Living With the Gypsy Moth

By David G. Karnosky and Clive G. Jones

Reprinted from Garden magazine, Volume 5, No. 3

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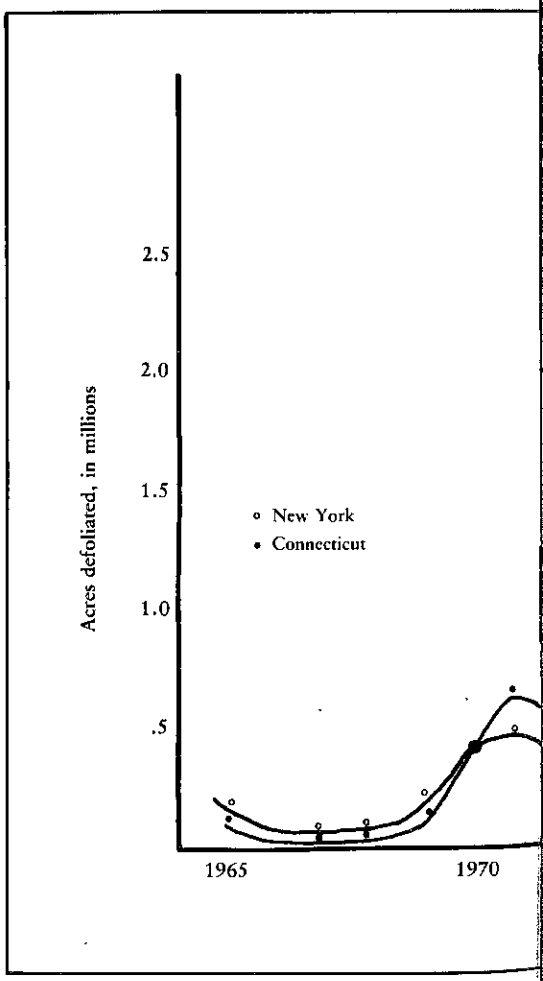
Tree owners cannot eliminate this imported pest, but they can take measures to keep the defoliation of valuable specimens to a minimum

Although more has been spent on their control than on any other insect pest of trees, gypsy moths have become major



pests in many areas; in the epidemic year of 1980 they defoliated more than two million acres in New York state alone. The moth infestation this season shows signs of being as bad — worse in some areas.

Worried gardeners and woodlot managers are flooding botanical gardens and extension services with pleas for information on control methods. Although control is still a far from perfect art, a variety of available measures can help a tree owner minimize gypsy moth damage.

Gypsy moth outbreaks do occur in Europe, where the insect is native, but the problem is less severe there than in the U.S., probably because natural controls and smaller forests tend to keep the insect in check. In Massachusetts, where the moth was first introduced, outbreaks seem to be diminishing in extent and severity, and we are almost certainly seeing the start of processes already operating in Europe.

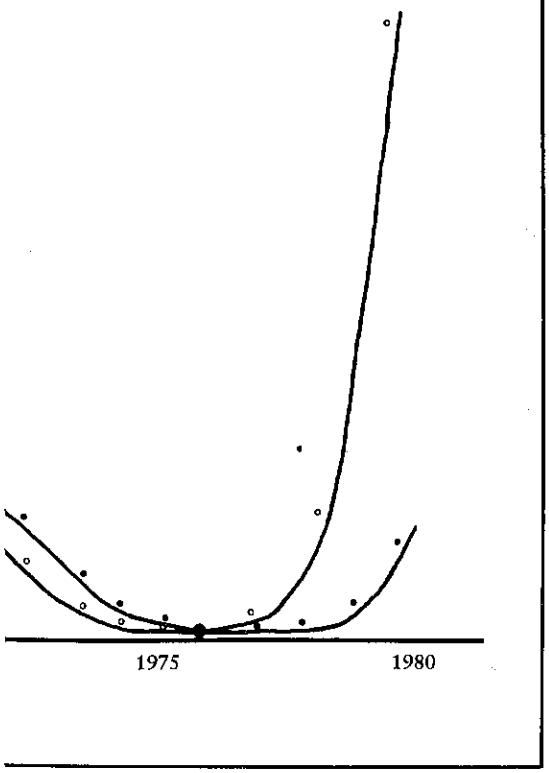
Scientists have been able to identify, introduce into the U.S. and establish ten exotic parasites: six wasps and four parasitic flies. In addition, two native ground beetles and a variety of birds, shrews, mice and medium-sized mammals also prey on larvae (caterpillars) and pupae (cocoons).

A virus and a streptococcus bacterium are two known microbial pathogens of gypsy moths. The virus can be a major factor in reducing gypsy moth populations.

While researchers continue to study the gypsy moth, there are disagreements over which control strategies are best. For example, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is trying to stop gypsy moth eggs from hitchhiking across the country on campers and recreational vehicles. APHIS therefore sprays the insecticide Sevin on public and private campgrounds in Pennsylvania, a state in which infestation is especially heavy.

Pennsylvania's Department of Environmental Resources (DER) officials believe, however, that the spread of gypsy moths cannot be stopped, consider campground spraying ineffective, and advocate natural controls such as insect predators or spraying with milder insecticides.

Local politics have also come into play. County and town officials frequently disagree as to who has jurisdiction in determining areas to be sprayed, and the type of spraying to be allowed. One Connecticut township has recently enacted an ordinance banning all toxic spraying except for



The gypsy moth's population rises and falls in cycles in the Northeast (left). At population peaks millions of acres will be defoliated. This pest native to Europe favors oaks (far left) but consumes the foliage of many other species as well.

Profile of an insect pest

The gypsy moth, *Lymantria dispar*, is an Old World native, and its egg masses were brought to Boston around 1869 by an entomologist searching for a hardy silk moth. Unfortunately a few of the larvae escaped and became established on the local vegetation. Lacking any natural predators, the moth population grew rapidly and in the 1880s severely defoliated trees.

Despite the present strict quarantine regulations and spray programs, the gypsy moth has steadily spread. While the insect, blown by the wind, can travel only short distances each year by itself, vehicles have carried it far from the Northeast, to the Carolinas, Kentucky, Missouri, Ohio, Virginia, Wisconsin, Michigan and even California.

Gypsy moth eggs hatch in late April or early May about the time trees begin to leaf out. The tiny larvae climb trees and when they reach the outer branches they begin feeding. If food is limited, they drop on silken threads which carry them a few feet or as much as several miles. This is the means by which the insect naturally expands its range.

As the larvae become larger, they devour all green material on their host plants. Feeding habits change as the larvae mature. They generally feed at night, but in epidemic areas, they may feed around the clock.

The larvae of two tent caterpillar species are often mistaken for gypsy moth larvae. While both of these can cause serious local defoliation, they are less widespread than the gypsy moth.

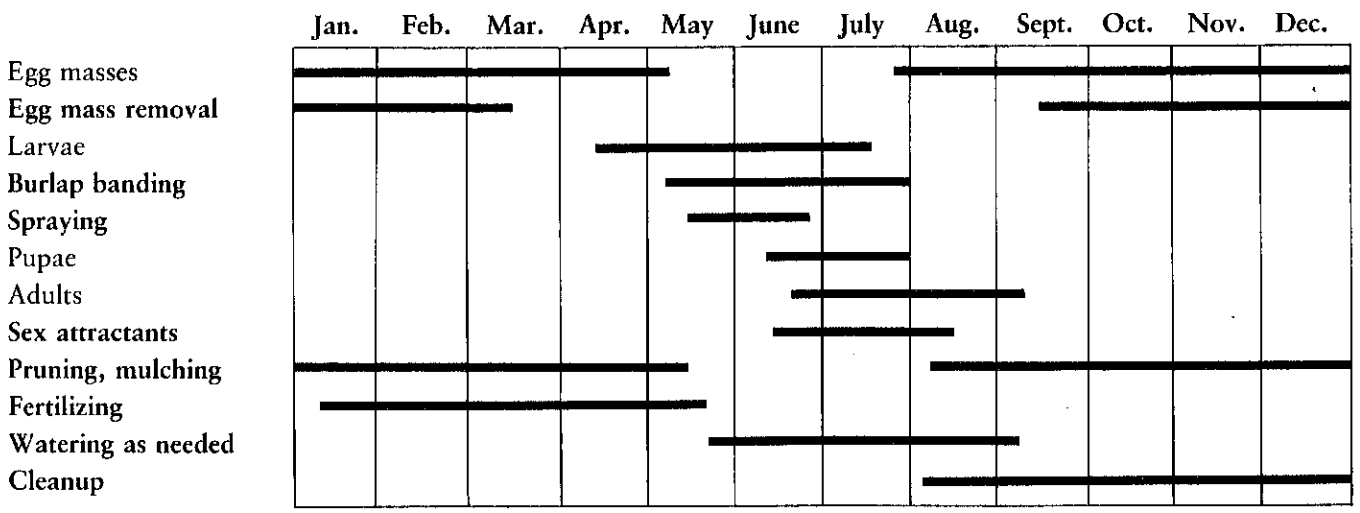
By late June or early July gypsy moths have completed their larval stages and seek a sheltered place to spin cocoons. Within about two weeks, the one-inch long adult moths emerge. The dark brown males appear several days earlier than the cream-colored females. The female moths, which have well developed wings but whose weight of eggs prevents them from flying, crawl to an elevated place and emit an attractant chemical (sex pheromone) which brings males from as far as a mile away. Shortly after mating the female deposits her eggs—on the undersides of branches, tree trunks, stone walls, fences, buildings, vehicles, or any shady protected place. Human refuse along the forest edge may provide additional egg sites, a partial explanation for the observation that the concentration of gypsy moths may be ten times as high around homes as in nearby woodlands.

Each female deposits up to a thousand eggs in a single mass, covering them with hairs; the eggs overwinter. Temperatures well below zero for a prolonged period do decrease their survival—although the exact effects of temperature, times and location are not fully understood.

Gypsy moth larvae are generalist feeders but prefer some trees over others. Oaks, preferred above all other trees, grow abundantly on the well-drained upland slopes and hilltops favorable for gypsy moth population buildup.

Within areas in its established range, gypsy moth populations rise and fall in cycles. In New York State, for example, gypsy moths defoliated more than 416,000 acres of forest during 1971, a peak year. Then the population began to decline, and the insects defoliated only about 9,000 acres in 1975. During the past five years, the population has gradually increased again: 1980 was an epidemic year and almost 2.5 million acres were affected.

Gypsy moth life cycle and control



commercial operations such as nurseries, greenhouses and golf courses.

Protecting one's own trees

Control of some kind is badly needed because gypsy moths can take a heavy toll on trees. Defoliation depletes the tree's food reserves; repeated defoliation can reduce the tree's vigor, leaving it susceptible to attack by other insects or diseases. Hardwood trees generally withstand two to five successive years of defoliation before dying, although even a single season's defoliation can stress a tree so badly that it may need ten years to recover fully.

Hardwood trees growing on poor sites or in adverse conditions may die after only one year's defoliation. Evergreens also often die after one complete defoliation since they cannot replace their foliage as readily as hardwoods can.

The homeowner's decision to use control measures should be based on his particular combination of insect abundance, site characteristics and tree species and condition.

- Gypsy moth abundance. If your property is surrounded by woodlands in which gypsy moth populations are high, you will almost certainly suffer tree damage. If you see hundreds of egg masses per acre, or a large number on a few individual trees, such as oaks, you can expect severe damage.

If the insect has not yet reached your area or if there was no previous major defoliation of trees that gypsy moths prefer, you may not need a control program this year.

- Site characteristics. Well-drained, exposed slopes or hilltops, especially those downwind of an existing outbreak, are more likely to be defoliated than moist, lowland sites with deep litter.
- Tree species. You are more likely to have a problem if your property has a preponderance of species gypsy moths prefer: alder, apple, aspen, hawthorn, larch, linden, oaks, willow, and gray, paper and river birches. Because oaks are so abundant in the Northeast, these are the trees most frequently defoliated.

The least preferred species are ash, balsam fir, black locust, butternut, catalpa, Eastern red cedar, holly, mountain ash, red spruce, Scotch pine, sumac and tulip tree. Other trees come somewhere in between.

- Tree condition. Trees that have been recently defoliated may need special attention. Because a single defoliation of an evergreen can often kill, you might want to control infestations near valuable specimens.
- Size of property. If you have a great deal of acreage, you might have only two options: a large scale spraying, or nothing at all.

Control measures in combination

While large areas of infestation will be sprayed this year by various government agencies, the homeowner and small woodlot manager can protect individual trees by using an integrated control program, that is, a variety of measures used together.

A direct way to control the insects is to get rid of their egg masses, scraping them off into a container with a knife, paint scraper or stiff brush. Destroy the eggs by burning, burying or soaking them in soapy water before flushing them down the toilet. Do not paint egg masses with creosote or similar materials—it can damage your trees. Egg masses can be removed from September through mid-March.

If the gypsy moth population is not too large, you can significantly reduce the local population by removing egg masses. If the population densities are high, however, there will probably be enormous numbers of egg masses high up in the trees, hard to reach. So you have to be realistic about how many egg masses you can remove.

You can also entrap the larvae. In late May or early June, the nearly mature caterpillars move down the tree to rest in the shade, and a simple band around the tree at that time will catch a large number.

Take a one-or two-foot-wide strip of burlap or black polyethylene a little longer than the circumference of the tree. Tie this loosely with string around the tree at chest height (five feet) and fold the top half of the band over the string. Check the band daily

and remove and destroy larvae. Later, larvae will form the cocoon stage under the flap and can be removed and destroyed.

A four to five inch band of a sticky material such as Tanglefoot applied to the outer top of the band may increase its effectiveness. However, such sticky materials should not touch the tree bark directly since they can injure the tree and leave unsightly marks.

Another strategy is to set out a synthetic version of the female gypsy moth sex attractant, which can be used to attract adult males to a sticky trap or to fill the air with enough attractant to disorient them and prevent mating. Hercon Gypsy Moth Trap, Hercon Luretrap and Hercon Disrupt Flakes are some products. (We do not endorse brands named in this article but merely mention them as being among those that are available.)

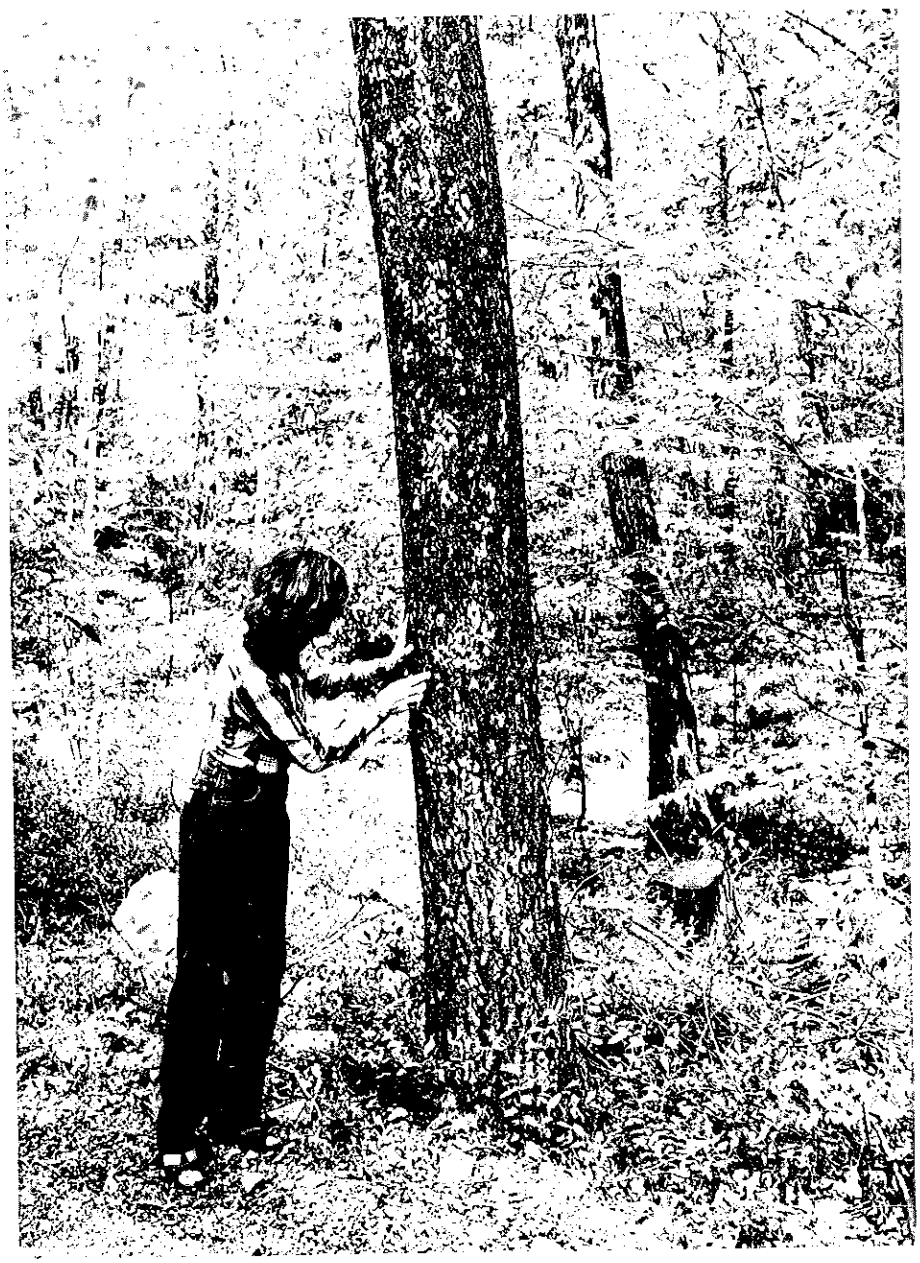
Sex attractants, which can be used between mid-June and mid-August, may be useful if the insect populations are small, but are of limited value at high insect densities. They are also costly, and their timing and distribution are critical.

When the gypsy moth population is very high or when conifers are starting to show signs of damage, spraying may be the only effective control. The spray *Bacillus thuringiensis* (BT) is a biological control, infecting the moths with a bacterial disease. Bug Time, Dipel, Thuricide are some brand names. Carbaryl (Sevin) is a broad-spectrum, short-acting chemical control. Both sprays are effective against the moths in their larval stages, May and June.

Sevin is toxic to most insects, including honeybees, and so it should not be used in the vicinity of beehives. Because it is toxic to other insects, it may also kill insect predators of the gypsy moth. Sevin can also kill aquatic animals, so it should not be sprayed over ponds, lakes or running water. BT should not be sprayed over open water either.

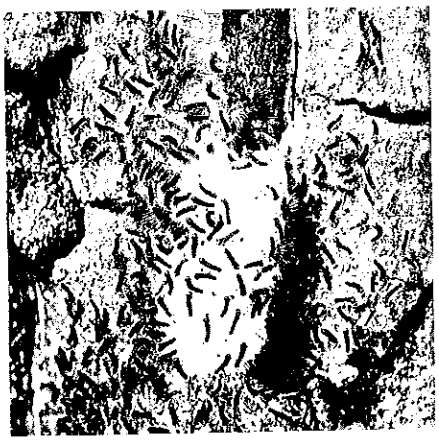
Neither spray offers absolute protection. Sevin is more effective, but given its greater potential drawbacks its use probably should be limited.

If you do spray, carefully follow label directions and spray at the right time. If you expect much defoliation, spray when the damage is first noticed, not after the trees have been defoliated. BT takes three to ten days to take effect, while Sevin acts more quickly. Both Sevin and BT remain active for only a short time so a second spraying may be necessary.



David F. Karnosky

When moth populations are high, each tree can harbor hundreds of egg masses, each with up to a thousand eggs. Tree owners can minimize damage by destroying egg masses, trapping larvae, spraying, and keeping trees in good condition.



Mark Warner

If you need to spray a large number of trees, you might want to consult a professional pesticide applicator, forester or arborist. Make sure the spray company is registered and licensed.

The vigorous-tree strategy

Some indirect methods of control involve keeping trees vigorous to reduce the effects of leaf loss. Newly planted ornamentals or established trees during drought periods will benefit from regular summer watering. Trees growing on poor soil and trees defoliated within the past few years may benefit from spring soil fertilizing. Pruning trees and removing dead and damaged branches in the fall and winter reduce the later moisture demand and improve vigor.

If you live where gypsy moth outbreaks have been frequent, you may want to remove susceptible tree species if they are not ornamentally important. Woodlot managers can selectively harvest susceptible species for lumber, pulpwood or firewood, which will also encourage growth of species gypsy moths don't much like.

You may want to try removing gypsy moth shelters—bark flaps, dead branches, tree stumps and refuse. You may want to encourage insect-eating birds by providing winter food and spring nesting sites and attract small mammal and insect predators by leaving a deep leaf litter under your trees.

We still do not fully understand the ecology of the gypsy moth. Even when we eventually do, and can design more effective long-term controls, we will never eliminate this pest. We have to live with the gypsy moth. Control measures are part of the compromise. □

Dr. David Karnosky, forest geneticist at Cary Arboretum, Millbrook, N.Y., became interested in gypsy moth infestations as an outgrowth of his work on developing pest-tolerant trees for planting. Dr. Clive Jones studies insect-plant relationships as part of his work at Cary Arboretum on chemical ecology.