

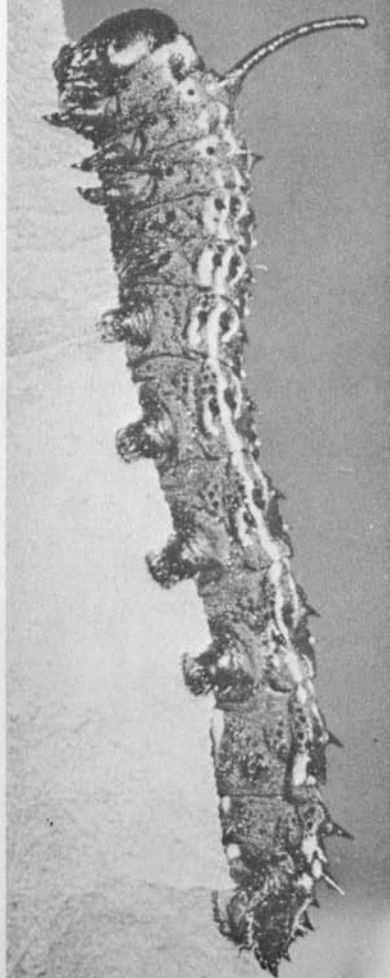
The Orange-Striped OAKWORM.

Stephen W. Hitchcock

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Foreword

Last summer the orange-striped oakworms chomped their way through many Connecticut woodlands, into backyards and across town lines and highways, right onto the front pages of the newspapers. There may or may not have been more oakworms than ever before; their story began before we kept records.

But we do know that a lot more people now live where the oakworms have always lived. This may not bother the oakworms but it annoys the newcomers. Man understands that he is to have dominion "over every living thing that moves upon the earth," especially near him. He views with alarm all hordes of insect trespassers with their disregard of scripture, zoning laws, and lot lines.

To gain dominion over every living thing is clearly going to take more time. Until then, we may have less trouble with the natives in Connecticut woodlands — natives like the orange-striped oakworm — if we know something of their way of life.

In this circular, Stephen Hitchcock tells us something of the habits of this creature, how it gets along from year to year, and what can be done to keep the pest within bounds.

This publication is one of many reporting on research at this Station to help people understand the living world around them. This knowledge helps us to get along with the insect pests that make their home in the Connecticut countryside.

Cover photo: Larva feeding on oak leaf.
(About three times actual size.)

Acknowledgments

In addition to field observations made during the 1958 outbreak, the works of many entomologists have been drawn upon freely in this paper. Control recommendations in part are from T. W. Kerr of the Rhode Island Agricultural Experiment Station and R. B. Friend, formerly Chief Entomologist at this Station. Additional field observations were made by R. C. Wallis and Stephen Collins, of this Station. The pictures were taken by B. W. McFarland. The map of infestations is from surveys by Ralph Cooper and his staff.

The Orange-Striped Oakworm

Stephen W. Hitchcock

The orange-striped oakworm, *Anisota senatoria* (Smith & Abbot), is one of the chief leaf feeders on oak in Connecticut. Unlike the gypsy moth, the oakworm is not an introduced species but is native to this country. The sporadic outbreaks of this insect in the past have been quite localized. Defoliation may occur over just a few acres or even on a single tree. However, these outbreaks often appear consistently in the same areas. This pattern appears not only in Connecticut, but also in other parts of the United States and Canada.

Certain restricted areas of the Connecticut and Thames River valleys appear to be particularly susceptible to the ravages of this pest. Occasionally, there is a flare-up of this insect over much of the state. Figure 1 shows the areas in Connecticut where the greatest defoliation took place in 1958. Even in this bad outbreak year, which was the worst on record, the damage was chiefly restricted to the southeastern part of the state. The insect is, however, undoubtedly present in low numbers over all the state.

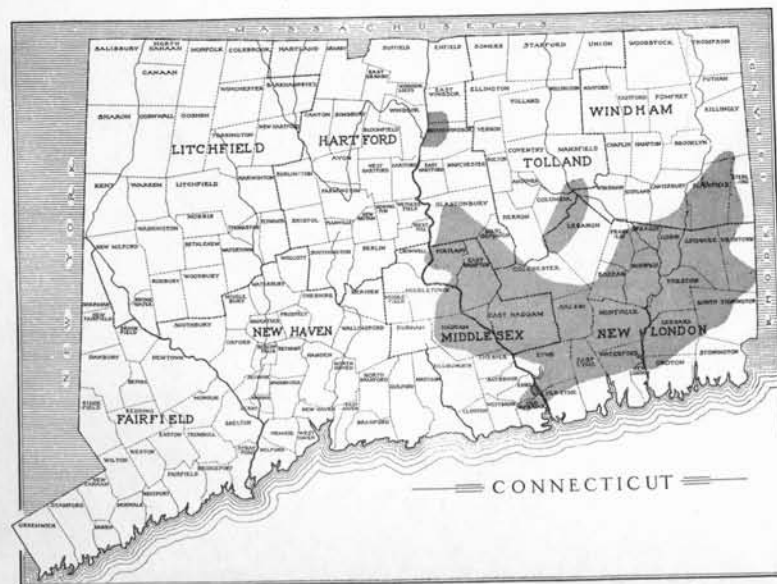


Figure 1. Areas of greatest defoliation by the orange-striped oakworm in Connecticut during 1958.

Appearance

The orange-striped oakworm is usually not noticed until it is almost a full-grown larva. At this time (cover photo) the caterpillar ranges in size from 1 inch to 2 inches in length. Its head and legs are black. The body is black with orange or yellowish stripes extending longitudinally down the sides and back. Four such stripes run along each side of the body and another stripe runs longitudinally along the lower surface of the insect. The most striking feature of the caterpillar is two black projections, about as long as the width of the body, which arise from the mesothorax. The exact function of these projections is not known but they are thought to have some protective use. Although they may appear to resemble antennae, they are not, because true antennae are always placed on the head.

The pupa is dark brown and ranges from $\frac{3}{4}$ to about $1\frac{1}{4}$ inch in length. It may be distinguished from most other pupae by a long forked protuberance at the tail (Fig. 2). The pupa is slightly rough to the touch because of numerous short spines, found principally on the margins of the abdominal segments and on the head.

The adult moths (Fig. 2) have thick bodies densely covered with yellowish red hairs. The wings are an orangish-purple with an obvious oblique stripe on the forewing and often a fainter stripe on the hindwings. There is a prominent white spot and numerous black dots on each forewing. The wingspread of the female is 2 to $2\frac{1}{2}$ inches. The male, which may be recognized by its feathery antennae, has a wingspread of about $1\frac{1}{2}$ inches and is usually slightly darker in color.

The eggs appear oval in outline when viewed from above, but when viewed laterally are seen to be flattened at their poles. Each egg is 0.04 inch in diameter.

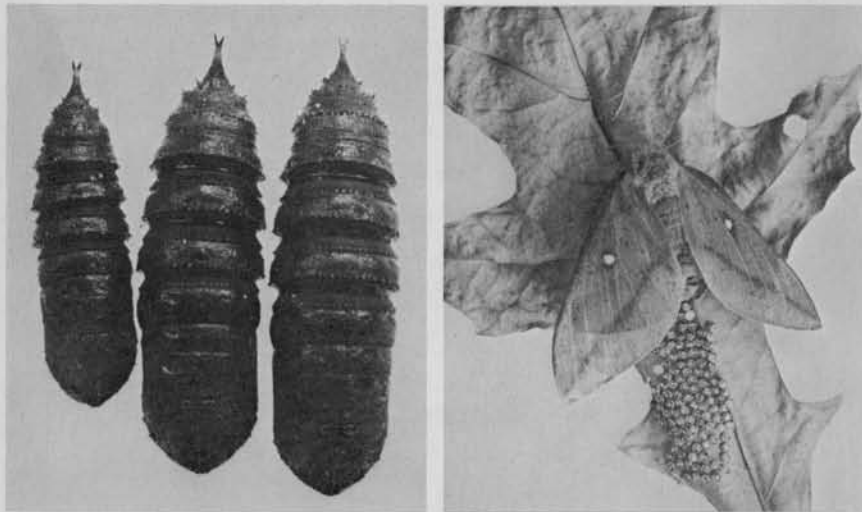


Figure 2. Pupae of the orange-striped oakworm at left. At right, a female and her eggs on an oak leaf.

Life History

The adults emerge from the overwintering pupae in late June, July, or early August. Oftentimes, the first warning to the householder of an approaching heavy infestation is the presence of many moths on the outside walls of buildings. The moths mate on the ground or low bushes soon after becoming adults.

The female deposits her eggs on the underside of an oak leaf on a seedling or on a leaf of the lower branches of an oak tree. These eggs are laid one next to the other in groups of about 200 to 700 (Fig. 2). The larva frees itself from the egg by chewing a slot in the side of the egg.

The newly hatched larvae are greenish-yellow. They remain greenish for the next two molts before acquiring the familiar yellow-striped pattern.

The larvae remain close together, feeding on the leaf. They grip each side of the leaf with their legs and prolegs and chew on the leaf margin (Cover). All of the leaf is eaten except the ribs and the area beneath the empty egg shells. In heavy infestations every leaf on the tree may be skeletonized in this manner (Fig. 4). Because the eggs have been deposited in the lower reaches of the tree, feeding by the larvae will first take place there. As the lower leaves are eaten, the groups of caterpillars gradually break up and the individuals scatter over the higher reaches of the tree. Those caterpillars which feed on young saplings will defoliate the tree and then move across the ground to nearby trees. On the taller trees the uppermost leaves are often fed upon slightly or not at all, and thus the entire tree will be stripped of leaves except for a tuft of leaves on the topmost branches.

As the time approaches for pupation, the caterpillars descend to the ground and search for a suitable site in which to pupate. Pupation usually takes place in September but in some areas caterpillars may be feeding well into October, depending in part upon when they hatched from the eggs. The mature larvae penetrate the leaf litter until further progress is halted by the layer of rootlets and humus beneath. In yards with a turf cover they will seek out and burrow into cultivated areas such as flower beds. The larvae then shorten and thicken and change into dark brown pupae. There is no cocoon nor excavated cell where pupation takes place. Even in areas of heavy infestation the number of pupae will vary from place to place within a single woodlot.

The naked pupae remain beneath the leaf litter through the winter and spring. The adult moths emerge the following summer. There is only one generation a year in Connecticut.

Host Plants

This insect is virtually restricted to oak in its feeding. Although there may be a preference for one kind over another, all species of oak tested appear to be fed upon freely. Trees other than oaks are occasionally fed upon, especially in serious outbreaks when the oaks have been

stripped of leaves and the caterpillars are moving about in search of fresh foliage. Damage to other trees by this insect is never serious. Usually it appears to be exploratory feeding, and at worst will result in skeletonizing the leaves of a few twigs. When an oak and another tree are growing with their branches intertwined, the orange-striped oakworm will strip the oak, leaving the other tree relatively untouched.

Other plants, in addition to oak, upon which the larvae have fed are chestnut, birch, maple, hazelnut, beech, and witch hazel. The first three are the only ones upon which any amount of feeding was found. Heavy infestations and defoliation, however, occur only where there are stands of oaks.

Damage

Defoliation of the oaks is the primary damage from this pest. Although this may seem to be injurious, it takes two or more years of complete defoliation to cause permanent damage. This rarely occurs. Feeding by the orange-striped oakworm, unlike that by the gypsy moth, begins in midsummer. Serious defoliation will not reach its peak until late August or September. The oaks therefore do not lose their leaves more than a month or two before they would naturally drop. Consequently, it is believed that little permanent harm is done to the oaks. Seedling oaks, since they are attacked earlier in the season, suffer more heavily than the larger oaks.

Heavy infestations in past years have attracted little attention, principally because they were in relatively isolated woodlots. However, when people live in oak woodlands which are subject to attack by this pest, other considerations arise. Oak trees in a yard are unsightly when heavily attacked by this insect. Moreover, the caterpillars and their droppings make the lawn beneath an unpleasant site. Caterpillars are crushed under foot and drop on children playing beneath the branches of the oak. In bad infestations, caterpillars from nearby woodlands often creep up the sides of houses. At the inside corner of two walls, the caterpillars accumulate until they may be gathered by the panful.

While the insect is annoying, it is harmless to humans. Neither the caterpillars nor the moths bite or sting. It is said that the short stiff spines along the side of the larvae sting like nettle when they pierce the skin. Few people handle the caterpillars with bare hands, and even this minor irritation is unreported in Connecticut.

However localized or temporary the presence of these caterpillars may be, they are a serious nuisance to the people concerned.

Natural Control

Oak is common in the woodlands of Connecticut, but outbreaks of this insect occur only in certain years and in certain areas. This implies that natural controls ordinarily keep this pest in check. The whole story of these controls is not known but is under investigation. A thorough knowledge of some of these factors would not only aid in predicting outbreaks but also might lead to better control.

Weather probably plays a considerable part in delimiting the extent of the damage by this insect. The oakworm appears to be favored by the more humid areas and the wetter years.

A cold, hard winter with little snow cover to act as insulation undoubtedly kills many pupae beneath the leaf litter. An early cold spell kills many of the late larvae which are still actively feeding before they have time to pupate. Under dry conditions the larva has difficulty in becoming a pupa.

Seventeen different species of parasites have been reported to attack the orange-striped oakworm. In 1958, a species of Tachinid appeared to be the most active parasite attacking this pest in Connecticut. The eggs of these flies may be seen with the naked eye as small, elongate white structures on the back of the caterpillar. The dipterous larvae which hatch from the eggs kill their host after the oakworm has burrowed into the leaf litter and pupated. Other insects attack the eggs of this moth.

Birds do not appear to be of particular importance in reducing populations of the caterpillar.

Shrews and other small mammals feed on the overwintering pupae and so kill considerable numbers.

A fungus, *Cordyceps militaris*, has been observed to attack the pupae.

Artificial Control

At times, it may be desirable to use sprays to control this pest, especially in outbreak years or when defoliation of valuable shade trees is threatened.

It is much easier to control the insect if sprays are applied when the larvae are young. Not only are the insecticides more effective then, but also the young larvae are concentrated in the understory of the oak forest and have done little damage.

Both DDT and lead arsenate are effective against this pest. One to two pounds of DDT 50 per cent wettable powder in 100 gallons of water



Figure 3. Oak trees defoliated by the orange-striped oakworm. The tree in the foreground was sprayed about a month before the picture was taken.



Figure 4. Defoliation by oakworms in residential Glastonbury on September 23, 1958.

or one level tablespoonful in one gallon of water will give control when applied with a hand sprayer.

In the past, spray applications by airplane have been used with mixed success. A ground rig is probably more effective around houses and adjacent woodlands with roads available. A mist blower may be used to spray trees in the yard. The spray should also be directed into the surrounding woodlands. This will, of course, prevent defoliation for only a short distance into the woods, but will provide a buffer zone to protect the householder from the caterpillars. One gallon of a 25 per cent DDT emulsion to six gallons of water used in a mist blower should give adequate protection.

As the moths deposit their eggs fairly close to the ground, and because the young larvae tend to stay together, it is possible to get some measure of control by pruning the low branches of an oak as they become infested and burning them. This, of course, is practical only when a few trees are attacked.

As some of the reasons for changes in the population of this insect are unknown, it is impossible to forecast the outbreak years in advance. Because the caterpillars are scarce one year doesn't mean that they will not be present in great numbers the following year. Likewise, outbreak years have also been followed by years of low caterpillar abundance. The homeowner who recognizes that the young larvae are feeding on the oaks can control the oakworms before they have stripped the trees and moved into his yard. This is most easily done by examining the undersides of oak leaves about August first to look for the egg masses or young larvae.