

## The Gypsy Moth and the Homeowner

The gypsy moth caterpillar is the most serious threat to oak forests in the United States. The pest was introduced into Massachusetts from Europe in 1869, but it did not spread rapidly until the late 1960's. In Maryland, the first gypsy moth appeared in 1959, the first egg mass in 1971, and the first extensive defoliation occurred in 1981. Damaging levels of defoliation usually occur where oaks are the most abundant trees. If you have oak trees on your property, gypsy moths pose a threat to the beauty and value of your land. When a heavy infestation occurs in a populated area, the numerous, wandering caterpillars become a nuisance to people also. This fact sheet will provide you with information about the identification, habits and control of the gypsy moth.

### Appearance and Habits

The gypsy moth develops in four different stages each year: egg, caterpillar or larva, pupa or cocoon, and adult moth. The following description of the gypsy moth life cycle is characteristic for Central Maryland. Each form is illustrated in maximum life size unless otherwise indicated.

#### Eggs

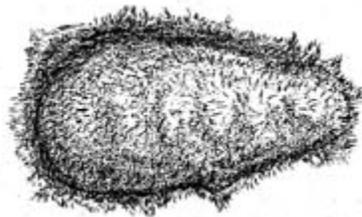
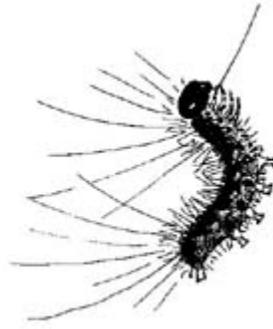


Figure 1. Egg Mass

Adult female moths cannot fly so they crawl about to lay their eggs. The eggs may be found in bark crevices, on the undersides of branches, and on the ground under loose stones, boards, firewood, lawn furniture and other structures. Each egg mass is covered with fine yellow hairs from the female's abdomen which turn tan, and then become almost gray. The entire, felt-like, oval mass can be as large as 40 millimeters (1 1/2 inches) long and 20 millimeters (three-fourths of an inch) wide, and contains about 1,000 eggs. This pest overwinters in the egg stage. Eggs begin hatching in April or early May, depending on spring temperatures. Egg hatching is earlier in southern counties and later in northwestern ones.

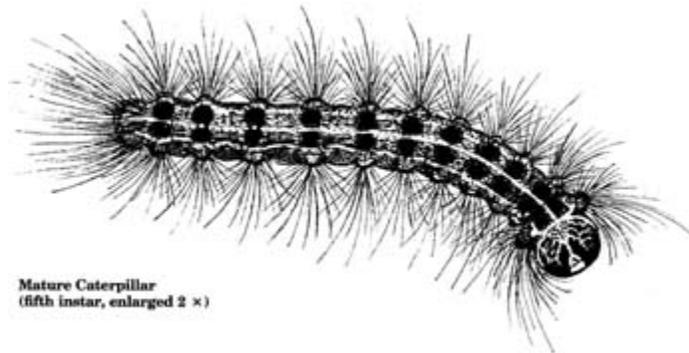
## Young Caterpillars (or larvae)



**Figure 2.** Ballooning Young Caterpillar (enlarged about 4x)

The newly hatched caterpillars are only 1 millimeter (one-sixteenth of an inch) long and mostly black. They are called first instar or first stage caterpillars. First instar caterpillars crawl into treetops where they are seldom seen in low populations. Some larvae spin silk threads and hang from them until the wind carries them away. This is called "ballooning" and is one way gypsy moths spread. After feeding for several days, the caterpillars shed their skins and grow to about 10 millimeters (three-eighths of an inch) in length. The second instar caterpillar is mostly black but has a visible band of light brown down its back. The third instar caterpillar is about 15 millimeters (five-eighths of an inch) long and looks like the second one except that it has 10 pairs of blue spots down its back. During most of May the caterpillars are small and not quite half-grown. Several instars may be present at one time. The second and third instar caterpillars feed in treetops during the day. The damage they create looks like shotholes, which are not easily detected from the ground. This is unfortunate since this is the best time to spray trees for excellent gypsy moth control.

## Older Caterpillars



**Figure 3.** mature Caterpillar (fifth instar, enlarged 2x)

Important changes occur in the habits and appearance of the fourth instar caterpillar. At this stage, it is about 25 millimeters (1 inch) long after shedding its skin. On its back are pairs of raised humps or tubercles. The first five pairs of dots remain blue but the last five pairs turn brick red. Fourth-stage caterpillars rest during the day. They hide on tree trunks in shaded areas and only feed at night. In large populations, not all caterpillars find resting places in trees. Some crawl down the trunk at dawn and find hiding places on the ground. At dusk they migrate back up the tree to feed all night. This activity usually begins in late May. In June, the caterpillars begin eating entire leaves; leaf loss (defoliation) becomes evident when large numbers are feeding. The fourth stage is usually the first one noticed by homeowners in cases of light infestations.

The male caterpillar has five stages in its life cycle while the female has six. The caterpillar is at its largest size in the last stage. The female can grow to about 65 millimeters (about 2 1/2 inches) in length. Laststage caterpillars feed voraciously in June and are responsible for most of the leaf loss in trees. In late June, when a gypsy moth population is high, these large caterpillars crawl away from defoliated

trees by the thousands. At this time they search for more food, or for hiding places where they change into the pupal or resting form. This searching activity takes them up house foundations, onto decks, lawn furniture, campers, trailers, air conditioners, sheds and sometimes inside houses. This activity can continue to be a nuisance until early July, to the annoyance of homeowners.

Other kinds of caterpillars-cankerworms, tent caterpillars and the fall webworm-are oftentimes confused with gypsy moths. Cankerworms feed on many types of trees at about the same time of year as gypsy moth caterpillars. They are green or dark brown and are sometimes striped. However, they lack the dense hairs of gypsy moth larvae and are easily recognized by their smooth, hairless appearance. Tent caterpillars emerge earlier than gypsy moths by about 3 weeks to 1 month. They are usually quite large, up to 50 millimeters (2 inches), by the time gypsy moths have hatched. Although they are dark and hairy, you can distinguish them from gypsy moth caterpillars by their white stripes or the rows of irregular white spots down the middle of their backs. Their sides are often marked with blue stripes. The eastern tent caterpillar builds tents of white silk in the branches of trees such as the cherry tree. Gypsy moths never build such tents. Fall webworms first appear in mid- to late June on a variety of trees. They are hairy and are light yellow or brown. They build webs on the ends of tree branches and are most abundant in July and August, long after gypsy moth caterpillars are gone. More information on these pests can be found in Entomology Leaflet 21.

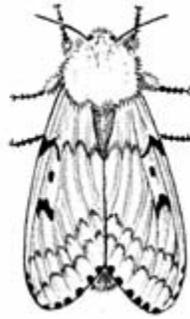
## **Pupa**



**Figure 4.** Pupa

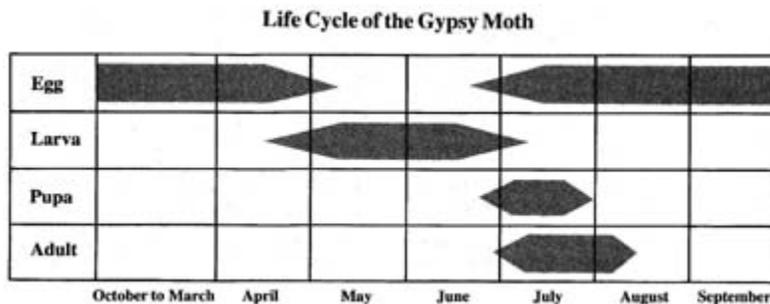
After finding a suitable protected place, the long, hairy caterpillar changes into a smooth, teardrop-shaped, dark brown, motionless pupa that is about 15 to 28 millimeters (up to 1 inch) in length (see illustration). This process begins around mid-June. You can find pupae wedged singly or in groups in bark crevices. When these preferred places are filled, you can find them clinging to the siding overhang above the house foundation, around door frames, in woodpiles and under other objects in the yard. Pupae and egg masses attached to cars and trailers often are transported to other parts of the country, to areas where they can begin new infestations. Gypsy moths hitchhike and propagate in this manner over long distances in the United States. Pupae usually are unaffected by sprays.

## Adult Moths



**Figure 5.** Adult Female (enlarged 2x)

Adult moths emerge from their pupal cases from late June to late July. Female and male moths differ in habits and appearance. Female moths have wings but cannot fly. Their wings are white with small dark marks along the front edge and tips (see illustration) These marks sometimes rub off With wings outspread, female moths measure up to 50 millimeters (2 inches) from tip to tip. Few moths this size have white wings Their enlarged abdomens are covered with light yellow hairs and no markings Only one common moth in Maryland is similar to the gypsy moth, but it has distinct black dots on a bright yellow abdomen. Since male gypsy moths are brown with numerous black markings they can be confused with many other moths. However, male moths are attracted to the females' sex odor (pheromone) and are one of the few day-flying moths found abundantly in Maryland. Stimulated by this odor they often fly miles from where they develop as caterpillars. Identification of male gypsy moths is useful only to entomologists. Neither the male nor the female adult moth eats leaves Adults live a short while, during which time they mate and the female deposits the egg mass. This occurs from July to mid-August.



**Figure 6.** Life Cycle of the Gypsy Moth

## Advice to Citizens

There is no practical way to eradicate the gypsy moth. However, by using a combination of many control tactics it is possible to manage gypsy moth populations. This process of wisely combining available controls and relying on relevant biological, environmental, economic and sociological information to make decisions is known as Integrated Pest Management (IPM). IPM is the realistic approach to dealing with the gypsy moth problem. Several management considerations follow.

Deciduous trees usually can tolerate up to 50 percent defoliation without serious effects. Sometimes healthy trees like oaks can be completely defoliated in one season and not be killed. They usually grow new leaves by the end of summer. However, repeated defoliation for several years in a row can be fatal. Conifers (evergreens) usually die after one complete defoliation. Do not remove defoliated plants unless they fail to leaf out in the spring following a defoliation. The combined effects of bad weather (especially dry years), poor soil type, low tree vigor, and the activity of disease organisms and wood-boring insects are responsible for most tree deaths in the years after defoliation occurs. When gypsy moth populations are large, causing repeated defoliations, their food becomes scarce and a virus kills most of the starving

caterpillars. For the next few years, parasites and predators usually keep the population down. The main problem for homeowners with valuable shade trees is to prevent defoliation over the 50 percent level from occurring 2 or more years in a row.

## **Control Tactics**

### **Plant Resistant Trees**

Trees can be grouped into three categories based on how much gypsy moths prefer them for food. (1) Where growing conditions are suitable, the following trees can be planted and gypsy moths normally will not eat them: ash, yellow or tulip poplar, sycamore, black locust, American holly, mulberry, eastern red cedar and red spruce. Check with your county Extension agent to determine which of these trees will grow best in your area. (2) Trees not preferred by young caterpillars, but which can be attacked by older larvae include maple, hickory, dogwood, walnut, black gum, beech, pine, hemlock, cherry and elm. (3) Trees which gypsy moths prefer to eat include: oak, sweet gum, linden, willow, birch, apple, alder, boxelder and hawthorn. Since pure oak stands are the ideal breeding ground for this pest, do not plant an area with more than 20 percent oak trees, and interplant these with trees less preferred by the gypsy moth.

### **Destroy Egg Masses**

When infested shade trees are fairly isolated, egg mass destruction may reduce caterpillar numbers the following spring. Remove egg masses from all infested trees, structures and lawn items by scraping them into bags for disposal or into solutions such as soapy water. Be careful not to inhale the hairs and do not handle the egg masses without gloves. Some people are allergic to the hairs on the egg masses. You should remove all litter from the yard to eliminate hiding places for females seeking pupation or egg-laying sites. Egg masses should be removed before April when egg hatching begins.

### **Destroy Caterpillars Without Insecticides**

You can destroy caterpillars on trees without using insecticides. You can use two banding methods instead. The first method, known as a barrier band, prevents caterpillars from reaching leaves in the treetops. Many small larvae land on the ground or on other substrates when they migrate. Other larvae hatch from eggs laid on structures other than trees and must climb trees to reach the leaves. Older larvae sometimes move from one tree to the next, over the ground. By placing a barrier band around the trunk, these larvae can be prevented from reaching the tree's canopy. Several kinds of bands are available. The most effective ones fit snugly into the cracks and crevices of the bark and have a coating that remains sticky for a long time. Larvae cannot move past these bands; they either starve below them or become entangled in them. Barrier bands should be put in place by April and inspected weekly to repair tears or to reapply sticky materials. Other sticky materials are available and may be applied directly to the bark of the tree. Label directions must be strictly followed to avoid tree injury. Some oil-based materials may be harmful to trees when applied to the bark. Thin-barked trees such as beech or birch may be very susceptible to bark injury.

A second banding technique employs the use of a hiding band. At most population levels older caterpillars crawl down trees to hide in protected places during the day. Placing a hiding band around the tree trunk provides a refuge for larvae where they can be removed and destroyed. A simple band consists of a strip of burlap (or similar material) about 18 inches wide that is tied at the middle around the tree trunk. This creates a double flap 9 inches wide that provides shelter for migrating larvae. These larvae should be removed and destroyed daily or every two days. If you do not destroy caterpillars regularly, gypsy moth populations may actually increase due to the refuge the band provides. Burlap bands will also attract larvae ready to pupate and females ready to lay eggs. They can also be destroyed beneath the bands. You must have these bands in place by early June. You may use the burlap band together with the barrier band but place it at least 18 inches above the barrier band. Wear gloves when handling gypsy moth larvae, pupae, adults, or egg masses to avoid skin irritation. More information on the use of bands is available from your Cooperative Extension Service Office.

## **Trap Males and Disrupt Mating**

The female gypsy moth produces a sex-attractant odor, called pheromone, which attracts males upwind from great distances. This chemical is available commercially in male traps. However, the backyard male-attractant traps used by individual homeowners, have no demonstrated value in controlling moth populations. Male traps are most useful to entomologists studying the movement and buildup of moth populations. When relatively large amounts of pheromone are placed in a small area, male moths become disoriented. They fail to find females and mate with them. This technique is known as mating disruption and has been used to manage gypsy moths, but only when populations are extremely low. Information on mating disruption as a management tool can be obtained from your Cooperative Extension Service Office.

## **Use Insecticides**

The cheapest, easiest and most effective way to control gypsy moths is to spray your trees with an insecticide registered with the Environmental Protection Agency (EPA). Insecticides\* available for homeowner use include Imidan 12.5 WP (phosmet), Marlate (methoxychlor), Orthene (acephate), Sevin (carbaryl) and B.t. (*Bacillus thuringiensis*). This last insecticide is a bacterium that kills caterpillars only. It is sold under a growing list of trade names, such as Agway BT, Bactur, Biotrol, Dipel, Sok-BT and Thuricide. B.t. must be sprayed on second to third instar larvae when oak leaves are half opened. Older caterpillars are not easily controlled by this bacteria.

If you are unable to spray your treetops, hire a professional arborist. Arborists use highly effective insecticides unavailable to homeowners, such as Dimilin W-25 (diflubenzuron) and Turcam (bendiocarb). Where spraying is not desirable, professionals can inject systemic insecticides such as Bidrin (dicrotophos) into tree trunks. These chemicals move into the leaves where they kill caterpillars for about a month. Bark discoloration sometimes results from injections but it does not appear to harm the trees. Depending on tree numbers, size and location, arborists may charge from \$5 to \$100 or more per tree.

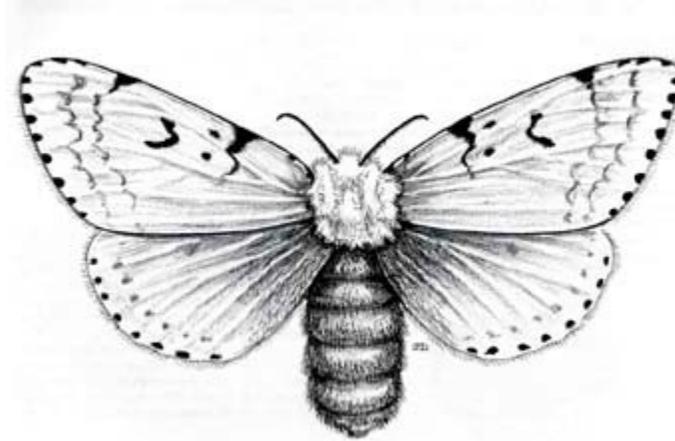
The cheapest and most effective way to spray large numbers of tall trees is from an aircraft. Aerial applicators are available for hire, but this approach is best-suited to tracts of land larger than 5 to 10 acres. Cooperative aerial suppression programs are conducted by the U.S. Forest Service, the Maryland Department of Agriculture, and your county government. If your community is in need of treatment and meets certain criteria, chances are you will be notified of an impending treatment. If you feel that your community requires treatment but has been overlooked, notify Gypsy Moth Control, Maryland Department of Agriculture, 50 Harry S. Truman Parkway, Annapolis, MD 21404. Fortunately, there are early warning signals of gypsy moth infestation because most populations build slowly over the years. Therefore, egg masses and wandering caterpillars are usually seen a year or two before serious defoliation occurs. Normally, medium-sized shade trees preferred by gypsy moths (category 3 discussed earlier) are not seriously defoliated unless there are more than 10 visible egg masses on each tree. When this number of egg masses is seen, insecticides can be sprayed the following May to prevent serious defoliation.

## **Caterpillars Around the Home**

The most frustrating time during a gypsy moth outbreak usually occurs in June when the large caterpillars begin crawling away from trees. As the caterpillars wander they cross lawns and climb on houses. They may even find their way indoors if the houses are in poor repair. These 2-inch long larvae are very difficult to kill with sprays, and new ones appear each day. Where large numbers congregate on buildings, they can be washed off with a hose. We do not recommend spraying insecticides on buildings. Insecticides generally are not efficient at this time because the caterpillars are not feeding. Some damage to local wildlife can occur if pesticide spraying is done repeatedly. As mentioned earlier, an intensive neighborhood tree-banding program will help eliminate many of these caterpillars.

## Protecting Shrubbery

In many landscapes shrubs are grown under large shade trees. In a gypsy moth outbreak caterpillars fall and crawl out of trees in large numbers. Some of these larvae crawl back into the trees, but others will feed on various shrubs, especially the late instars. Most garden insecticides labeled for ornamental plants will give some protection to shrubs and flowers. Examples of these insecticides are B.t., orthene, and sevin.



**Figure 7.** Female Gypsy Moth (enlarged 3.5 x)

## Municipal Gypsy Moth Control

Regardless of control procedure(s) adopted, the most successful way to reduce gypsy moth populations in heavily infested areas is through communitywide action. This encompasses cooperation among all interested agencies, using an interlocking approach to immediate and future moth control and suppression. The agency primarily involved in communitywide control programs, in conjunction with municipal governments, is the Maryland Department of Agriculture.

## Public Intervention

In each county, Extension agents of The University of Maryland Cooperative Extension Service have been on 'Gypsy Moth Alert' for several years. They can provide you with the latest information on gypsy moths. They can tell you how you can control and suppress these destructive pests in your particular area. The county Extension office will arrange for educational programs and will supply information through the appropriate media, when and if your community is threatened by a gypsy moth infestation. Agents will also recommend appropriate pesticides to use and identify caterpillars and adult moths. The following Extension Service publications about the gypsy moth are available from your County Extension agent. 'Effects of Gypsy Moth Defoliation #91A'; 'Maryland Gypsy Moth IPM Program #91'; 'Pesticide Options for Gypsy Moth Control in Aerial Spray Programs, Fact Sheet #386'; and 'How to Protect Your Shade Trees With Sticky Barrier Bands, Fact Sheet #476'.

\* Names in parentheses are common name; that is, official or generic name, given to pesticides. These should be listed on insecticide labels under active ingredient, regardless of the brand or trade names.

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