K-STATE Kansas State University

Home and Horticultural PESTS

Bagworms

Shade trees and woody ornamentals are subject to attack by numerous species of insects. The larvae of various moths and butterflies constitute some of the most destructive foliar feeding pests. While caterpillars of most species are "wormlike," and therefore, may not appear that much different from one another; one species, *Thyridopteryx ephemeraeformis*, is instantly and universally recognized: **Bagworms!** (Figure 1). As their name implies, bagworm larvae/caterpillars/worms live in bags.

Figure 1.

Seasonal Life History

Bagworms overwinter as eggs deposited in the female pupal cases which are individually housed within spindle-shaped female bags. From mid-May through mid-June, larvae hatch from eggs and exit from the posterior opening of the old bag. Individual larvae often drop down from the bag on a fine silk. Swinging in the breeze, larvae come into contact with limbs or foliage. Larvae then immediately construct their miniature silk-lined bags. Only after the bags have been completed do the larvae begin actual feeding activities. Larvae decorate their bags with bits and pieces of whatever foliage they are feeding on. As larvae grow, their bags proportionately increase in size (Figure 2, bottom row).

As they feed and move about, bagworm larvae remain entirely within their bags with only their head and thoracic (legged) segments protruding from the bag's anterior opening. Larvae temporarily close off the anterior opening when it is time to molt. Upon completion of the molting process, larvae reopen their bags and continue foraging. A bag's posterior opening is always open, and provides an exit through which fecal materials and shed skins can be eliminated.

Figure 2.

By mid- to late August when feeding activities are complete, larvae firmly anchor their bags to the twigs and branches on which they were feeding. Next, they permanently close the anterior ends of their bags. Within the bags, the larvae twist and turn around so that their heads face downwards near the posterior opening of their bags. This done, larvae enter the pupal stage.

Pupation is completed in 2 to 3 weeks. Just prior to moth emergence, male pupae work their way through the posterior opening until they partially protrude. Male moths then emerge from the pupal case. **Male moths** are black in coloration but

Figure 3.

their wings are clear (Figure 3). **Female moths**, upon completion of their pupation, remain in their 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).

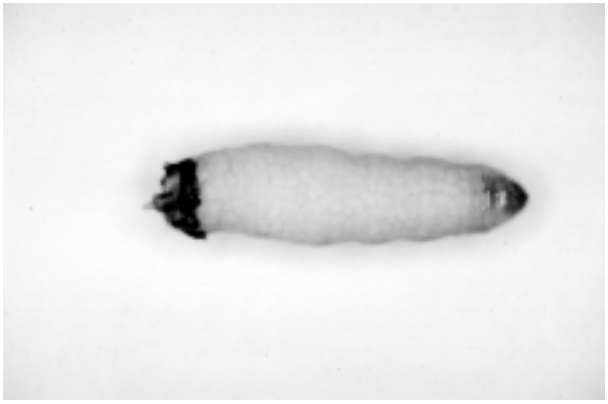

Figure 4.

Male bagworm moths find female bags by utilizing their feathery antennae to "home in" on the source of a female-emitted sex pheromone. Once at the female's bag, male moths extend their abdomens and copulatory organs and thrust them through the posterior opening of the female bag and then through a slit in the pupal case which houses the female moth. After copulation, females deposit their eggs (up to 1,000 eggs per female) into their pupal cases. After all of their eggs have been deposited, female moths use their body hairs to "plug" the entrance into the pupal case, thus, helping to isolate and protect the eggs from parasites and "the elements of winter" (cold temperatures and moisture). Greatly diminished in size, spent females attempt to exit their bags. Those successfully doing so drop to the ground where they die. Those which are unsuccessful in exiting their bags die, and their bodies form an additional "plug" to protect the eggs. This completed, the seasonal life cycle is repeated with the overwintering eggs.

Hosts

While widely recognized as a notable pest of eastern red cedar and junipers, bagworms will attack arborvitae, spruce and pine. An array of broadleaf trees, shrubs and ornamentals serve as hosts to bagworms: willow, maple, oak, box elder, sycamore, poplar, locust, rose, barberry, pyracanthia, clematis, sumac elm, cherry, quince pear, peach and blackberry. In the absence of these hosts, bagworm reportedly feed freely on clover, ragweed, parsley and nightshade.

Bagworms are not restricted to the host species upon which they began their feeding activities. After defoliating a host plant, larvae are capable of migrating ("on foot") in search of the next available host, be it the same species from which they came or a completely different species. In one instance, larvae moved out of defoliated junipers and up the trunks of neighboring flowering crabs where they proceeded to defoliate.

Damage

The damage caused by bagworm feeding activities is much the same as for any lepidopteran species. Small larvae are not especially destructive, only being capable of taking "small bites"—they do not require great amounts of plant material to sustain themselves. However, as larvae enter later developmental stages, they require greater amounts of food to sustain their greater sizes. In a short period of time (seemingly overnight), heavy populations of large larvae may completely defoliate the tree hosts upon which they are feeding.

While broadleaf/deciduous trees have greater abilities to absorb foliar feeding damage (auxiliary buds can replenish foliage within 3 to 4 weeks depending on the time of the season), coniferous species are more easily damaged due to their slower growth patterns. Thus, several successive years of heavy foliar feeding (by uncontrolled bagworm populations) may even result in the death of large established conifers such as those making up the bulk of plantings in windbreaks.

Control

It is accepted that, in nature, there are naturally occurring factors (i.e. climatic and biotic) that suppress populations of certain insect species. Similarly, under optimal moisture and temperature conditions, coupled with a disruption (lessening or elimination) of the numbers of predators and parasites, a species population may rapidly build, especially if that species possesses a high reproductive capability. Thus, bagworm population outbreaks occur from time to time, and may persist for several consecutive years until such time that their populations are naturally reduced to nondamaging levels.

When it becomes necessary for people to intervene in attempting to control bagworm, there are two basic options: cultural and/or chemical control.

Cultural: People who are opposed to utilizing insecticidal sprays to control bagworms may attempt to eliminate bagworm infestations via handpicking individual bags. The best time for bag removal is during the winter months when bags stand out in stark contrast against the darker foliage of evergreens, or against a lighter background if leaves have dropped off of deciduous plants/trees. Handpicking should be completed by late April or early May before larvae hatch from their eggs to begin their current season feeding cycles.

While male bags with evident extruded pupal cases need not be removed, **ALL OTHER BAGS** should be picked and destroyed or disposed of. Remember that many bags may be found deeper within tree foliage, thus requiring a very thorough search and removal procedure. Again, a single missed female bag could result in a thousand new bagworm larvae.

Handpicking becomes impractical when an individual planting is literally covered with bags, or is too tall to make handpicking possible. Also, if there are many infested plantings, hand picking is not an option. Short of the removal and disposal

of an entire tree/bush, there is little else left to do (of a cultural method) against bagworms.

Insecticidal Sprays: Once bagworm outbreaks have reached epidemic levels, the application of an insecticide 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 vary 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, upper 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 upon the condition of the infested tree(s). If the previous year's damage was slight, a single spray treatment should be applied in late June. The delay between the appearance of new larvae and the spray application will ensure that all of the larvae will have emerged from the parent bag. At this point, bagworms will not have caused much additional feeding damage due to their small size, and slightly damaged plants can withstand this.

If the previous year's feeding damage was severe, any additional feeding damage by even 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 activities begin, and a follow up treatment 2 to 3 weeks later to kill later-emerging worms not killed by the initial treatment.

Thorough spray coverage is essential to reduce bagworm populations. Merely waving a spray nozzle (misting) over infested trees only kills those 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 rows of Eastern red cedars planted for a substantial linear distance. 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.

There are various **insecticidal products** registered for use against bagworms. Bacillus thuringiensis (Bt) products are commonly marketed under the trade names DiPel, Thuracide, Cutlass, Crymax, Condor and Mattch. It is essential that Bt products be applied against bagworms while they are still in early growth stages. Several Bt applications may be required to attain effective control.

Figure 5.

Figure 6.

Active ingredients (Trade Name) of synthetic insecticides registered against bagworms include: acephate (Orthene); bendiocarb (Turcam); bifenthrin (Talstar); carbaryl (Sevin, Carbaryl); chlorpyrifos (Dursban, Bagworm Spray); cyfluthrin (Decathlon, Tempo); diazinon (Diazinon); dimethoate (Dimethoate, Cygon); fluvalinate (Mavrik); lambda-cyhalothrin (Battle, Scimitar); neem (Azatin); permethrin (Astro) and trichlorfon (Dylox).

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 3 to 4 months (Figure 5 versus Figure 6); to as long as 2 years (Figure 7 versus Figure 8).

IT IS THE RESPONSIBILITY OF THE END USER TO READ ALL OF A PRODUCT'S LABEL TO ENSURE ITS SAFE AND LEGAL USE ON THE INTENDED PEST AT THE PROPER SITE AND ON THE INTENDED HOST.

Figure 7.

Figure 8.

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