# School Pest Solutions

# Spongy Moth


The spongy moth (formerly gypsy moth) was accidentally introduced into Massachusetts in 1869 and was widespread across the northeast by 1902. It has traveled west as far as Ohio, north to Montreal, and south to North Carolina. Central Michigan has an isolated population. More isolated populations occasionally spring up in other states, but they are usually quickly eliminated.

Because of heavy defoliation and subsequent tree mortality, the spongy moth is the most important insect pest of forest and shade trees in the eastern United States.

## Identification and Biology

Female adult moths are creamy white with dark brown bands across the wings. The body is thick and covered in short hairs and the antennae are thin. She has a 2" wingspan, but has poor flying abilities. The male, in contrast, has a 1/4" wingspan but is much more adept at flying. The body is narrower and darker than the female's, and the wings are brown with black or dark brown bands. The antennae are feathery.


*Adult Male*


*Adult Female*

Eggs are globular and white, about 1/32" in diameter. The female will lay them in oval masses averaging 400-500 eggs per mass, but they may reach up to 1,000 eggs. The masses are about 1/2" to 2" long, depending on the shape. The eggs are covered in the hairs from the female's abdomen.

When the larvae hatch, they are the same buff color as the egg mass, but turn black within four hours of hatching. Younger caterpillars are brown to black and have long hairs on the body. Older caterpillars are black and have 11 pairs of colored bumps called tubercles along the surface. The front five pairs of tubercles are blue and the back six pairs are red. Each one is topped with a tuft of brown or yellow hairs. A yellow line runs from the head to the end of the body.

## Hosts

The wide variety of host plants plays a major factor in why the spongy moth is so hard to control. The larvae feed on the leaves of almost 500 different species of trees and other plants. The adults do not feed- they do not have functional mouthparts. Larvae especially like oak trees, including red, black, chestnut, and white oak. Basswood, aspen, birch, and beech are other favorites. Maple trees, hickory, cherry, and pine are also eaten, but not to the same extent as the others. As with many other pests, the larvae will attack already stressed trees more readily than healthy trees.

## Population Cycles

Spongy moth populations exist in four phases: innocuous, release, outbreak, and decline. The innocuous phase is characterized by very low population. This may continue for several years, during which the different stages may be very difficult to find. After a few years, the release phase starts; this results in a population density increase up to many times over. The outbreak stage occurs with populations that are high enough for the larvae to create noticeable defoliation. This stage rarely lasts more than a couple years. The decline stage is a result of the defoliation. The population rapidly crashes, brought on because of starvation and disease.

## Environmental Factors

***Temperature:*** The eggs, when they are exposed to temperatures less than -45 F, encounter high mortality. Larvae die when they are exposed to temperatures below freezing.

***Moisture:*** Larvae will drown when exposed to heavy rainfall at hatching. If rain occurs during the first instar, caterpillars will seek shelter on the underside of leaves, potentially increasing the duration of this instar. If this continues, the extended congregation may result in increased stress for the larvae, increasing their susceptibility to nucleopolyhedrosis virus, or "wilt".

***Light:*** Spongy moths react to light in almost all stages. The instars hatch and follow light, leading them up the stem of the host plant, where they disperse. Young instars feed during the day and seek shelter at night, while older instars do the opposite. Adult emergence also is affected by the dark and light cycles.

## Monitoring and Thresholds for Spongy Moths

***Population monitoring:*** Several methods are available for monitoring spongy moth populations. The choice of method should be based on the population level suspected, location of sampling site in relation to the established United States infestation area, and resources available. The U.S. Forest Service currently provides spongy moth survey assistance to any federal agency on request, and should be consulted if you wish to have a survey conducted.

***Adult male trapping:*** These techniques involve the use of special traps baited with a synthetic form of the sex pheromone produced by receptive female spongy moths. The trap currently used for spongy moth surveys by the U.S. Forest Service and the USDA Animal and Plant Health Inspection Service (APHIS) are fully described by Schwalbe (1979). Although several variations of the trap design are manufactured, the USDA-approved traps can be obtained from your regional U.S. Forest Service office. Pheromone traps should be placed before male moths begin flying. An effective technique only for relatively low populations, pheromone trapping is recommended for use in areas outside (or on the edges of) established infestations.

***Larval trapping:*** The collection of spongy moth larvae under burlap bands, while not useful in quantifying population density, can serve as another early indicator of low (e.g., recently established) but building populations. The most convenient method involves tying a 12"-wide burlap band around the trunk of each tree to be monitored so that the top 6" of the band can be pulled down over the bottom, making a shaded flap in which larvae will hide during daylight hours. Bands should be monitored two times each week and any trapped

larvae should be destroyed. The presence of spongy moth larvae in such traps indicates that a population may be developing in the vicinity of the trap site and that other survey methods should be used to determine whether treatment is required. Tar-paper wrappings and plastic tree flaps can be used instead of burlap.

***Egg mass counting:*** Several methods have been developed for determining the number of spongy moth egg masses in an infested area. Egg mass counts can be done from the time of oviposition, usually June-August, until egg hatch the following April or May. Counts are easier and probably more accurate, after the leaves have dropped from deciduous trees. The walks generally follow an "M"-shaped pattern through the area to be sampled, which helps to eliminate an edge effect. In forest situations, edge trees have found to have more egg masses than interior trees.

## Non-Chemical Control of Spongy Moths

***Egg mass destruction:*** Scraping and removing egg masses is one of the oldest methods used against the spongy moth in North America. In residential areas, where up to half or more of the egg masses may occur within reach of the ground, this approach may destroy a significant portion of the population. However, because of the tendency of larvae to migrate in from adjacent areas, scraping should not be relied upon for effective control. Vegetable oils have been shown to be effective ovicides when applied to egg masses in the fall and a soybean oil product is registered for use on spongy moth egg masses.

***Barrier bands:*** Sticky barrier bands placed on tree trunks can prevent larvae from traveling between trees. They also may reduce the defoliation on isolated trees. However, they are not totally reliable. Sticky barrier bands are available commercially or can be made from duct tape and Tree Tanglefoot. Tanglefoot should be applied to the tape and not the surface of the tree because it can damage bark. Since they can reduce larval populations somewhat, and because of their low cost, sticky barrier band use may be advisable on high value, individual trees when no other treatment will be used. However, sticky barrier bands alone should never be relied upon to prevent defoliation.

## Natural Enemies of Spongy Moth

Naturally occurring predators and parasitoids of the spongy moth, while numerous and abundant, are not capable of preventing outbreaks. Efforts to control spongy moths by rearing and releasing large numbers of parasitoids have not been successful. A good alternative is to use management techniques that will not adversely affect the natural predators.

## Pathogens

***Bacteria:*** The naturally-occurring bacteria *Streptococcus faecalis* and *Pseudomonas spp*. occasionally cause high levels of mortality (up to 60%) under outbreak conditions (Podgwaite 1981).

***Nucleopolyhedrosis virus****:* A virus of the genus *Baculovirus* is closely associated with all North American spongy moth populations. Its effects are most often seen under outbreak conditions, when a large proportion of the larval population may be killed. For more information on this disease, see the full chapter on spongy moth management listed below.

***Entomophaga fungus****:* For the first time in 1989, the fungal disease *Entomophaga maimaiga* was reported causing widespread mortality to North American spongy moth populations (Hajek and Soper 1992). This disease was known to cause extensive mortality in Japan. It is now known to occur in 13 states from Maine to Virginia (Elkinton et al. 1991). The appearance of larvae killed by Entomophaga is similar to that of virus-killed larvae, and definitive identification requires examination by an expert.

## Predators

***Invertebrate predators**:* Ground beetles, ants, and spiders are known to feed on spongy moth larvae and pupae. One predatory beetle, Calosoma sycophanta, was successfully introduced into North America from Europe. This ground beetle sometimes becomes abundant in outbreak spongy moth populations, but usually lags one to three years behind (Weseloh 1985).

***Birds**:* Many species of birds feed on spongy moths, but they are not a major diet item for any of the common species (Elkinton and Liebhold 1990). Most birds are deterred by the long hairs on larvae. Nuthatches, chickadees, towhees, vireos, orioles, catbirds, robins, and blue jays are probably the most important species in innocuous-phase spongy moth populations. Cuckoos and flocking species such as starlings, grackles, red-winged blackbirds and crows may be attracted to outbreak populations (Smith and Lautenschlager 1978).

***Mammals**:* Shrews and white-footed mice eat larvae and pupae and may be a major factor in the maintenance of low spongy moth populations (Elkinton and Liebhold 1990). There is some evidence that regional changes in small mammal density may account for the region-wide onset of spongy moth outbreaks (Liebhold and Elkinton 1989).

## Favored-Host Removal

Since the demise of the American chestnut as the dominant overstory tree in the eastern United States deciduous forests, oaks have become a dominant species. Unfortunately, oaks are also the favored hosts of the spongy moth throughout its range. In the absence of external control measures, repeated defoliation of favored trees may result in a shift of dominance to nonhosts and less favored hosts, such as maples. This will ultimately reduce the magnitude of the spongy moth problem in these areas. While selective removal of favored spongy moth hosts is an impractical solution for most park sites, selection of planting material for areas under development (e.g. urban schools) to exclude favored hosts is definitely feasible and should be strongly encouraged.

*Information from this page can be found on the National Park Service's IPM Manual:* http://www.nature.nps.gov/biology/ipm/manual/gypsymth.cfm.

## Additional Resources

Gypsy Moth [Minnesota DNR Invasive Species Page]
Gypsy Moth Fact Sheet [PA State Entomology Extension]
Gypsy Moth in North America [US Forest Service]

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