Department of
Forestry and Natural Resources

Cooperative Extension Service

FOR-174

Fall Webworms

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Fall webworms are native tent caterpillars that can be found throughout the United States and southern Canada[1]. This species is distinguished by its "tent" constructed at the ends of tree branches, allowing caterpillars to feed gregariously on enclosed foliage (Figure 1). While these insects can cause heavy defoliation, especially during periodic outbreaks, fall webworms by themselves do not cause mortality in healthy trees and are typically not a serious concern meriting management. However, other tent-forming caterpillars may be confused with fall webworm (such as the eastern tent caterpillar) and learning to distinguish these species can be useful for understanding potential impacts.

BIOLOGY

Fall webworms (*Hyphantria cunea*) are native moths, most easily recognized in their larval stage when caterpillars form silken webs in the foliage of trees. The web constructions serve as a nursery and defensive shield during their development[2]. Fall webworms are generalists capable of feeding on almost any species of hardwood tree or shrub. In Kentucky, fall webworms most commonly feed on elms, hickories, maples, and sweetgums[3]. In the northern part of this insect's range, only one generation is produced each year, while in the southern part of its range, between two and four generations may occur annually[4]. In Kentucky, two generations often occur each year; the first generation of adults emerge in March or April while the second develops in late June or July[3]. Typically, the first generation is smaller and less noticeable than the second.

Two forms of the fall webworm, both the same species but with slight morphological and behavioral differences, can be found in Kentucky. This includes both the red-headed, with reddish-orange larval head capsules, and black-headed, with black larval head capsules (Figure 2). In general, the black-headed form is thought to be more prevalent in northern populations of fall webworms, while the red-headed form more prevalent in the southern extent.

Fall webworms exhibit complete metamorphosis. They begin their life cycle as egg masses on the undersides of leaves of a host tree[4]. Egg masses may include 400-1000 light green-colored eggs, often covered with scales from the female moth, and laid in either a single (for black-headed forms) or a double layer (for red-headed forms)[4]. Within one to two weeks, larvae hatch from the eggs as pale yellow or tan caterpillars with two lines of black dots along their length[5]. Larvae feed and continue to grow for four to six weeks, and as they mature, develop light colored or tan hairs that originate in bundles from orange-brown or black spots along their bodies[1]. The growing larvae may become darker in color and also develop distinctive reddish-tan or yellow stripes (in red-headed forms) or brown to black stripes (in

Figure 1. Fall webworm tent located at the end of a branch. Photo credit: Linda Haugen, USDA Forest Service, Bugwood.org

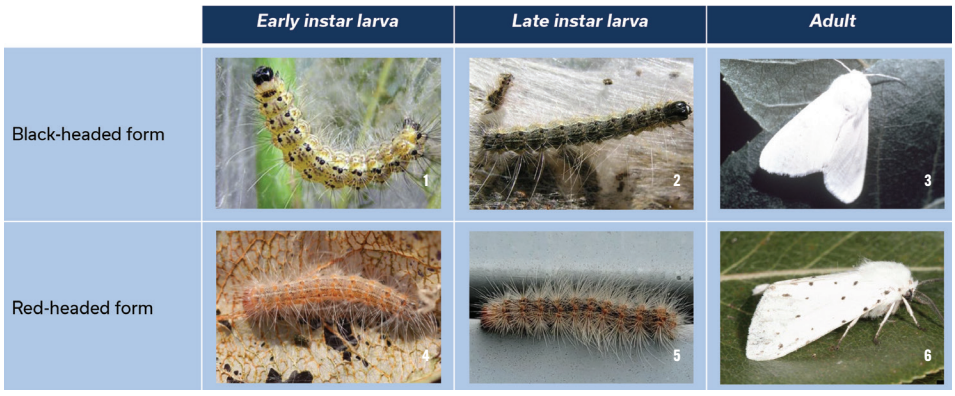


Figure 2. Black-headed and red-headed form comparison.

Crocker, E., Larson, J., and Hollowell, H. 2023. Fall Webworms. FOR-174. Cooperative Extension Service, University of Kentucky, Department of Forestry and Natural Resources. 4p.

Figure 3. Caterpillars within and on their silken tent. Photo credit: Steven Katovich, USDA Forest Service, Bugwood.org

Figure 4. Multiple fall webworm tents covering one tree. Photo credit: Lacy L. Hyche, Auburn University, Bugwood.org

Figure 5. Browning of branch tips caused by fall webworm. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org

black-headed forms)[2]. These larvae are typically about 1 ¼ to 1 ½ inches long at maturity[2]. After molting to the final larval stage, black-headed forms will leave the nest to feed on surrounding foliage while red-headed forms, even in this final larval stage, remain within the nest and feed on enclosed leaves[4].

The following stage of development, the pupal stage, is less conspicuous than the larval stage. Larvae spin tan or light-brown silken cocoons in which to pupate[1]. These cocoons are loosely constructed around crevices in bark or in the soil, or even occasionally on the sides of manmade structures[4]. The actual pupae of fall webworms inside the cocoon are dark brown and typically around 5/8 of an inch long[1]. The final stage of fall webworm development is the adult moth stage. After hatching from the cocoon, adult fall webworms' wings are entirely white (typical with black-headed forms) or white with small black or brown spots (typical with red-headed forms)[1]. The moth's bodies are typically hairy and white with small orange or tan spots and are about 1 ¼ inches in length[4].

Because fall webworm caterpillars' tent-forming habits are so distinctive, understanding the behavior of these caterpillars can also help identify them. Fall webworm females lay their egg masses on the underside of leaves in early to mid-summer[6]. When larvae emerge they immediately begin to feed on leaves and spin their silken webs to construct a tent[1]. These tents often begin to appear in mid- to late-summer[4]. Tents may contain a few hundred larvae feeding together in a single colony[6] (Figure 3). They initially enclose some leaves at the branch tip within their webbing as a source of food, eliminating the need to leave their nests to feed[5]. Larvae skeletonize the leaves, feeding on the leaf tissue while leaving the veins of the leaves intact[1]. Because the larvae feed within their web, pieces of leaves, droppings from the caterpillars and old molted skins may collect in the tents as well, creating debris in the bottom of the tent[2]. As the caterpillars develop and require more food, they expand their tent to envelop more leaves; this process of expanding the web may create tents that are two to three feet in length[5]. In cases where many tents exist in one tree, these tents may expand to enclose the entire crown of the tree, completely defoliating it[1]. However healthy trees can survive such defoliation and do not suffer long-term damage from fall webworm defoliation.

Once larvae mature, they undergo the next stage of their lifecycle, leaving their tents to crawl around the tree or nearby structures[6]. The larvae can sometimes become a nuisance as they wander from their host trees to pupate. After finding a place to spin a thin silken cocoon, caterpillars pupate and emerge as adults in late summer to begin the cycle for the second generation of caterpillars. This second generation feeds and develops in August or September in Kentucky, overwintering in the pupal stage within their cocoons[1]. These silken cocoons are often formed in the leaf litter or upper layer of soil, or on tree trunks or buildings. Adults emerge the next year to form a successive generation in late spring or early summer[6].

SIGNS AND SYMPTOMS

Egg masses of the fall webworm can be difficult to detect due to their light color and location on the undersides of leaves, so the first noticeable signs of these insects are their silken tents[7]. Webs on the ends of branches that enclose foliage in late summer are a telltale sign of fall webworms[7] (Figure 4). The caterpillars themselves are also often conspicuous throughout the tent. Foliage within these webs is often skeletonized by the larvae and turns brown prematurely[4]. Because of this browning of branch tips, from a distance this damage can sometimes be mistaken for other diseases or insects that cause flagging at branch tips (Figure 5). Additionally, once the caterpillars leave their tent to pupate, they often disperse from the trees in large numbers and can cause a conspicuous nuisance as they cover sidewalks and streets in urban and residential areas[6]. Although

fall webworms are an extremely conspicuous defoliator, the damage to trees is superficial[3].

SIMILAR INSECTS AND DISEASES

Fall webworms are distinct from other species of tent caterpillars in their construction of tents at the ends of branches rather than at forks in the branches[3]. This allows the caterpillars to feed on enclosed foliage within the protection of the tent instead of having to leave the tent to feed in the open. Eastern tent caterpillars and forest tent caterpillars are active at a different time of year and build tents in branch forks, leaving their tents to feed at night.

If fall webworm caterpillars are seen on the ground or on the trunks of trees, they are occasionally mistaken for walnut caterpillars or tussock moth caterpillars because of the tufts of hair that cover the caterpillars' bodies. However, walnut caterpillars are dark brown or black with light hairs while fall webworms have lighter tan or yellow bodies with some brown stripes or spots. Tussock moth caterpillars have shorter and more abundant hairs. These caterpillars also differ in host tree preferences, seasonal occurrence, and range. Additionally, the tussock and walnut caterpillars do not form tents in foliage and therefore cannot be mistaken for fall webworm if a caterpillar is found in a tent.

BEHAVIOR OF FALL WEBWORM

- Caterpillars form tents at the ends of branches and enclose leaves within the tents (tents can typically be found July through September)
- Caterpillars feed for 4 to 6 weeks, skeletonizing leaves and defoliating branches
- As caterpillars develop, they expand their tents, sometimes to 2 to 3 feet in length
- Caterpillars eventually leave their tents to spin a thin cocoon and pupate in crevices in bark, in the soil, or on nearby structures
- Outbreak populations can last for 1 to 3 years, but only cause superficial damage

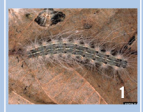
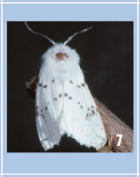
	Fall webworm	*Spongy moth*	*Forest tent caterpillar*	*Eastern tent caterpillar*	*Walnut caterpillar*	*Tussock moths*
Caterpillar						
Adult						
Seasonal Activity	First generation: April-June; second generation: July-September	April-July	March-May	April-May	June-August	April-June
Host Trees	Most broadleaved trees	Any	Most broadleaved trees	Trees in Rosaceae family	Trees in Walnut family	Varies (most hardwoods susceptible)
Tent-Building Behavior	Yes (at branch tips)	No	Yes (at branch forks)	Yes (at branch forks)	No	No

Figure 6. Common caterpillar species comparison chart.

The spongy moth is another pest that may be mistaken for fall webworm as both a larva and adult. Adult female spongy moths have white wings with small brown zig-zagging stripes but are otherwise very difficult to differentiate from fall webworm adults. As caterpillars, spongy moth and fall webworm also look similar with markings along the bodies and small bundles of hair originating from spots all over their bodies. However, spongy moth caterpillars have distinctive spots along their backs arranged in pairs, with 5 blue spots near the head followed by 6 red spots at the posterior end of the caterpillar. Fall webworm caterpillars may develop spots, but they are not in the same distinctive blue and red pattern. The following visual comparison chart helps illustrate the differences between these caterpillars (Figure 6).

IMPACT

Both the active defoliation of the feeding larvae and the empty tents left when caterpillars emerge to pupate can lower the aesthetic value of many ornamental trees and shrubs[5] (Figure 7). While outbreak populations may persist for one to three years, healthy trees are often able to recover after these defoliating events[1]. Additionally, because defoliation from fall webworms typically occurs in late summer or early fall, most trees have already undergone their seasonal growth and therefore are not as susceptible to long-term damage by the defoliation[2].

MANAGEMENT

In most cases, active management may not be necessary for fall webworms. While caterpillars may defoliate and lower the aesthetic value of trees, they rarely cause substantial harm to trees[3]. During most years, the many natural predators of fall webworm, such as birds and other insects, are capable of keeping the webworm population in check[6].

Woodland owners

In woodland settings, it is not cost-effective nor necessary to manage for these insects. Most often, fall webworm outbreaks target trees that are on the edges of the forested area and do not affect trees deeper within a stand. Because outbreaks only last from one to three years and the defoliation caused by fall webworms does not cause appreciable damage, outbreaks should simply be waited out. However, woodland owners concerned about trees that are under stress from other environmental conditions can encourage healthy trees through proper silvicultural practices that promote tree vigor, such as thinning overstocked stands and removal of invasive species.

Residential landowners

In residential areas, the presence of fall webworms can be a much more conspicuous and aesthetic problem. There are some small-scale management options available to urban and suburban landowners who wish to protect particular ornamental trees[5]. Repeated defoliation of young or recently planted trees, typically less than 5 years old, may weaken a tree and require some management (Figure 8)[1].

Young trees overall may be more susceptible to damage from insects and diseases. In the case of fall webworm, the defoliation of young trees can prevent those trees from photosynthesizing and producing enough sugars to maintain their health. As a general guideline, trees with over 20% of their canopy covered in fall webworm tents may experience some effects to health and should be monitored[2]. One option for management is manual removal of the tent; the webbing may be destroyed by simply pulling a stick through the tent and dislodging the caterpillars from the branch then putting the webbing and caterpillars in soapy water[7]. Another option for management involves pruning infested branch tips and destroying the tents manually[5]. However, pruning these branches causes just as much damage to the plant itself as the webworms would cause through defoliation of that branch during one season. Do not burn the tents while they are still in the tree as this most often causes the tree more harm than the initial defoliation by the fall webworms[2]. Options other than manual removal of the tents are available but may be unwarranted if manual removal is feasible. *Bacillus thuringiensis var. kurstaki* (aka Btk) is a bacterial insecticide that may be used for treatment. It specifically targets caterpillar larvae and will not harm many of the other beneficial insects that may be present in a tree at the time of treatment. In order to work, caterpillars must consume treated foliage, so treatment should be applied to leaves surrounding the web that the caterpillars would consume in the near future. This treatment is typically most effective when tents are small, and caterpillars are still in their early life stages. Spinosad, another organic insecticide, can be effective if applied in the same fashion. Other chemical insecticides may be available as well[6].

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Figure 7: Caterpillars skeletonizing leaves within their tent. Photo credit: Lacy L. Hyche, Auburn University, Bugwood.org

Figure 8: Canopy defoliation caused by fall webworm. Photo credit: Ryan Armbrust, Kansas Forest Service, Bugwood.org

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Figure 2: [1]Milan Zubrik, Forest Research Institute-Slovakia, Bugwood.org. [2]Bruce Watt, University of Maine, Bugwood.org. [3]Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org. [4]Whitney Cranshaw, Colorado State University, Bugwood.org. [5]G. Keith Douce, University of Georgia, Bugwood.org. [6]Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org.

Figure 6: [1]James B. Hanson, USDA Forest Service, Bugwood.org. [2]Jon YGerald J. Lenhard, Louisiana State University, Bugwood.org. [3]Steven Katovich, Bugwood.org. [4]William M. Ciesla, Forest Health Management International, Bugwood.org. [5]Lacy L. Hyche, Auburn University, Bugwood.org. [6]Herbert A. "Joe" Pase III, Texas A&M Forest Service, Bugwood.org. [7]Gerald J. Lenhard, Louisiana State University, Bugwood.org. [8]USDA APHIS PPQ, Bugwood.org. [9]Mark Dreiling, Bugwood.org. [10]Whitney Cranshaw, Colorado State University, Bugwood.org. [11]Mark Dreiling, Bugwood.org. [12]Mark Dreiling, Bugwood.org.

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