Home and Horticultural

PESTS

K-STATE Research and Extension

Bagworms

Shade trees and woody ornamentals are subject to attack by numerous insect species. The larvae of various moths and butterflies are among the most destructive foliar-feeding pests. Although caterpillars of most species are wormlike and not easy to distinguish from one another, the species *Thyridopteryx ephemeraeformis*, commonly known as bagworms, is easy to recognize (Figure 1). As the name implies, bagworm larvae (caterpillars) live in bags.

Figure 1. Bagworms are easily recognized.

Seasonal Life History

Bagworms overwinter as eggs, which are deposited in female pupal cases, which are individually housed within spindle-shaped female bags. From about mid-May through the end of June, larvae hatch and exit old bags. Individual larvae drop from the bag on a fine strand of silk. Swinging in the breeze, they come in contact with limbs or foliage and immediately construct miniature silk-lined bags. When bags are complete, larvae begin feeding. They decorate bags with bits and pieces of foliage. As larvae grow, bags expand to accommodate them (Figure 2).

Larvae remain in the bags to feed and move about with only heads and thoracic (legged) segments protruding from the front. When it's time to molt, the front of the bag is closed temporarily. Afterward, it is reopened and the larva continues to forage. The back of the bag remains open to allow the elimination of skin and feces. By mid- to late-August, bagworm feeding is complete. Larvae anchor bags to branches and seal themselves inside. Larvae turn to face the posterior opening of the bag and enter the pupal stage.

Figure 2. Bagworm life stages

Pupation is completed in two to three weeks. Just before moths emerge, male pupae work their way through the posterior opening, protruding slightly. **Male moths** are black with clear wings (Figure 3). After pupation, **female moths** remain in pupal cases within the female bags. Lacking wings, legs, antennae, mouthparts, and functional eyes, female moths are nothing more than soft, white, slug-like, egg-filled sacks (Figure 4).

Male bagworm moths use feathery antennae to find female bags by locating the source of female sex pheromone. Once at the female's bag, the male moth extends its abdomen and copulatory organ and thrusts it through the posterior opening of the female bag and through a slit in the pupal case that houses the female moth. After copulation, females deposit eggs (up to 1,000 per female) into their pupal cases. After eggs have been deposited, female moths use their body hairs to plug the entrance to the pupal case, helping to isolate and protect the eggs from parasites, cold winter temperatures, and moisture. Greatly diminished in size, spent females attempt to exit their bags. Those that are successful drop to the

Figure 3. Male bagworm moth

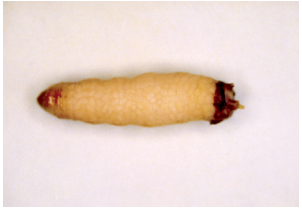

Figure 4. Female bagworm moth

ground and die. Those unable to exit die, too, and their bodies form an additional plug to protect the eggs. Once completed, the seasonal life cycle is repeated with overwintering eggs.

Hosts

Although bagworms are widely recognized as a pest of eastern red cedar and junipers, they may attack arborvitae, spruce, and pine. An array of broadleaf trees, shrubs, and ornamentals serve as hosts: willow, maple, oak, box elder, sycamore, poplar, locust, rose, barberry, pyracantha, clematis, sumac elm, cherry, quince pear, peach, and blackberry. In their absence, bagworms feed freely on clover, ragweed, parsley, and nightshade.

Bagworm activities are not restricted to their original host. After defoliating one plant, larvae can migrate to another, which may be the same species or one that is completely different. In one instance, larvae moved from defoliated junipers, up the trunks of neighboring flowering crabapples, and defoliated them, too.

Damage

The damage caused by bagworm feeding is much the same as it is for any lepidopteran species. Small larvae are not especially destructive because they are only capable of taking small bites and do not require a large amount of plant material to sustain themselves. But as larvae enter later developmental stages, they require more food. In a short time, seemingly overnight, heavy populations of large larvae may completely defoliate a tree.

Deciduous trees, which can rapidly replenish foliage, are better able to withstand foliar feeding damage. On the other hand, coniferous species are more susceptible to damage because of their slower growth. Successive years of heavy foliar feeding by uncontrolled bagworm populations can kill large, established conifers such as those that make up most windbreaks.

Control

Naturally occurring factors (i.e., climatic and biotic) can suppress populations of certain insect species. Similarly, under optimal moisture and temperature conditions, coupled with a reduction in the numbers of predators and parasites, a species population may build rapidly — especially if that species is capable of reproducing rapidly. As a result of such factors, bagworm population outbreaks occur from time to time and may persist for several consecutive years until populations are naturally reduced to nondamaging levels. When intervention is necessary, both cultural and chemical controls are available.

Cultural: Those who are opposed to using insecticidal sprays to control bagworms may try to eliminate bagworm infestations by handpicking individual bags. The best time to remove bags is during the winter when bags stand out in stark contrast to the darker foliage of evergreens, or against a lighter background if leaves have dropped off of deciduous plants or trees. Hand-picking should be completed by late April or early May before larvae hatch and begin to feed.

While male bags with extruded pupal cases need not be removed, **all other bags** should be picked and destroyed or eliminated. Remember that many bags may be hidden deeper within tree foliage and require a thorough search and removal procedure. A single missed female bag could result in a thousand new bagworm larvae. Handpicking may be impractical if a tree is covered with bags, is too tall, or if there are many infested plantings. Short of removing and disposing of an entire tree or bush, few cultural practices are available to control bagworms.

Insecticide Sprays: Once a bagworm outbreak has reached damaging levels, an insecticide application is required to eliminate bagworm larvae. There are several points to consider when implementing bagworm control.

Insecticidal control is most effective when larvae are in their early developmental stages — smaller larvae are more susceptible to insecticides. It is imperative that bagworm-infested trees be monitored for the presence of newly emerged larvae. Initiation of bagworm activities varies from year to year, depending on springtime temperatures. **Typically, bagworm larvae will begin emerging from the overwintering bag by mid- to late May.**

Given their small size (1 millimeter), newly emerged bagworm larvae are practically undetectable. However, a week after they emerge from the bag in which they overwintered, their newly constructed bags will be 3 to 4 millimeters long (Figure 2, top row, right). Bags will be brownish and will stand out in contrast to the surrounding foliage. It requires some concentration to discern small bags, but once detected, they become readily apparent. The bags will be in continual motion as the small worms feed and move about.

Initiation of spray treatments depends on the condition of the infested tree(s). If the previous year's damage was slight, a single spray treatment should be applied at the end of June or the first week in July. The delay between the appearance of new larvae and the spray application will ensure that all larvae will have emerged from the parent bag. At this point, bagworms will not have caused much additional feeding damage because of their small size, and slightly damaged plants can recover.

If the previous year's feeding damage was severe, any additional feeding damage even by small larvae could cause further setback to trees. In these instances, immediate treatment is recommended to preserve new and important growth essential to restoring tree vitality. It is imperative to apply a treatment when feeding begins and a follow-up treatment two to three weeks later to kill worms that emerge later that were not killed by the initial treatment.

Thorough spray coverage is essential to reduce bagworm populations. Merely waving a sprayer nozzle and misting infested trees only kills bagworms feeding on tree peripheries. Insecticides must be applied with sufficient sprayer pressure, and in adequate amounts of water carrier to ensure penetration of dense foliage.

Treatment of windbreaks presents a challenge. Windbreaks generally consist of several long rows of eastern red cedars. It is difficult to deliver insecticides to upper portions of mature trees and inner portions of the windbreak. It is, therefore, recommended that a high-pressure ground sprayer capable of delivering high volumes of an insecticide mixture be used to

achieve total coverage. While this will be laborious and time consuming, it will be effective.

Although aerial applications have appeal in terms of ease of insecticide applications to large tree areas, achievable gallon per acre delivery rates will likely be insufficient to penetrate and provide thorough coverage against massive bagworm infestations.

Insecticides are chemical products that, when applied to targeted pests, disrupt normal physiological processes, causing death. The active ingredient is the actual component, or killing agent, contained in an insecticidal product. Many companies may purchase the same active ingredient and formulate it into their respective products/product line. At the time of publication, 522 products were registered in Kansas for use against bagworms. It is impractical to list them all, and retailers are not likely to stock every product. Users should visit local stores to check availability.

Although all pest species may not be specifically listed on a product label, under Kansas Administrative Regulation 4-13-28 of the Kansas Pesticide Law, which applies to target pests not specified on the pesticide's label or labeling, "Any pesticide may be applied for the purpose of controlling a pest that is not specified on the pesticide's label or labeling provided that: (a) (1) the pesticide's label or labeling authorizes application of the pesticide to the same crop, animal or site requiring application; (2) the pest to be controlled belongs to the same general group of pests intended to be controlled by the pesticide to be applied; (3) the pesticide's label or labeling does not specifically prohibit its application to the target pest to be controlled, or to the crop, animal or site to which the pesticide is to be applied; and (4) the application of the pesticide to the target pest, or to the crop, animal or site, has not been prohibited by rules and regulations promulgated by the secretary. (b) Each pesticide applied in accordance with the provisions of the abovementioned subsection (a) of this regulation shall be deemed not to cause any unreasonable adverse effects on the environment, nor to endanger the health, safety or welfare of the citizens of this state."

If evergreens have not been damaged beyond the point of no return, expect recovery to occur. The rate of recovery will depend on the severity of damage. Once bagworm populations have been eliminated or reduced to nondamaging levels, fairly good recovery will occur within as little as three to four months (Figure 5 versus Figure 6 on page 4); to as long as two years (Figure 7 versus Figure 8, page 4).

Bagworm Damage and Recovery

Figure 5. Bagworm damage, June 1995.

Figure 6. Four months later, October 1995.

Figure 7. Bagworm damage, August 1996.

Figure 8. Two years later, August 1998.

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