The Gypsy Moth in Connecticut

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The gypsy moth is a major pest of Connecticut woodlands. It is a native of southern Europe and Asia, and was introduced into this country 100 years ago. It spread into Connecticut in 1905, was eradicated, but came in again in such numbers in 1913 that all further efforts at eradication failed. By 1952 it was present in all parts of the State.

Caterpillars of the gypsy moth prefer the developing foliage of apple, aspen, birch, linden, oak, and willow as food. After they have fed on one of these favored hosts, they will feed freely on hemlock, pine and spruce trees. A few larvae may mature on black or yellow birch, cherry, elm, hickory, or maple trees. Ash, locust, tulip, and dogwood are relatively immune to attack.

The gypsy moth varies greatly in abundance from season to season. It may be present in very small numbers for several years. For reasons not entirely clear, numbers increase sharply, and within a year or two may completely defoliate the trees. After one or two seasons of heavy defoliation, the infestation declines, usually within a single season. The principal cause of such a sudden collapse has usually been disease acting on partially starved caterpillars. This same syndrome has occurred in the case of many native pests of woodlands, such as the cankerworm, linden looper, orange-striped oakworm, eastern tent caterpillar, and forest tent caterpillar.

The apparently sudden development of an outbreak, and the habit of large caterpillars to wander in search of food seem to focus an unusual amount of attention on this pest. Certainly more legislation has been passed concerning the gypsy moth and its control than any other pest occurring in the State.

The purpose of this publication is to present the significant scientific facts about the insect, and to suggest how these may be adapted to control measures.

Life History

The gypsy moth passes the winter in the egg stage. The eggs are in masses of from 100 to more than 500. These look and feel like a piece of chamois skin. There may be several layers of eggs covered by brown hairs from the body of the female moth. The caterpillars hatch about May 1, and if the weather is warm enough, start to feed immediately.

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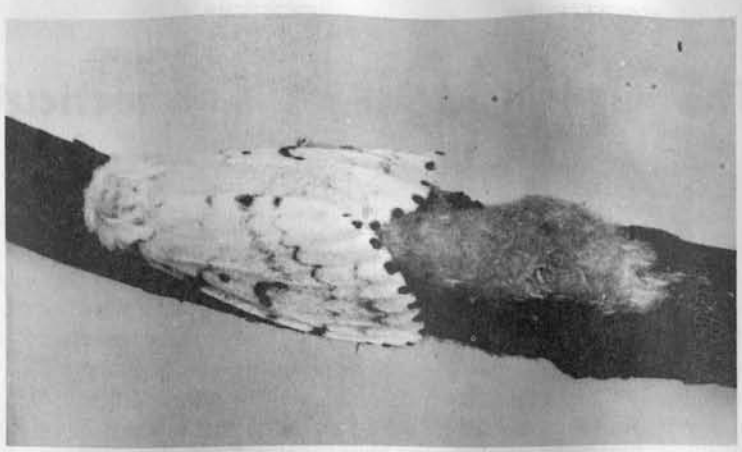

Figure 1. Female gypsy moth and egg masses.

Most of the feeding is done at night; and during the day, the young caterpillars remain relatively quiet.

The fully grown caterpillars are almost 2 inches long, with a brownish or gray background color. There are three light stripes along the back. Each segment except the first has a pair of tubercles; the first five pairs (from the head) are blue; the last six brick red.

Feeding is completed between the third week of June and the middle of July. The caterpillars then crawl about seeking a resting place, and transform into pupae. Each pupa is attached to bark or wood and may have a few strands of silk spun around it.

Adult moths emerge in from 10 to 14 days. The males emerge first. They are relatively small and dark in color, with a slender abdomen. The females emerge a few days later. They are dirty white in color with faint brown markings, and the large abdomen is covered with buff hairs. The female does not fly. Males fly freely and seek out the females for mating. Eggs are laid near the place where she emerges. In addition to the bark of trees, eggs may be laid on stones, buildings, or any object nearby.

The gypsy moth is in the egg stage from late in July until the following May, in the caterpillar stage from May to the first part of July, in the cocoon for about two weeks, and in the moth stage for about a week.

Methods of Dispersal

Since the female moths do not fly, natural dispersal is mostly by newly-hatched caterpillars. These are very small and very light, and are covered with hairs. Under proper conditions, they may be blown for relatively long distances by the wind. There is also a possibility that such major storms as hurricanes may blow fragments of bark, on which eggs occur, for several miles.

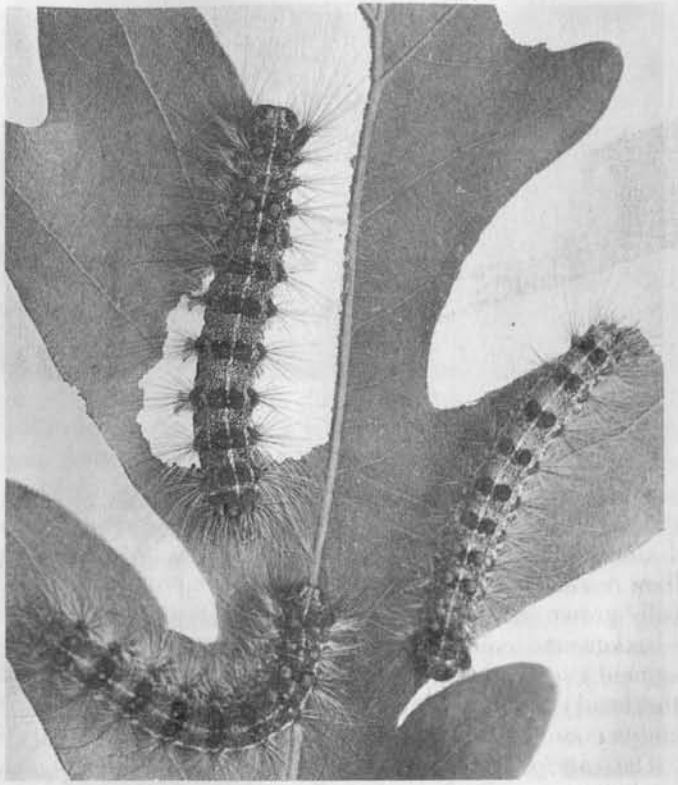

Figure 2. Fully grown caterpillars.

The large caterpillars also disperse by crawling, especially when all the foliage is consumed before they mature. The distance of such spread is not very great.

The principal means of artificial dispersal is by transfer of egg masses on the bark of trees, on stones, and even on scrap iron. There is also a possibility of transferring large caterpillars which crawl into cars or trucks parked in or near infested woodlands. Such transfer is of little significance in a state such as Connecticut because all sections of the state are now infested. It is a problem when infested vehicles or material moves into uninfested states to the south and west.

Economic Importance

The gypsy moth has defoliated large areas of woodland in Connecticut, starting in 1938. Between 1950 and 1968 some 431,000 acres were recorded as defoliated to a substantial degree, usually more than 50 percent. In that same period more than 449,000 acres were sprayed because

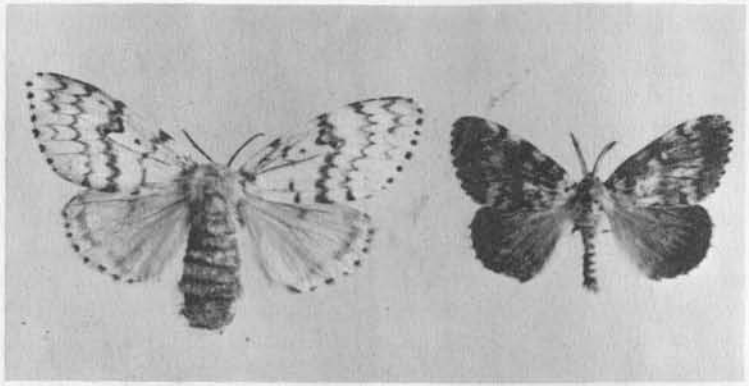

Figure 3. Female (left) and male gypsy moths.

the insect was present in epidemic proportions. This includes at least two major outbreaks, one in 1954 and the other from 1962 to 1965. Some of the acreage was defoliated more than once in this period. It is estimated that between one-fourth and one-half of the highly susceptible woodlands in the six counties have been defoliated.

The economic damage to timber is very difficult to determine. Deciduous forest trees growing on a moist site are seldom killed by a single defoliation. Serious mortality results only when the site is dry (or there is a drought) or as a result of successive defoliations. Thus Stephens (1963) reported mortality exceeding 10 percent, and approaching 50 percent in some localities on dry slopes defoliated in 1962. In the same year, large hemlocks in Litchfield County were killed by a single defoliation. Serious mortality of large red oaks in Litchfield County has been attributed to defoliation by leaf tiers followed by gypsy moth infestation.

In the area in which Stephens found the highest mortality, the woodlands were not under management for production of timber. Any economic loss would, therefore, be of potential rather than present value. Perry (1955) published an estimate of $5.00 per acre as the loss to defoliated commercial forests in northern New England. This figure seems reasonable for application to many woodlands in the northwestern part of the state.

Commercial recreation areas in Connecticut have suffered substantial financial losses. Three summer camps on one large lake had numerous cancellations when the premises were overrun by wandering larvae. Tenants of summer cottages in another section of the state moved out when the trees were defoliated. An occasional commercial picnic area has been forced to close for one of the three summer months. The loss in dollars when recreation areas are affected far exceeds losses in timber value.

Finally, occupants of houses built in woodlands have had the annoyance of wandering larvae (Fig. 4). Most homeowners consider this a real nuisance.

Fluctuations in Abundance

At the present time, the gypsy moth is known to be established in all sections of the state. In most areas, the infestation is so light that it is usually unnoticed by residents. Such a light infestation may persist for many years, and when conditions are favorable, increase sharply in abundance. The usual pattern is that noticeable feeding occurs one year, and massive defoliation the next. However, the variations are not cyclic in terms of regularity of outbreaks.

Reasonably accurate methods of forecasting the degree of defoliation to be expected have been developed. The basis of the forecast is the counting of all the viable egg masses visible in spots chosen at random, the determination of the size of the egg masses, and an estimate of the proportion of the trees that are favored food. An average of 500 egg masses of normal size per acre in woodland composed of at least 50 percent favored hosts usually produces enough larvae to cause heavy defoliation. Late frosts and cold wet weather during May result in less defoliation. Warm weather with normal rainfall increases the amount of defoliation.

The determination of the degree of infestation may be made at any time between August and May. However, it is easier to see the egg masses after leaves have fallen.

It is sometimes difficult to estimate the number of new egg masses in a woodland heavily defoliated. The old egg masses remain on bark and stones for several years. They are usually much darker in color than new egg masses, and of course careful examination will show the egg shells rather than viable eggs.

Figure 4. Gypsy moth larvae on a suburban home.

Control

A reasonable degree of "natural control" exists in Connecticut at present. There are established parasites abundant on eggs, larvae, and pupae. The principal insect predators are beetles, and particularly *Calosoma sycophanta* L. introduced from Europe. Deer mice (white-footed mice) and shrews eat large numbers of larvae and pupae. A few species of birds eat gypsy moth larvae. A polyhedral virus and several bacteria cause disease among the larvae. Disease seems to be more common in heavy infestations, and in times of high humidity. Finally, unusually low winter temperatures are known to kill eggs. Incipient outbreaks have been prevented by temperatures of —24°F or lower. In such cases, the egg masses covered by snow are usually not affected.

Hand Methods

What might be called hand methods of control were used generally for the first 30 years that the gypsy moth was present in this country. Limited use continued in Connecticut through the days of the Civilian Conservation Corps (about 1940). Egg masses were painted with creosote oil colored with lampblack to kill the eggs. The effectiveness was limited by inability to find all the egg masses. Large caterpillars were trapped under burlap bands wrapped loosely around the trunks of infested trees, and destroyed usually by crushing. Pupae were also collected in the same manner.

These methods are still useful, particularly on small shade trees. The amount of labor makes application to large areas of woodland impractical.

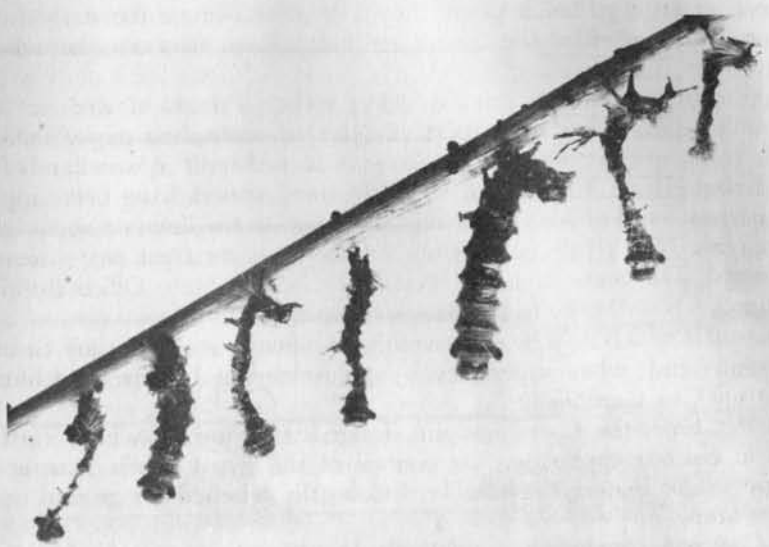

Figure 5. Larvae killed by virus disease.

Management

Control of the gypsy moth by management of woodlands was proposed by Clement and Munro (1917), and renamed silvicultural control by Behre, Cline, and Baker (1936). They advocated removal of susceptible species, especially those of low commercial value, and encouragement of growth of resistant species. On dry sites, the proportion of oaks, gray birch and aspen would be reduced sharply, and growth of hemlock and white pine encouraged. On moist sites, the percentage of favored species could be considerably higher without risking heavy infestation. The foresters who made the proposal emphasized that this management was sound whether or not gypsy moths were present.

A large commercial forest has been under such management for many years. During the course of two outbreaks of the gypsy moth in Norfolk, that forest has remained relatively free from infestation. Several large tracts in state forests have had similar management. The one tract in an area of heavy gypsy moth infestation escaped serious damage.

Spraying

The sole purpose of the spraying used in Connecticut in recent years has been to prevent defoliation of trees heavily infested at the time of spraying. The basic principle has been to apply a chemical to the young foliage in sufficient quantity to kill the caterpillars feeding there. The "ideal" time is the week after all the eggs have hatched. The calendar date varies from year to year, but is seldom earlier than May 1 or later than May 20. The non-persistent materials now in use are not suitable for earlier application, because they lose effectiveness too early in the season. Spraying after the larvae are half grown may also be unsatisfactory.

Application from the ground using either a mist blower or large hydraulic sprayer has been most effective in controlling gypsy moth on shade trees, and in protecting premises of houses built in woodlands from wandering larvae. In addition to shade trees, sprays have been applied to a narrow band of woodland trees surrounding the lawn or opening.

Spraying by aircraft is the only feasible way to treat large areas of woodland. The State Board of Pesticide Control, State Office Building, Hartford, has authority to regulate such spraying.

Materials which may be approved by the Board at present are carbaryl (Sevin®) and, when supervised by a governmental agency, trichlorfon (Dylox®), or Gardona®.

At this time, the Board has not designated materials which must be used in custom application for control of the gypsy moth. Among the non-persistent materials available, and legally labelled for ground application are:

1. Carbaryl (Sevin®) of relatively low toxicity to people, birds and fish, but highly toxic to honey bees.

2. Methoxychlor of equally low toxicity to people, not particularly toxic to bees, but somewhat higher toxicity to wildlife.

3. Bacillus thuringiensis (B T), a bacterial preparation which is pathogenic to gypsy moth larvae when used in sufficient quantity. Two applications may be necessary in heavy infestations. There seems to be no hazard to either people or wildlife connected with this material.

Other non-persistent chemicals are being developed, but have not yet been labelled for use in controlling the gypsy moth.

Acknowledgments

Citations for information taken from many Station publications have been omitted in the interest of simplicity. I, therefore, here acknowledge extensive use of information in the publications of W. E. Britton and Roger B. Friend. I am responsible for the manuscript, but acknowledge suggestions by C. C. Doane and D. E. Leonard. Photographs were by B. W. McFarland and the late B. H. Walden.

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