive years of partial defoliation before suffering permanent injury. If defoliation occurs early in the season, the tree utilizes stored energy reserves and produces another set of leaves. If defoliation occurs after the major photosynthetic period (usually mid-August), the tree suffers little since new buds have already been produced and energy reserves have been stored. Leaves would have begun to fall naturally within a short time after this late defoliation, and thus no damage is done to the tree.

A good example of early season defoliation is caused by leafhopper feeding on maple. Most leaves can be destroyed by early July. However, within 3 weeks enough new leaves are produced so that the crown appears normal. Later, trees show no gross symptoms of reduced vigor.

The eastern tent caterpillar, *Malacosoma americana*, and the forest tent caterpillar, *M. disstria*, consume hardwood leaves in spring and early summer. The former species constructs webs in the branches where it feeds; the latter does not.

Heavy infestations of either caterpillar can defoliate a tree, and efforts should be made to prevent this esthetic loss. As soon as tents are observed, they should be removed and burned. During the winter, egg masses which completely surround twigs are readily observed and can be collected and destroyed. This can be a difficult job on large trees. Neither species should cause alarm or necessitate chemical control measures.

Late summer defoliation of red, white, and black oaks is common in the eastern United States. The oak leaf skeletonizer, *Bucculatrix ainsliella*, is responsible for much of this leaf destruction which begins in spring but does not become obvious until late summer. Although complete leaf

destruction is common, enough leaf area is intact during the important photosynthetic period so that host vigor is not significantly altered.

In the fall, after the larvae have completed development, they spin down from the branches on long, silken threads. During this time they are carried by wind to many different objects and non-host trees where they spin conspicuous white cocoons in which they pupate. These tiny cocoons are observed by many people who become concerned that their premises are infested with damaging pests. However, in the spring the newly emerged adult moths fly from their pupation sites to nearby hosts. Thus, the oak leaf skeletonizer is a conspicuous insect which attacks shade trees and causes noticeable symptoms. But it is *usually not a pest* since it does not threaten the host's life or reduce its esthetic value until just before natural leaf fall occurs.

Two common and conspicuous caterpillars which defoliate hardwoods in late summer are the fall webworm, *Hyphantria cunea* (Figure 1), and the western tent caterpillar, *Malacosoma pluviale*. Both species begin feeding and web construction after the major photosynthetic period of their hosts. The webs should be removed from ornamentals and burned when they first appear. A good time to remove the nests is during inclement weather when most caterpillars remain in the webbing.

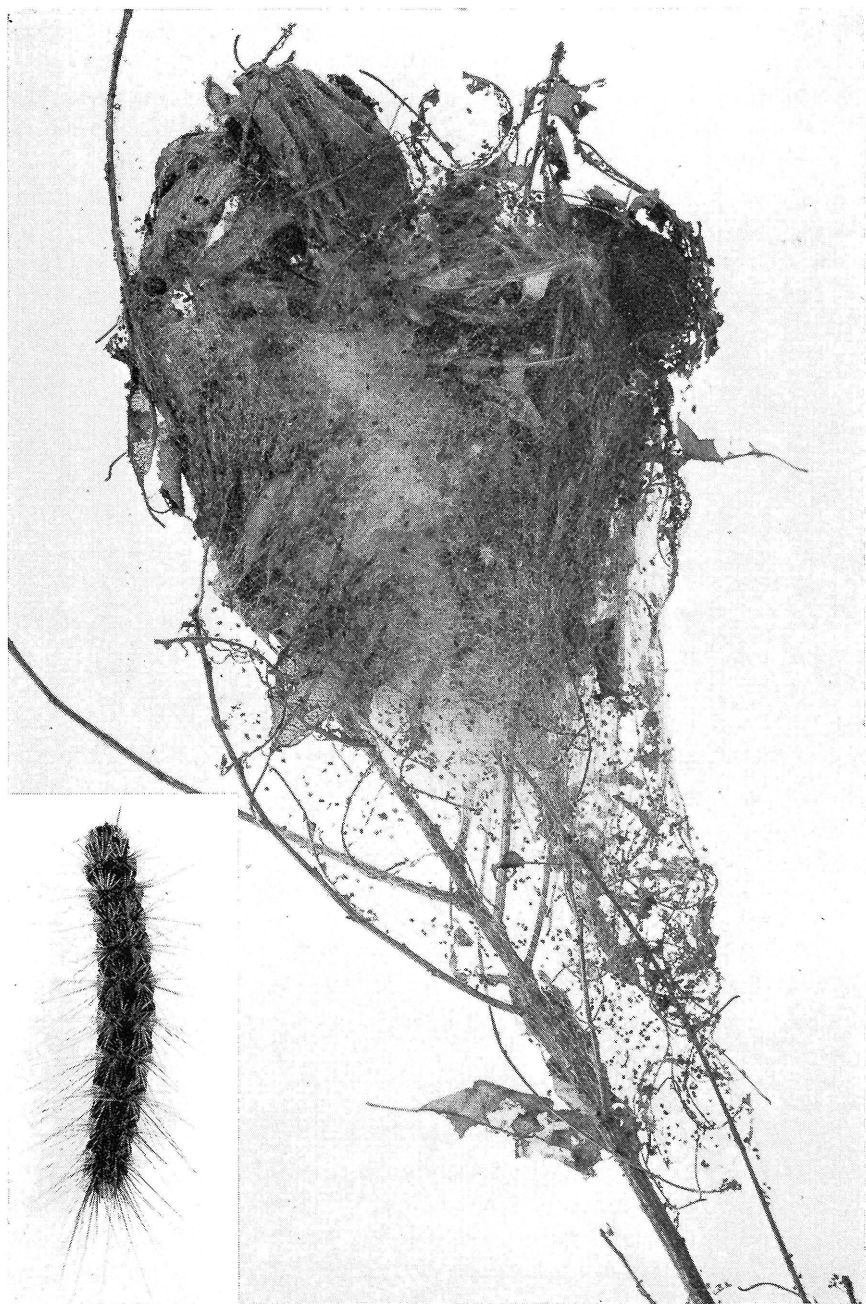
Other defoliators of deciduous trees are in the same class as those discussed. Remember, they may not be pests if they destroy only part of one set of leaves in a season and do not repeat this more than two succeeding years.

Coniferous evergreens present a different picture when defoliated. It is possible that either new or old needles are consumed or otherwise destroyed by insects so that food is manufactured and new buds are produced by the host. However, one complete defoliation before new buds are formed is usually fatal to these evergreens. Thus, defoliators on conifers should be watched carefully. If insect populations seem to be building, control measures should be initiated, especially on high value trees.

## Galls

Gall insects and mites produce some of the most spectacular symptoms of infestation observed on woody ornamentals. Nearly everyone has seen oak galls of one kind or another (Figure 2). Many different insects and mites cause galls on deciduous trees, but surprisingly little research has been done on these creatures.

The reason that little effort has been spent studying gall insects on broadleaf trees appears to be because they usually do not reduce host vigor. Thus, most gall formers really aren't pests. It is true that excep-



**FIG. 1.**—Typical damage and webbing of fall webworm, *Hyphantria cunea*, on native hardwood. Inset shows general character of an individual larva of this moth.



tionally high populations of twig galls can cause branch distortion, but such cases are rare. Leaf galls usually destroy less than 10 to 15 percent of the photosynthetic surface of a leaf and therefore cause little decrease in manufacture of food. Obviously, leaf galls on deciduous trees will not be carried over from one year to the next since leaves fall naturally in autumn. The number of leaf galls on the tree in a given year depends entirely upon the success of the gall maker that year.



**FIG. 2.**—Typical oak leaf gall on Texas red oak, *Quercus shumardii*.

Other sucking insects which feed on the foliage of woody ornamentals include scales, aphids, and mites. These are usually small, inconspicuous insects which can multiply rapidly and cause permanent injury before their presence is noted. Gross morphological symptoms of their presence are chlorosis (yellowing), mottling, and premature needle or leaf drop. For example, the spotted pine aphid, *Eulachnus agilis*, feeds on 1-year-old Scotch and Mugho pine needles during the spring and summer. As feeding continues, needle color changes from the characteristic green to yellow and finally to yellow-brown. Needles showing these symptoms are only loosely attached to the tree and drop before winter, soon after the aphids transfer to the new foliage. Thus, only 1 year's needles remain on heavily infested trees, reducing their esthetic and economic value.

This pest and others like it should be controlled as soon as they are detected. Nurserymen and researchers are beginning to notice more and more sucking insect problems on woody ornamentals. Careful vigilance must be maintained to insure that damaging populations do not build up on landscape plants and shade trees.

## **DAMAGE TO TRUNKS AND STEMS**

### **Borers**

Borers are possibly the most serious insect pests of woody ornamentals, especially shade trees. They lead obscure lives within their hosts where they are protected from natural enemies and insecticides. Because borers cause no visible external symptoms early in their lives, the ornamental value of a specimen tree can be ruined before their presence is detected. Indeed, few people are aware that borers are infesting their ornamentals until enough structural damage has been done to cause twig or limb dieback or trunk breakage.

The reason for such damage is related to the feeding habits of the larval stage of borers. They feed in the heartwood, reducing the strength of the woody tissues, and in the cambium (growing layer of cells), thereby girdling the tree. Conductive tissues are destroyed, preventing translocation of nutrients. Limbs or trunks weakened by borer galleries are easily broken by strong winds. After more than two-thirds of the cambial circumference is damaged, the plant is not able to maintain itself and dies.

Prevention is the best way to protect woody ornamentals from borers. Vigorous trees are reported to be able to resist borer attack. Thus, anything a homeowner can do to prevent stress to his ornamentals should reduce the possibility of borer damage. Proper fertilization, watering (especially during summer drought), and control of sucking and defo-

liating insects which seriously reduce plant vigor should be practiced. Care should be taken to prevent mechanical root and stem wounds and water stress resulting from paving completely around a tree.

Some common borers which are important in Ohio are the lilac borer, *Podosesia syringae syringae*; ash borer, *P. s. fraxini*; locust borer, *Megacyllene robiniae*; and bronze birch borer, *Agrilus anxius* (Figure 3). All of these pests can kill their hosts and control measures should be used as soon as their presence is detected.

### Sucking Insects

Scales and bark aphids may be found on stems and trunks of woody ornamentals. Bark aphids should cause little concern, since they seldom become dense enough to damage the host. But if they become numerous, they can be killed or dislodged by a fast stream of water. However, scale insects often build up damaging populations since they are usually inconspicuous and sometimes difficult to control.

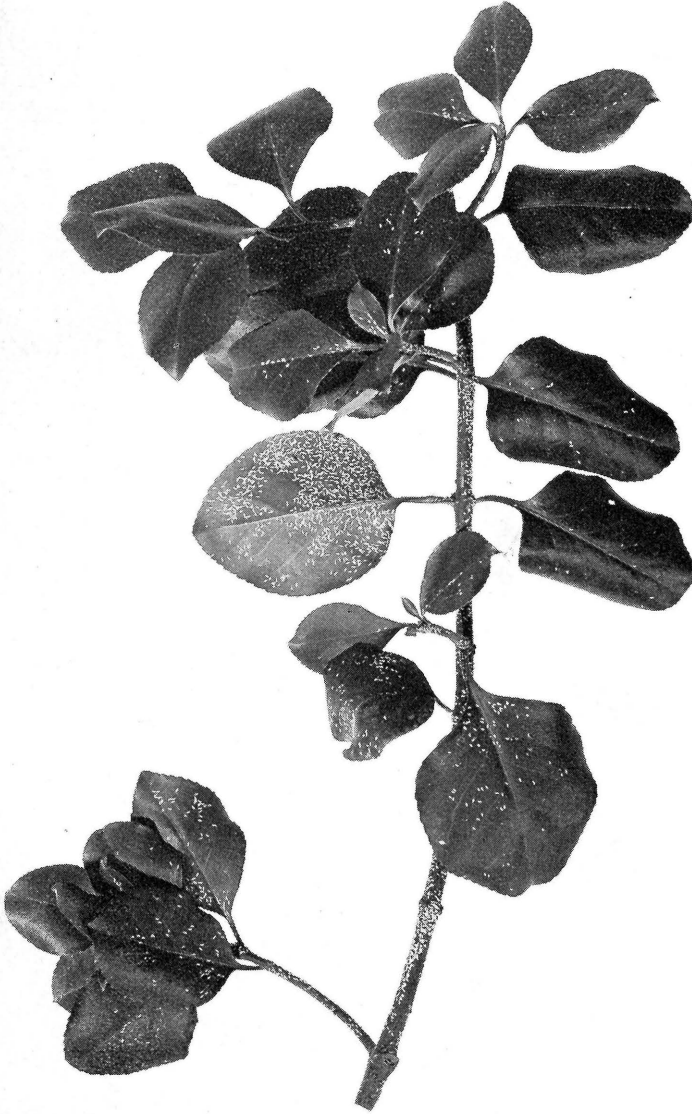


**FIG. 3.**—Bronze birch borer, *Agrilus anxius*, adult near D-shaped emergence hole on trunk of paperbark birch.



**FIG. 4.**—Representative soft scale insect, the magnolia scale, *Neolecanium cornuparvum*, on *Magnolia* species.

There are two major groups of scale insects: soft scales (Figure 4) and armored scales (Figure 5). Soft scales are mobile in all immature stages and are not protected by a hard covering. Rather, they are



**FIG. 5.**—Representative armored scale insect, the euonymus scale, *Unaspis euonymi*, on *Euonymus vegetus*.

naked or are covered with cottony, waxy, or powdery material which they secrete as protection for their eggs. The entire soft scale (including its covering) is usually convex and ranges in size from the inconspicuous to spheres nearly 1 inch in diameter.

A common representative of this group is the cottony maple scale, *Pulvinaria innumerabilis*. Other members of this group which may become destructive include the tulip tree scale, *Toumeyella liriodendri*, and the magnolia scale, *Neolecanium cornuparvum*. Most soft scales are easily controlled when detected early but threaten the esthetic value or existence of a woody ornamental if not controlled.

The armored scales are usually smaller than soft scales, immobile except in the first nymphal (crawler) stage, and are protected by a hard covering composed of cast (old) skins and a waxy secretion. Because armored scales are small ( $\frac{1}{8}$  inch or less), their presence is usually not

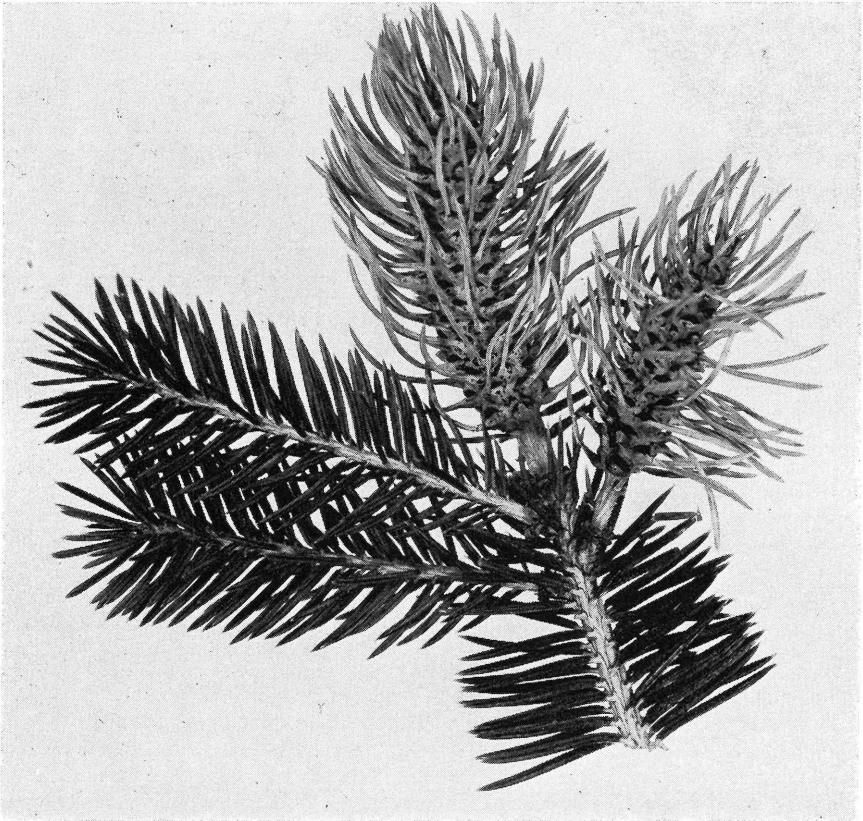


FIG. 6.—Gall formation on Colorado blue spruce caused by *Adelges cooleyi*.

noticed until they have injured their host. They are beneath a hard covering most of their lives, and are often difficult to control with currently recommended insecticides. Thus, armored scales are apt to be more important than soft scales on trees and shrubs.

Woody ornamentals should be inspected at least once each year to detect early, small scale infestations. Common armored scales include the euonymus scale, *Unaspis euonymi*, and the oystershell scale, *Lepidosaphes ulmi*. These scales often build up in numbers which cause branch death or complete tree death. Scales also make their host more susceptible to bark beetle and borer attack.

The esthetic value of evergreen conifers can be destroyed by galls and these trees should be managed accordingly. Gall aphids on spruce cause pineapple-shaped swelling at the bases (eastern spruce gall aphid, *Adelges abietis*) of the tips (Cooley spruce gall aphid, *A. cooleyi*) (Figure 6) of new twigs.

Since twigs are permanent structures, the number of galls on a tree is additive from one year to the next, and the tree soon becomes unsightly and growth is reduced. Thus, conifers must be watched carefully and control measures initiated as soon as the first galls are detected. Young galls can be pruned from individual trees in early summer before they open and release aphids which will cause more galls the following spring.

Homeowners often become concerned when they see caterpillars on limbs and trunks of their trees. However, caterpillars are defoliators and cause no direct injury to bark. The only time they are found here is when they are resting, changing from a defoliated branch to one which is foliated, or after they have completed feeding and are seeking a pupation site, usually in debris or soil. If they are numerous, they can be controlled with a contact insecticide. Control isn't necessary in most cases.

## **DAMAGE TO ROOTS AND CROWNS**

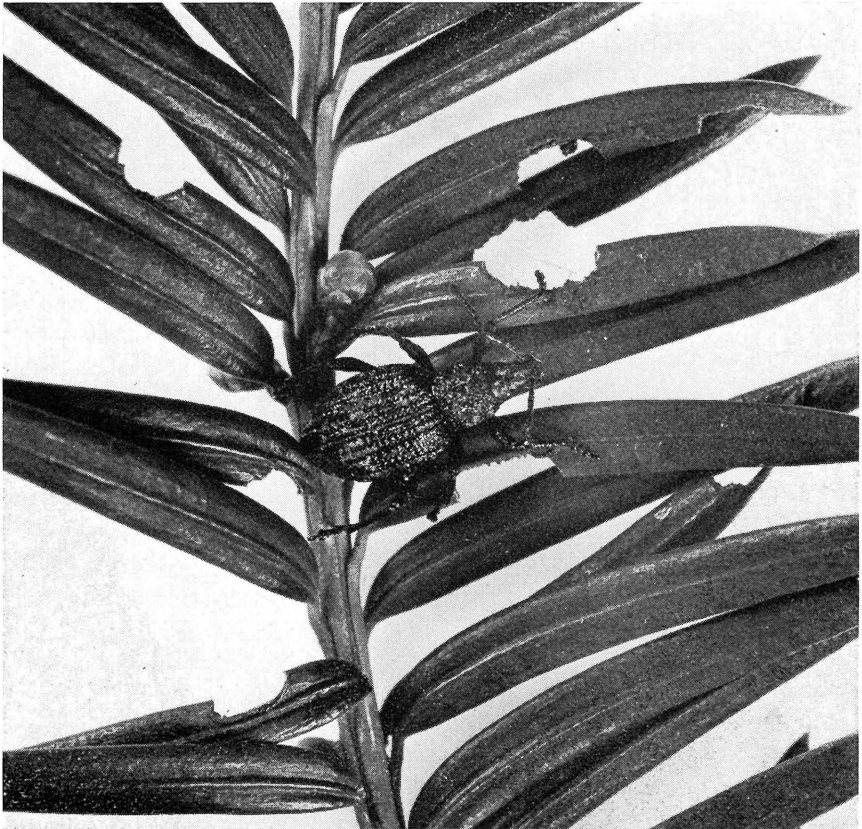
The adage, *out of sight, out of mind*, often applies to growing plants. Often a root problem is the last consideration when, in fact, it should be one of the first if wilting occurs. Wilting is usually caused by something other than insects, but there is potential for this kind of symptom to result from insect feeding. It can be assumed that if an insect is feeding on roots, it is causing injury. As with foliar problems, the plant is capable of sustaining a certain amount of damage to its roots, and most woody plants are capable of some root regeneration. In most cases, however, damage thresholds have not been determined for root feeders.

The crown of a plant is the transition zone between stem and roots. A little insect feeding in this region can cause significant damage and ex-

pose the plant to attack by parasitic fungi. Since this area is usually covered by soil and debris, it is often overlooked when trying to diagnose a tree or shrub disorder. This stratum of the soil is the natural habitat of many insects, including species of weevils, borers, and aphids. Damage to this part of a plant is often fatal.

Other insects spend most of their lives feeding deeper on or in the root system. The larvae of weevils feed on root hairs and bore into larger roots, where they may feed for an entire year. Nymphs of the periodical cicada, *Magicicada septendecim*, often referred to as the 17-year locust, spend all but a few months of their lives feeding on the roots of hardwoods.

Other insects initiate the formation of galls on roots. Such galls inhibit the uptake of minerals and water. As a rule, well-established,



**FIG. 7.—Adult black vine weevil, *Brachyrhinus sulcatus*, on *Taxus* species, showing typical crescent-shaped feeding injury caused by adults.**



vigorous plants can tolerate some damage by root feeders. However, pests like the black vine weevil, *Brachyrhinus sulcatus* (Figure 7), may occasionally increase in numbers so that they cause damaging injury to *Taxus* and *Rhododendron*. Root problems are difficult for the homeowner to diagnose and a specialist should be consulted.

### MISTAKEN IDENTITIES

Appearances can be deceiving. It is not uncommon to mistake a harmless structure for an insect or insect damage. It is also easy to confuse true insect damage with a totally unrelated problem. For example, there are a number of common weeds, sheep sorrel (*Oxalis* sp.) for one, which forcibly eject their seeds when mature. These seeds are small, brown, and *segmented* and resemble small scale insects as they cling to the stems and foliage of nearby plants. Conversely, immature maple whiteflies resemble seeds more than insects.

Spruce galls caused by aphids, and brown bags constructed by bagworms and attached to the host, superficially resemble dried cones in late fall and winter. These are actually symptoms of insect injury which may damage the host. They should be removed as soon as they are detected.

Some woody plants such as white oak have large, conspicuous lenticels (breathing pores) on the bark. These can be confused with scale insects, although they are much different in appearance than those scales which attack oak. Hence, *proper identification of a pest problem is extremely important for good management of woody ornamentals.*

Small, almost microscopic mites feed on deciduous leaves as they expand and cause small hair-like growths (patches) or bladder galls on the leaves. These galls cause homeowners much concern but do not require control measures. Most of our common woody ornamentals have characteristic pubescence or hairs which may be confused with galls. Some of the black oaks, especially pin oak, exhibit a natural pattern of tiny leaf hairs at the junction of the veins, not unlike those caused by mites.

Wind whip of some of the spiny-leaved ornamentals such as holly cause pin-prick damage of foliage which may be confused with damage caused by some female insects when they deposit their eggs in holly leaves.

Late frost damage is often confused with shoot moth damage on new growth of some conifers. The converse is equally misleading. So homeowners should *beware of casual diagnosis of problems.*

## ENVIRONMENTAL PROBLEMS

Aphid feeding causes distortion of foliage similar to that caused by some herbicides (chemicals used for weed control). Honeydew (sugary excrement of aphids) is sometimes produced in great enough quantities by aphids that it coats the surface of the host. When sooty mold grows on this honeydew, the plant appears to be smothered by coal dust. Thus, environmental contaminants and insects can cause similar symptoms. It takes a careful diagnosis by an authority to differentiate between these causes of plant injury.

Increasingly large numbers of phytotoxic factors in the environment of plants cause damage symptoms similar to those caused by insect feeding. Some pollutants are quite subtle, such as concentrations of toxic gases which cause chlorosis (yellowing of foliage) and loss of vigor. Others are more apparent.

Chemicals intended for control of insects sometimes prove to be toxic to the plant (this is called phytotoxicity). Thus, much testing is required before a pesticide is labeled for a particular crop. Herbicides often adversely affect prized ornamentals. Even highly selective herbicides sometimes damage nearby, unrelated plants.

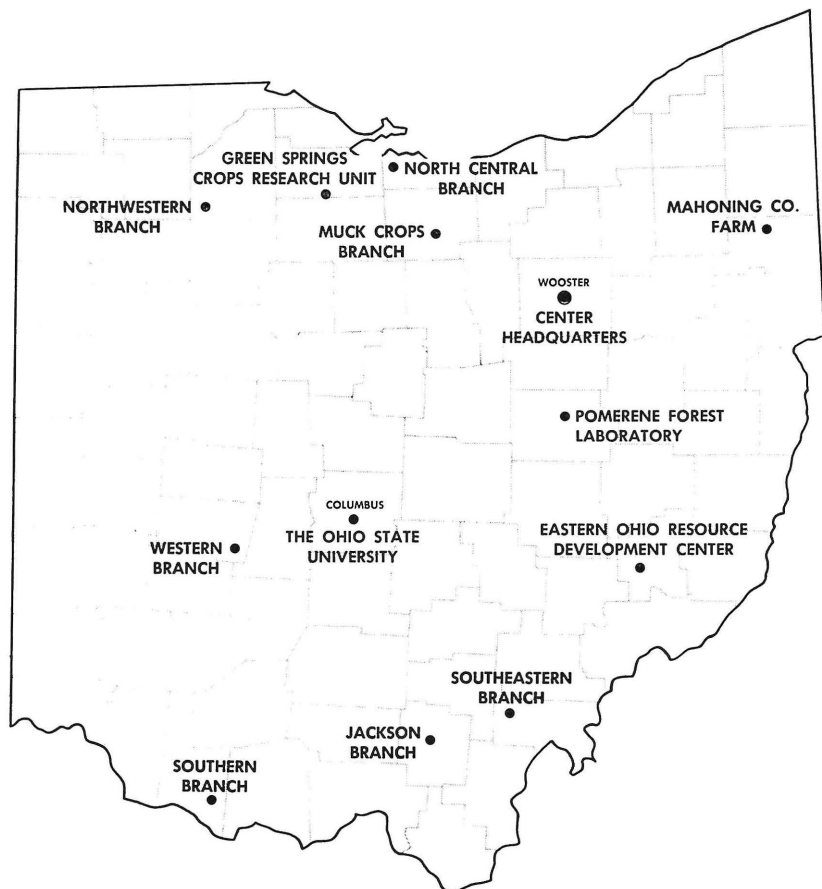
Salt used for ice and snow removal has proved highly toxic to many plants. The use of crushed lime or cinders in a garden path or service area may modify the acidity of the soil to exceed the tolerance of the existing vegetation. Equally as lethal is extensive paving adjacent to ornamental plantings, because impervious surfaces do not allow air and water exchange with the roots and impair proper root development. The initial grading prerequisite to paving may remove or cover enough roots to destroy desirable specimens.

## CONCLUSIONS

These are only a few examples of the common insect-related problems of woody ornamentals. Some insects should not cause alarm, while others should be controlled as soon as possible. Obviously, an insect found on an ornamental should be properly identified and its life cycle and damage potential learned before control measures are considered. Remember, not all insects on woody ornamentals are pests!

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# The State Is the Campus for Agricultural Research and Development



Ohio's major soil types and climatic conditions are represented at the Research Center's 13 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 15 departments on more than 6500 acres at Center headquarters in Wooster, nine branches, Green Springs Crops Research Unit, Pomerene Forest Laboratory, and The Ohio State University. Center Headquarters, Wooster,

Wayne County: 1953 acres  
Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 acres

Green Springs Crops Research Unit, Green Springs, Sandusky County: 26 acres

Jackson Branch, Jackson, Jackson County: 344 acres

Mahoning County Farm, Canfield: 275 acres

Muck Crops Branch, Willard, Huron County: 15 acres

North Central Branch, Vickery, Erie County: 335 acres

Northwestern Branch, Hoytville, Wood County: 247 acres

Pomerene Forest Laboratory, Keene Township, Coshocton County: 227 acres

Southeastern Branch, Carpenter, Meigs County: 330 acres

Southern Branch, Ripley, Brown County: 275 acres

Western Branch, South Charleston, Clark County: 428 acres