SP 609

Insect Defoliators of Ornamental Trees and Shrubs

Frank A. Hale
Associate Professor
Entomology and Plant Pathology

Jerome F. Grant
Professor
Entomology and Plant Pathology

Leaf feeding by insects on ornamental plants is common. This feeding damage is usually superficial and hardly noticeable. In such cases, control is not necessary. Beneficial predators, parasitoids, pathogens and unfavorable weather are all factors that help to regulate insect defoliator populations. Occasionally, more noticeable leaf feeding damage or considerable webbing occurs. While unsightly, this moderate feeding damage or webbing does not generally harm trees or shrubs. Common defoliators include moth caterpillars (Order Lepidoptera), sawfly larvae (Order Hymenoptera) and beetle larvae and adults (Order Coleoptera).

Often, our first inclination is to get out a sprayer and spray the pests with an insecticide. When possible, consider removing silken nests and caterpillar pests, such as the eastern tent caterpillar and fall webworm, by pruning the infested branch or by removing the nest with a garden rake or gloved hand. Other gregarious caterpillars that do not produce webs, such as yellownecked caterpillars, can be shaken from a limb and crushed. All of these techniques can be done in less time than it would take to spray. Still, spraying insecticide is often more practical, especially if the pests are distributed throughout a large tree or shrub where they would be hard to reach without a sprayer. Consider using a hose-end sprayer with a long nozzle designed to reach pests in larger trees. For additional information on the selection, handling and disposal of chemical insecticides, or for management recommendations for specific pests, please refer to Agricultural Extension Service publications entitled ***"Commercial Insect and Mite Control for Trees, Shrubs and Flowers***," PB1589; "***The Eastern Tent Caterpillar and Its Control***," SP341-N; "***The Japanese Beetle and Its Control***," PB946; and "***Using Pesticides in Greenhouses***," PB1595.

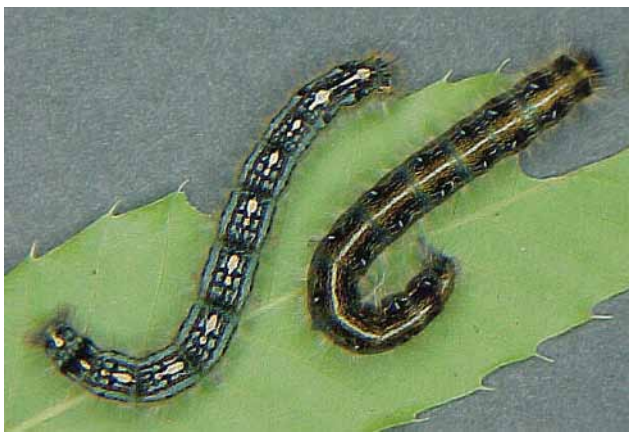
Many times the pests have completed development and left the plant by the time the damage is noticed. It is important to periodically examine plants for pests and the early signs of plant damage. Then, treatments can be made while the pests are still present. If the pests have only one generation per year, you may have only one opportunity to control them that year. Other pests may have two or more generations per year. Plants attacked by these pests will need to be monitored closely so that subsequent generations can be detected and controlled before much damage occurs.

In a landscape setting, control measures are often justified at damage levels well below that which would harm the plant. We put an aesthetic value on the plants in our landscape, and pest control is often desired to protect the beauty of the plant well before the health of the plant is threatened. In fact, most healthy deciduous trees can withstand a complete defoliation every three or four years without being significantly harmed. It is usually only when repeated defoliations occur once or more per year that the health of some trees or shrubs is seriously compromised.

Moth Caterpillars

Several types of webbing or nest-building caterpillars are often confused. These include the eastern tent caterpillar, the forest tent caterpillar and the fall webworm. These caterpillars, in their nests or on leaves of infested branches, can be pruned or pulled out by hand and destroyed.

The eastern tent caterpillar, *Malacosoma americanum* (Fabricius), is primarily a pest of black cherry, apple and crabapple, but will occasionally feed on other deciduous trees, including ash, birch, blackgum, maple, oak, poplar, cherry, peach, plum and pear. Caterpillars hatch in late March or early April from a black, spindle-shaped egg mass that encircles the twig. The egg masses, which are coated with a dark varnish-like substance called spumaline, were laid during June of the previous year. In early spring, when



David L. Cook

A forest tent caterpillar (left) with the key hole markings on its back and an eastern tent caterpillar (right) with the white stripe on its back.

Frank A. Hale

Eastern tent caterpillar nest on black cherry

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Fall webworm webbing on black walnut

the foliage begins to emerge, the small, white, silken nests can first be seen in the crotches of limbs. Caterpillars periodically leave the nest to forage on new foliage during the day, leaving trails of white silk wherever they forage. As the caterpillars grow, so does the size of the nest.

The caterpillars are black, somewhat hairy and have a white stripe down the back. A series of blue spots are located on each side between longitudinal yellow lines. When mature, the nearly 2-inch caterpillars move down the tree trunks to spin their white, silken cocoons on the bark of trees, on buildings, in grass and in other sheltered locations. The caterpillars can be quite noticeable as they cross sidewalks, driveways and highways prior to spinning their cocoon and pupating. The moths, which emerge in about three weeks, are cinnamon brown with two whitish stripes running obliquely across the forewings. Refer to *"**The Eastern Tent Caterpillar and Its Control***," SP 341-N, for more information on managing this pest.

The closely related forest tent caterpillar, *Malacosoma disstria* Hubner, is a major defoliator of tupelo, sweetgum, oak, ash, birch, basswood, elm and maple. Caterpillars hatch from a square-shaped egg mass that encircles the twig. The young caterpillars move up into the tree to feed on flowers, leaf buds and eventually foliage. Forest tent caterpillars make silken trails wherever they forage. While they do not make a nest like the eastern tent caterpillar, they do make a silken mat on the tree trunk or branch when they are ready to molt. Caterpillars have lots of blue coloration, including a bluish head and broad blue lateral bands bordered by thin, broken orange and brown lines. A series of prominent, white, keyhole-shaped markings run down the back, which is in contrast to the solid white line of the eastern tent caterpillar.

While the eastern and forest tent caterpillars are only active in the spring, the fall webworm, *Hyphantria cunea* (Drury), is active from spring through fall, with three generations occurring each year in Tennessee. Unlike the eastern tent caterpillar, the fall webworm forms large web nests that cover the ends of the branches. They enlarge the nest as they continue to feed for four to eight weeks. Two races of fall webworms, a blackheaded race and a redheaded race, may be encountered. The eggs of the blackheaded race are laid on the underside of leaves in a single-layer mass in mid-March, while the eggs of the redheaded race are first laid in double layers in mid-April. Long, fine hairs arise from the body and there are rows of bumps (= tubercles) on the back and sides of the caterpillar. The mature caterpillar of the blackheaded race is yellowish or greenish, with two rows of dark tubercles down the back that border a dark stripe. The redheaded race is a brownish orange or yellowish tan with orange to red tubercles.

Fall webworms attack at least 88 species of trees in the United States, including persimmon, pecan, hickory, black walnut, sweetgum, American elm, maples and sourwood. This pest has spread to Europe and Asia, where it attacks even more species. While not considered a serious forest pest, fall webworms can defoliate small trees in the landscape. It is probably best to use chemical control on smaller trees to prevent defoliation. If using an insecticide, choose one that will not adversely affect beneficial insect populations. On larger trees, it is usually sufficient to just remove unsightly webbing that can easily be reached. Do not be overly concerned about webbing high up in the tree.

Two other early-season caterpillar pests are the fall cankerworm and the spring cankerworm. These caterpillars can defoliate a variety of hardwoods, including ash, elms, maples, oaks and cherry in April and May. They have a reduced number of abdominal prolegs so that the middle part of the body raises when they crawl, characteristic of loopers or inchworms. The fall cankerworm is 1 inch long when mature and varies from light green to black, with a wide dark stripe down the back and light yellow lines on the sides. Spring cankerworms are $^{4}/_{5}$ to $1^{1}/_{5}$ inches long, with a yellow stripe on the sides. The highly variable body color ranges from black or reddish to yellowish brown or yellowish green. The head is light and mottled.

Eggs of both species hatch around bud break, and young caterpillars feed on new foliage in April and continue feeding for about six weeks. Initial feeding produces small holes in the leaves, while older larvae devour the whole leaf

except for the petiole and major veins. The mature larvae then move to the soil and pupate. They have one generation per year.

These two cankerworms are named based upon when the respective females lay their eggs. The fall cankerworm lays its eggs in late fall (November and December), while the spring cankerworm lays its eggs in late winter to early spring (February and March). Wingless adult female moths climb the trunks of trees and deposit masses of eggs on the twigs. One means of control on high-value trees is to place a sticky adhesive band around the tree trunk prior to when the female moths crawl up the tree. Another control option is to apply an oil spray prior to egg hatch, while the tree is still dormant, in mid to late March. Chemical control of the caterpillars may be necessary to prevent severe leaf feeding.

Variable oakleaf caterpillars, *Heterocampa manteo* (Doubleday), attack many hardwoods, including linden and all oak species, but they prefer the white oaks. Infestations causing severe defoliation and covering millions of acres can occur periodically in eastern North America. The outbreaks usually collapse after two to three years, before much tree mortality occurs.

The yellowish-green caterpillars have a narrow white stripe down the back and variable purplish-brown markings, while the sides have one or two yellowish stripes. The amber head is accented on the sides, with a purplish-brown stripe beside a white one. The caterpillars are 1½ inches when mature. While the young caterpillars skeletonize the leaf, the more mature caterpillars consume the whole leaf except the petiole and the main veins. Caterpillars of the first generation occur in May and June, while the more abundant second generation can be found during August and September.

Frank A. Hale

Variable oakleaf caterpillar on linden

The gypsy moth, *Lymantria dispar* (Linnaeus), from western Europe, has been a pest in the United States since 1869. The female gypsy moth, which does not fly, crawls up trees and other structures to lay her egg masses. The spread of gypsy moths is aided tremendously by people parking automobiles and campers in infested areas during July. Eggs laid on these vehicles have the potential of hatching hundreds of miles away when the vehicles are moved. Gypsy moths have been introduced into areas of Tennessee by these means. Currently, they are more generally established in adjacent states, such as Kentucky and Virginia.

Pheromone trapping for male gypsy moths occurs each year in Tennessee. If an infestation is found in Tennessee, eradication efforts are initiated by state and federal agencies to prevent this pest from becoming established. Gypsy moth caterpillars hatch from early April to May. The tiny caterpillars will climb up the tree, hang from a silken tread and can be dispersed by the wind for several hundred yards to several miles.

The brownish-gray caterpillars are hairy, with five pairs of blue spots followed by six pairs of red spots in a double row down the back. They are serious defoliators of many types of trees. Favored host species include oak, apple, basswood, birch, sweetgum, willow and hawthorn. Less-favored hosts are maple, cherry, cottonwood, hickory, elm, blackgum, sassafras and hornbeam. During heavy outbreaks, they will feed on pine, spruce, white cedar, hemlock and beech. Trees that are ignored or rarely fed on are ash, butternut, black walnut, catalpa, eastern redcedar, dogwood, holly, black locust, sycamore and tuliptree. Oaks are especially vulnerable to gypsy moth attack. Many deciduous trees will start to decline or die after two consecutive years of defoliation, while conifers may not survive after one complete defoliation.

If you spot gypsy moths in your area, please contact the Tennessee Department of Agriculture at 615-837-5130. Try not to confuse the gypsy moth caterpillar, which does not make a silken nest, with the eastern tent caterpillar, which does. Refer to ***"Gypsy Moth Management for Homeowners***," SP 518, for more information on this pest.

The bagworm, *Thryridopteryx ephemeraeformis* (Haworth), is a common caterpillar pest in Tennessee. Bagworms get their name from the characteristic bags or cases that the caterpillars construct of silk and plant material. The bag is carried wherever the caterpillar goes. When disturbed, the bagworm merely pulls its head back into the bag for protection.

The bagworm is especially fond of junipers (including eastern redcedar), arborvitae, white pine and other conifers. They also feed on a number of shade tree and shrub species such as boxelder, sycamore, black locust, willow, elm, poplar, oak, maple and persimmon. Eaten areas on evergreens remain void of foliage, altering the shape and appearance of the plant. Large sections of evergreens can

be killed so that severely damaged plants often need to be replaced. On large deciduous trees and shrubs, defoliation is less evident, although the bags are unsightly.

Adult male moths are about 3/4 inch long, black, heavy-bodied with mostly clear wings. Adult females are wingless, legless and wormlike, and do not leave the bag in which they pupated. After emerging, the males fly, locate a bag containing a female and mate with the female inside the bag. From 500 to 1000 small, round, cream-colored eggs may be laid and overwinter in the bag of the adult female. Since some bags had contained males, not all bags examined will contain eggs during the winter.

Eggs begin to hatch in late April to mid May. Upon hatching, the young bagworms crawl out of the bottom of the bag and start to feed and construct silken shelters over their bodies. As the bagworms feed and grow, they continue to enlarge the exterior of their bags. Feeding and growth usually continue until August, when the mature, dark brown caterpillars are about 1 inch long. At this time, the bagworm attaches its bag, about 2½ inches long, to a twig, closes it and pupates inside. Handpicking the bags is easiest when the bagworms are still feeding and not attached to the twigs. Since there is only one generation per year, one of the best ways to control bagworms is to thoroughly handpick and destroy them in the summer, fall, winter or before the eggs hatch in the spring. On larger trees, handpicking may be dangerous and impractical. Chemical control is best made in the late spring when the bagworms are small and easier to kill.

Yellownecked caterpillars, *Datana ministra* (Drury), are active in July, August and September. There is one generation per year. The cinnamon brown moth lays single layer masses of white eggs on the underside of leaves in July. The caterpillars from each egg mass start feeding on the outer layer of the leaf, which better reveals the network of leaf veins. These "skeletonized" leaves turn brown, often remaining on the tree. As the caterpillars grow, they will devour whole leaves, leaving only the petiole and the median leaf vein. They feed together on individual leaves or groups of leaves, one branch at a time. They feed on river birch, oak, elm, basswood, willow and a variety of other hardwoods. These distinctive caterpillars have eight yellow longitudinal lines down the back and sides. The body is reddish-brown when young and turns black as they mature. They are about 2 inches long when full grown, with long white hairs covering the body. Directly behind their black head, they have a yellowish-orange segment, from which they get their name. When disturbed, the caterpillars will elevate the front and tail ends in a defensive posture. They will regurgitate fluids if handled, so be careful not to spot your clothing if pruning infested branches or shaking them to the ground.

Alan S. Windham

Feeding damage from yellowneck caterpillar

Sawfly Larvae

Many species of sawflies are found on both deciduous trees and conifers. Some of the common ones are pests of dogwood, birch, mountain-ash, rose, pear, cherry, currents, azalea, elm, mock orange, oak, pine and many other plants. The winged adult is usually light brown and about ¼ inch in length. The adult female uses her serrated ovipositor (hence the name sawfly) to insert single rows of eggs in the underside of the leaf along the main veins or in the needles of conifers.

Sawflies are closely related to bees, wasps and ants. Sawfly larvae have more than five pair (usually eight pair) of fleshy abdominal prolegs that lack hooked spines on the underside called crochets. The larvae of most Lepidoptera (butterfly, moth and skipper caterpillars) have a maximum of five pair of prolegs with crochets. It is important to note that some microbial insecticides [such as *Bacillus thuringiensis* (Bt)] control many types of lepidopterous caterpillars but do not control sawfly larvae. Be sure that you have correctly identified your targeted pest before applying management efforts.

The slug oak sawfly, *Caliroa quercuscoccinae* (Dyar), is a shiny, yellowish green larva that looks like a gelatinous worm. It has a black head and thoracic legs and is ½ inch long when mature. They feed in groups, with the larvae skeletonizing the lower surface of the leaves. Remove in-

Alan S. Windham

Yellowneck caterpillars defoliating one branch at a time

Frank A. Hale

Eight pair of prolegs on the pine sawfly larvae

fested leaves or small branches and destroy the larvae before they can do much damage. The adults and larvae are present throughout the summer, with two to three generations occurring per year. This pest of white and red oaks can completely defoliate some trees by late summer.

The introduced pine sawfly, *Diprion similis* (Hartig), is a pest from Europe. The larvae have a black, shiny head and a dark body covered with many different-shaped, tiny yellow and orange markings. Each mature larva spins a light brown, silken cocoon, attaches it to a branch or nearby structure and pupates. It feeds on red, Scots and jack pine, although white pine seems to be the preferred host in Tennessee. They usually have three generations per year, but a partial fourth generation may occur when temperatures remain mild throughout the fall. This fourth generation can totally defoliate even large white pine trees.

Beetles

Several species of leaf beetles are pests of willow, cottonwood or poplar. The cottonwood leaf beetle, *Chrysomela scripta* Fabricius, is a pest of cottonwood, other poplars and some willows. The larvae skeletonize the leaves while the adults chew larger holes. The adults overwinter beneath bark or under leaves and other forest debris. The ¼ inch long adult beetles are yellow with broken black stripes on the wing covers. Sometimes the wing covers are all golden to black. The head and the area directly behind the head are black. In the spring they fly to trees and feed on foliage. They lay clusters of lemon-yellow eggs on the underside of leaves. Young larvae are black, while older larvae have a black head and legs, a light to dark brown body with numerous rows of black tubercles and two rows of larger light yellow tubercles. These glandular tubercles can secrete a defensive compound if disturbed.

A closely related species, *Chrysomela interrupta* Fabricius, feeds on willow, poplar and alder. The adult beetle is similar in color to the cottonwood leaf beetle, but it has dark rounded or curved markings on the wing covers. The larvae look essentially the same as that of the cottonwood leaf beetle. Another leaf beetle that feeds on willow and poplar is the imported willow leaf beetle, *Plagiodera versicolora* (Laicharting). Their eggs are oblong, yellow and laid in loose clusters. Adults are ⅛ inch long, shiny, metallic-blue beetles, while the larvae are dark and somewhat similar to the previously described cottonwood leaf beetle larvae. Larvae skeletonize the upper leaf surface, while adults chew ragged holes in the leaves, usually starting at the edge of the leaf and moving inward.

Another leaf beetle, the locust leafminer, *Odontota dorsalis* (Thunberg), is a serious pest of black locust. Locust leafminers can brown the foliage of whole hillsides of black locust or for miles along highways, giving the foliage a fire-scorched appearance by early summer. Larvae feed on the inner layer of the leaf tissue, causing an irregular blotch mine. They prefer to mine in the terminal portion of the leaf. Mature larvae are ¼ inch long, yellowish-white and flattened with black legs, head and anal shield. They pupate inside the mine and after emerging, the adults skeletonize the underside of the leaf. The ¼ inch long adult is flattened, with a black head, antennae and legs. The thorax and wing covers are orange except for a black stripe down the middle of the back.

Sometimes if severely fed upon, black locust trees will produce a second set of leaves. Since the locust leafminer has two generations per year, these new leaves can also be damaged. Locust leafminer damage, when combined with other stress factors such as drought, can reduce growth and potentially lead to death of some highly stressed trees. Fortunately, control is unnecessary in most cases. Irrigation during drought conditions may help trees

Frank A. Hale

Slug oak sawfly larvae skeletonizing an oak leaf

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Introduced pine sawfly on white pine

Frank A. Hale

Locust leafminer adult with feeding damage

better tolerate the stress. Insecticide applications can be made in high-value landscapes.

Japanese beetle, *Popillia japonica* Newman, is an introduced pest that has been in the United States since 1916 and in Tennessee since 1936. The larvae, a type of white grub, feed on the roots of grasses and a variety of crops and ornamental plants. Grubs molt twice by the fall and overwinter in the third instar stage. They reach full maturity in the spring and pupate in an earthen cell in the soil. Adult beetles emerge from late May through June. The gregarious adult beetles aggregate on host plants to feed and mate for the next 30-60 days.

Japanese beetle adults feed on more than 300 varieties of plants. Certain preferred host plants such as American linden, Japanese maple, crabapple, crapemyrtle, plum and cherry tend to suffer much more feeding damage than the less-preferred host plants, such as magnolia, redbud, dogwood, red maple, silver maple, tuliptree, sweetgum, ash, boxwood, black oak, white oak and northern red oak.

Adult beetles skeletonize leaves. Severe feeding causes the leaves to turn brown and often drop. Feeding damage on thin, fine-veined leaves or flower petals will often appear as large, irregularly shaped cut-outs. Protective insecticide sprays can be made to the foliage of susceptible plants during the period when Japanese beetle adults are active. Several sprays on a 7-10 day schedule may be necessary to prevent excessive feeding damage. Refer to "***The Japanese Beetle and Its Control***," PB 946, for additional information.

Frank A. Hale

Adult Japanese beetle

Many different types of insects may be found on ornamental trees, and they may simply be beneficials, pollinators or visitors. It is important to be able to distinguish and identify the damaging insects to determine the appropriate management strategy. Through proper sampling and monitoring, control measures can be better timed to reduce damage caused by insect defoliators and protect the beauty and value of ornamental trees and shrubs.

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