

CONTROL

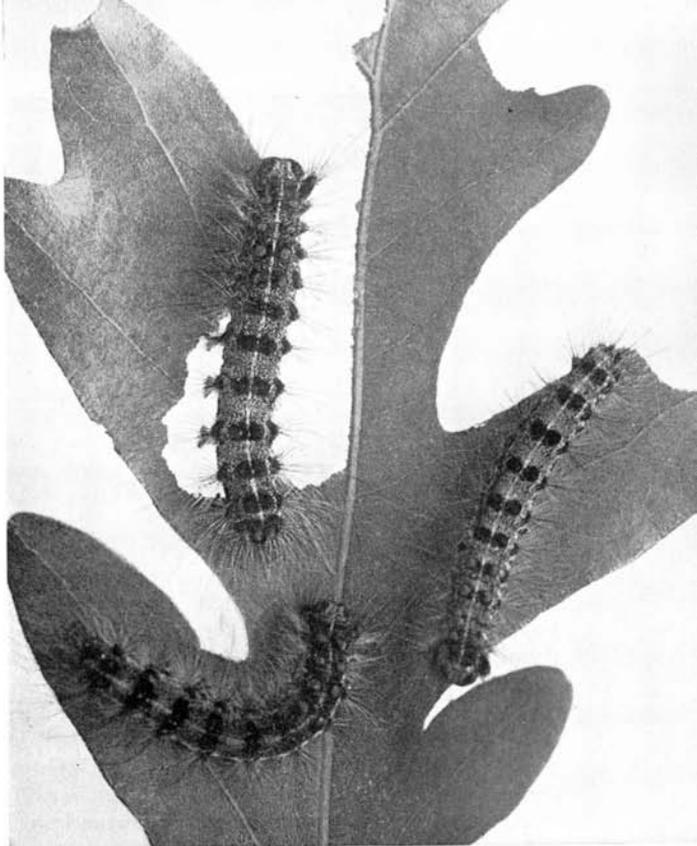
of the

GYPSY

MOTH

by Neely Turner

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**THE CONNECTICUT AGRICULTURAL
EXPERIMENT STATION, NEW HAVEN**

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The gypsy moth has been the subject of a number of bulletins of this Station, the first being No. 153, dated March, 1906. The present circular has been prepared to provide owners of woodlands with the latest information on the pest. Much of the information on the biology of the insect has been taken from the writings of the late W. E. Britton. More recent information has come from publications of R. B. Friend.

CONTROL OF THE GYPSY MOTH

Neely Turner and O. B. Cooke

The gypsy moth is a pest of forest trees native to central and southern Europe, northern Africa, and southern and central Asia, including Japan. In its original home it is usually held in check by natural enemies, but does do occasional severe damage when large numbers develop. It feeds on oak and other hardwood trees in its caterpillar stage in the spring.

About 1869 the gypsy moth was introduced into Massachusetts accidentally. The climate and woodlands proved to be highly favorable and it increased in abundance and became a serious pest and a nuisance. After trees were defoliated, the caterpillars wandered over lawns, gardens and houses. Massachusetts authorities made an unsuccessful attempt at eradication of the pest, and later attempted to restrict its spread to the west. At the same time they started research on the habits and control of the pest, and developed arsenate of lead, a very useful insecticide.

The gypsy moth spread into Connecticut in 1905. Prompt action was taken to eradicate it by means of the hand methods available. These included spraying, creosoting of egg masses, and collection of larvae and pupae under burlap bands and their destruction. Another infestation appeared in 1909, and it, too, was cleaned up. However, in 1913 so many infestations were found in the eastern part of the State that eradication attempts failed. A quarantine was established to prevent further spread, and efforts at eradication were continued. In spite of all these efforts, costing about \$1,250,000 by 1952, the pest has spread to all parts of the State.

Biology of the Gypsy Moth

Methods of Spread

The gypsy moth moves chiefly in two ways: (1) egg masses on trees, wood, lumber or stone may be transferred to uninfested areas, or (2) the newly-hatched caterpillars may be blown about by the wind. Quarantines have been

reasonably effective in preventing transfer of egg masses, but no way has been devised to stop wind spread. The female moths do not fly.

Life History

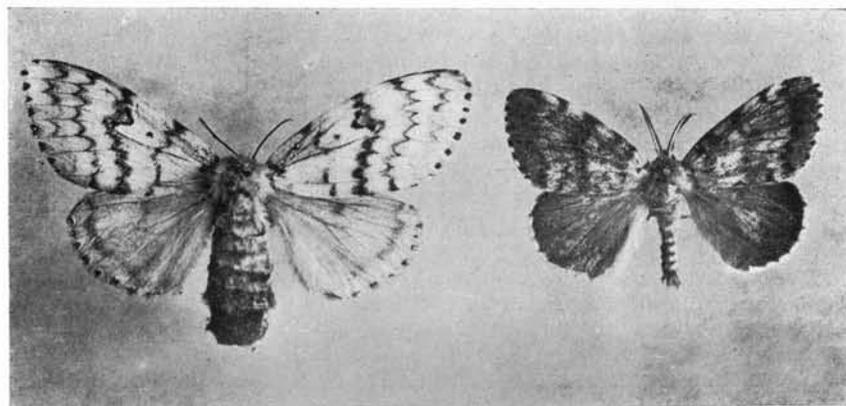
The winter is passed in the egg stage. From 300 to 500 eggs occur in each egg mass, which is covered by hairs from the body of the female moth. The egg masses look and feel like a piece of chamois skin. The young caterpillars hatch about May 1, and start to feed immediately. Most of the feeding is done at night; the caterpillars are very inconspicuous during the daytime, usually crawling down the trunk of the tree to hide in the ground litter during the daylight hours. The fully grown caterpillar (cover picture) is almost two 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 are brick red.

The larvae complete their feeding between the third week in June and the middle of July, and crawl about seeking a protected place for pupation. The pupa is naked, but may have a few strands of silk spun loosely about it.

Adult moths emerge in from 10 to 14 days. The female is dirty white with faint brown markings, and the abdomen is covered with buff hairs. The male is smaller and much darker in color, with a very small abdomen. The female is too heavy for flight; therefore eggs are laid near the place where she emerges. The adults usually live less than two weeks. The females lay eggs on trees, stones, buildings, or any object nearby.

Natural Control

As mentioned above, natural enemies play a large part in keeping the gypsy moth under control in Europe and Asia. The Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture sent entomologists to these areas to study and collect parasites and predators. Sev-



Adult gypsy moths. Left, female; right, male. The photograph shows the moths at natural size.

eral species were sent back to this country and established successfully. Some of these are well established in Connecticut, and every season kill large numbers of gypsy moth eggs, caterpillars and pupae. In addition to the natural spread of the parasites, colonies of some of them have been collected, reared, and released in the western part of the state.

A virus wilt disease of the caterpillars sometimes kills many. It is usually most effective when there is a very large number of larvae in a restricted area. It usually occurs so late that it does not prevent defoliation.

Temperatures below -25°F will kill egg masses unprotected by snow. In some winters, such as 1942-43, this is an important factor in reducing the infestation.

Economic Importance

When the gypsy moth became firmly established in Connecticut in 1913, it was feared that the insect might "ruin" the woodlands. In 1945 Dr. R. B. Friend¹ published the results of a comprehensive study of the pest. Up to that time, the gypsy moth had completely defoliated less than 3,000 acres of woodland in Connecticut. He concluded that "gypsy moth has attained the status of a native insect pest, with the natural factors of control operating in such a way that only sporadic local outbreaks will occur in forests." A survey of the damage done by the gypsy moth up to 1953 estimated the total damage done by killing trees and slowing their growth at about \$41,000.

A single defoliation usually does not kill many trees unless there is a severe drouth. Defoliation two years in succession, such as occurred in Granby and Simsbury in 1938-39, killed about 20 per cent of the oaks. The 1953 outbreak killed a few oaks growing on ridges.

Host Plants

Caterpillars of the gypsy moth prefer the foliage of oak, white and gray birch, willow, linden, apple, or Colorado spruce as food. After they have fed for a



Egg mass of gypsy moth. Bark on which it was laid has been removed from the tree. The egg mass, as shown here, is a little more than three times natural size.

¹Friend, R. B. 1945. The Gypsy Moth in Connecticut. Trans. Conn. Acad. Arts and Sciences 36:607-629.

time on 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. Caterpillars usually do not feed on ash, walnut, locust or tulip trees.

The susceptibility of woodland to serious damage by the gypsy moth depends on the amount of foliage of favored hosts available to the larvae. Thus, pine plantations in pure stands would not normally be damaged by the gypsy moth. Of the favored hosts, only oak and white and gray birch are usually common enough in Connecticut woodlands to build up a large population of gypsy moths.

Control in Connecticut

Research on the gypsy moth and its control started here in 1906 and has continued without interruption. The present work is based on the conclusion that the insect has the same status as a native insect. The principal requirements for satisfactory control of a native pest are: (1) ability to forecast outbreaks in advance of serious damage, and (2) development of economical control measures. Research already completed meets both these requirements.

Forecast of Outbreaks

As stated above, outbreaks of the gypsy moth can occur only in woodlands containing a sufficient number of favored hosts to build up a large population. Mapping started several years ago and completed in about two-thirds of the State has located the susceptible areas. Scouting need be done only in these susceptible areas in order to locate a heavy infestation. Each year trained scouts from the Experiment Station examine the susceptible woodlands and estimate the number of egg masses per acre. A standard system based on permanent study areas has provided information on the number of eggs per acre necessary to cause serious defoliation. If the population has reached a dangerous level, this information is publicized and owners can decide whether or not to spray their trees.

Additional information on long-term changes in abundance has been obtained from study plots. The gypsy moth seems to appear in cycles of about seven years. The last serious outbreak was in 1938 and 1939. The 1945 outbreak was apparently prevented by sub-zero temperatures in 1943, which practically destroyed a rising population. The next outbreak started in 1953 and is expected to reach its peak in 1954.

Spraying

The development of DDT to control gypsy moth, and of aircraft for spraying has provided economical control measures. When the caterpillars first start to feed, one-half pound of DDT per acre usually kills all of them. After they are partly grown and the trees are partially defoliated, one pound per acre is required. Airplanes using oil solutions or emulsions can apply the material

at a cost usually less than \$1.50 an acre for large areas. Since heavy infestations of this pest seldom occur over small areas, it is usually possible for owners of small woodlots in the same neighborhood to cooperate in spraying contracts and get the benefit of the price for large areas.

Small areas can also be sprayed by a mist blower from the ground. There should be roadways open at intervals of about 100 feet to allow thorough treatment. The cost per acre of treatment from the ground is considerably higher than from the air.

Isolated heavily infested trees and the woodland surrounding dwelling houses can be sprayed with a mist blower. In the case of houses, the operator may drive around the open area, directing the spray into the trees. This should kill enough of the larvae to prevent migration over the lawn and building.

Avoiding contamination of pastures adjoining woodlands is a problem. Trained pilots can usually treat woodlands without depositing large quantities of spray on pastures. Small woodlots surrounded by pastures can be sprayed with methoxychlor instead of DDT. Methoxychlor is supposedly not secreted in milk from cows feeding on treated forage.

Regulations on Aircraft Application

The application of materials from aircraft is controlled by law. The present State statute makes the State Department of Health responsible for permits. The owner of the land to be treated must make application before a pilot can obtain permission to apply sprays. Application blanks may be obtained from the State Department of Health in Hartford or from O. B. Cooke, Tobacco Laboratory, The Connecticut Agricultural Experiment Station, Windsor, Conn.

Timing of Sprays

In terms of the growing season, the ideal time for spraying is immediately after the first eggs hatch. It is not always practical to select this particular time for treatment, and sprays just before hatching or up to the time the larvae are half-grown should be effective.

The "cycles" of abundance in relation to spraying deserve comment. As a rule, there is a period of three or four years when few gypsy moths are present in the woods. Spraying during these years is not a necessity, and may not prevent an outbreak from occurring. The period when gypsy moths are scarce is followed by a few seasons when numbers increase rather rapidly, until enough are present to defoliate the trees. If no spraying is done, the "outbreak" usually lasts two years. Then parasites, weather and starvation usually kill most of the caterpillars, but not until after the trees are defoliated. Spraying in either of the usual "outbreak" years should control the pest, and make spraying the following season unnecessary.

In other words, the gypsy moth will have its ups and downs whether or not spraying is done. In "outbreak" years, trees will be damaged unless they are sprayed. This spraying will not prevent another "outbreak" in about seven years.