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THE APPLE-TREE TENT-CATERPILLAR



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## THE APPLE-TREE TENT-CATERPILLAR.

*Malacosoma (Clisiocampa) americana* Fabr.

By W. E. BRITTON, *State Entomologist.*

This bulletin is called forth by the unusual abundance in Connecticut in 1913 of the apple-tree or orchard tent-caterpillar, the outbreak covering the entire state except for certain localities along the coast.

Bulletin 139, dealing with this insect, was issued in 1902, but the supply was soon exhausted, and for several years it has been



FIGURE 1.—Apple tree almost defoliated, near Waterbury.

out of print. To furnish information and to point out the simple control methods is the object of the present bulletin, which is more than a revised edition of bulletin 139, as much of it has been rewritten and most of the illustrations are new.

### EVIDENCE OF DAMAGE.

The conspicuous white nests of the apple-tree tent-caterpillar during the month of May show everybody that the insect is

present. Though not as important as several other insect pests of the orchard, it is one of the most noticeable. Its destructiveness, however, is often more apparent than real. In ordinary seasons the caterpillars feed upon several species of wild cherry and do little harm in the orchard, though trees in hedgerows and along the highways may be attacked. Nevertheless, it causes some damage and when abundant, as at present, many apple trees are defoliated. This occurs early in the season and new leaves are put forth, but this weakens the trees appreciably and should be prevented, if possible.

The nests are always unsightly and mar the beauty of the landscape even if only worthless trees are attacked. The control of the tent-caterpillar is not difficult and there is no reason for allowing it to multiply unchecked. We should remove the worthless trees and take care of the others.

#### OUTBREAKS IN CONNECTICUT.

Though the nests are seen every spring in Connecticut, the insect has not usually been as destructive here as in northern New England. Normally the wild cherry furnishes the common food supply, and often the injury does not extend to apple orchards.

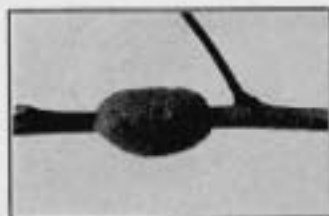


FIGURE 2.—Egg-Cluster of apple tree tent-caterpillar. Natural size.

In 1902, however, the tent-caterpillar was abundant everywhere and attacked not only cherry and apple trees, but several other kinds. One grower reported this as the most troublesome pest on his peach trees. The black cherry trees and choke cherry bushes along roadsides and hedgerows were stripped of leaves. According to our observations, the outbreak was not a local one, but occurred over the whole State, though somewhat more severe in the northern portion. The three agents employed that year

by the Station to gather fruit statistics, who covered the entire State in their travels, reported defoliated trees in nearly every town. The writer also made similar observations in those portions of the State in which he had occasion to travel.

Moreover, of all orchard insects the tent-caterpillar was the most commonly reported by the fruit growers.

The late Mr. T. S. Gold believed that the insect had not been so abundant for sixty-six years, or since the terrible ice storm of 1836, as in 1902.

In 1903, the caterpillars and their nests were very numerous, though perhaps less so than the previous year. Mr. J. M. Whittlesey of Morris wrote that in his neighborhood he had never seen the nests so abundant, but that most of the caterpillars died before reaching maturity. For several years after this outbreak, nests of the tent-caterpillar were not much in evidence. A few could be found everywhere, but the caterpillars did no damage and little attention was paid to them. In 1911 and 1912 a number of specimens and inquiries regarding them were received from various parts of the State.

Early in 1913 many egg-clusters were sent in, and when the trees put out their leaves in May it was evident that 1913 was a "caterpillar year," there being more nests or tents than in any year since 1902. In New Haven the nests are not very abundant, but back a few miles from the coast every neglected apple tree, every black cherry tree and every choke cherry bush, bears from one to fifteen or twenty nests, and many apple trees were stripped as in figure 1. At Stonington, which is a coast town, the caterpillars are extremely abundant and many trees are stripped. In Litchfield county the nests are very abundant. They are so reported from Salisbury and Norfolk and the writer observed them in portions of Roxbury, Woodbury and Washington, as well as in Waterbury, Middlebury and Southbury of New Haven County. Nearly all the roadside apple and wild cherry trees as well as the neglected orchards were stripped. In Newtown, nests were so abundant that prizes were offered for their destruction as is described on page 18.

#### DISTRIBUTION.

The apple-tree tent-caterpillar is a native of North America occurring throughout the Eastern United States and Canada,

westward to the Rocky Mountains. Damage was recorded as early as 1646, and at irregular intervals the species became so abundant that those years were termed "caterpillar years" by the settlers. These periodical outbreaks have doubtless occurred



FIGURE 3.—Nest on apple tree.

ever since, but are more pronounced and noticeable in New England than in other parts of the country.

#### FOOD PLANTS.

The black and choke cherry are the favorite and probably the natural food-plants of the species. The apple is the next choice, and in seasons when the caterpillars are numerous orchards are attacked and sometimes entirely defoliated. Lowe mentions\* cherry, apple, plum, peach, rose, witch hazel, beech, barberry, oak, willow and poplar as food plants. Weed found the caterpillars feeding upon birch,† and the writer has occa-

\* N. Y. Agr. Exp. Station, Bulletin 152, p. 281.

† N. H. Agr. Exp. Station, Bulletin 38, p. 53.

sionally found them eating the leaves of various species of oak. In Woodbury, this season the writer observed the old nests on oak and river beech (*Carpinus*).

#### HABITS AND LIFE HISTORY.

The eggs are laid in cylindrical masses encircling small twigs of the apple and cherry, during the last days of June or first of July. Specimens in breeding cages in the laboratory laid eggs soon after the middle of June, but this is somewhat earlier than they are laid upon the trees out of doors. After deposit-

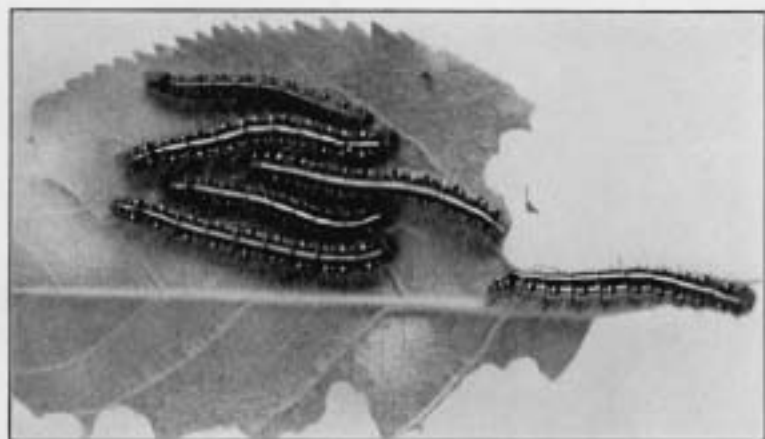


FIGURE 4.—Tent-Caterpillars. Partially grown. Natural size.

ing a ring of eggs averaging over two hundred in number, the parent moth covers them with a viscid fluid which hardens, giving them a varnished appearance. The eggs are probably greatly protected by this coating from the weather and from predaceous insects. See figure 2.

The eggs do not hatch until the following April, thus remaining upon the twigs for about nine months. The tiny caterpillars first feed upon the frothy mass surrounding the eggs, and next attack the new leaves which are then unfolding. After a few days they spin many silken threads to form their nest, usually in a fork of the branches. See figure 3 and front page of bulletin.



FIGURE 5.—Tent-Caterpillars resting on the outside of the nest.



This nest or colony contains the caterpillars from a single mass of eggs. The caterpillars feed in fair weather in the morning and again in the afternoon and according to Fitch again in the night, but during cloudy weather they remain in the nest. When nearly full-grown, the caterpillars may often be found at rest on the outside of the tent as shown in figure 5. They spin threads wherever they crawl along the branches from the nest to their feeding places.

The egg-masses do not all hatch at the same time, and it is not uncommon to find half-grown and newly-hatched caterpillars in the same vicinity. Mr. J. M. Whittlesey, of Morris,



FIGURE 6.—Cocoons of tent-caterpillar. Natural size.

Conn., states in a letter to the writer, that during the spring of 1902 the hatching period extended over nearly twenty-one days.

The average feeding period is about six weeks, during which time the caterpillars have molted or cast their skins several times. As they increase in size they become more voracious and devour the leaves rapidly. At each molting period they stop feeding for a few hours, then begin again with renewed vigor.

When fully grown the caterpillars cease eating and wander about restlessly for a day or two, then spin white silken cocoons in the grass under the trees, in the crevices of the rough bark, or about buildings, boxes, etc., that may be near the infested trees. See figure 6.

There is only a single brood each year.

A colony of tent-caterpillars was brought into the laboratory on May 1st. The nest had been formed, though the caterpillars were small, measuring about three-sixteenths of an inch in length and they had probably been hatched about a week. On May 26th, they had become full-grown and three or four pupated. In a week all had made their cocoons and by the 16th of June the adults began to emerge. This continued for nearly a week, until all had come forth. Meantime several egg-masses had been formed in the breeding cage by the females.

#### DESCRIPTION.

*Egg.* The eggs are grey in color and very small, being about one-eighteenth of an inch long, and slightly more than half as thick. The upper end is circular, and is slightly larger than the lower end. They are placed on end, close together, and covered one-sixteenth of an inch deep with a brown substance resembling glue. The whole mass usually encircles the twig, but is sometimes deposited on one side only. An egg-mass is shown in figure 2.

*Larva.* When first hatched, the caterpillar is very small and nearly black with a few grey hairs.

It molts five or six times as it increases in size, and after each molt the markings show more distinctly. When full-grown the caterpillar is from two to two and one-half inches in length and is thinly covered with long light-brown hairs.

The color is black with a white stripe along the back, and many short irregular brownish stripes or markings along the side of each segment. The sides are of a bluish color and each segment bears an oval blue spot nearly surrounded with black. The under side of the body, head, and legs are black. The larvae, natural size, are shown in figure 4.

*Pupa.* The pupa stage is passed in a white, oval cocoon, which is about one inch in length and half an inch in thickness. It is made of silken threads spun by the caterpillar and loosely woven. It is usually attached by one side to some object in a more or less protected place. Figure 6 shows a few of the cocoons.

*Adult.* The adult is a four-winged moth of light reddish-brown color with two whitish stripes, extending obliquely across

each fore wing. The female has a wing expanse of about one and one-half, and the male about one and one-eighth inches. The males are inclined to be somewhat darker in color than the females, though there is much variation in the intensity of the ground color and of the markings in both sexes.



FIGURE 7.—Adults. Female above. Male below. Natural size.

The rear wings are the same color as the fore wings, but are not marked with white stripes. Both sexes are shown in figure 7.

#### MISTAKEN FOR OTHER INSECTS.

Notwithstanding the fact that the tent-caterpillar is one of the best known and most familiar of all our injurious insects, it is often erroneously called "bag-worm." "Bag-worm" is the common name for *Thyridopteryx ephemeraformis* Haw., a very different insect occurring in the southern states. Each larva is inclosed and suspended in a bag or sack as is shown in figure 8. This insect is found in Connecticut chiefly on arborvitae, which has been imported from the South.

Fruit growers are apt to confuse the tent-caterpillar with the fall web-worm, *Hyphantria cunea* Drury, an insect which makes nests on the ends of the branches of fruit and forest trees later in the season. The two species are quite different and can readily be distinguished if we remember that the former occurs only in spring and chiefly in the crotches of the trunk or branches. The caterpillars remain inside the nest in cloudy and

stormy weather, but go out to feed. The latter (fall web-worm) is partially double brooded in Connecticut, and a few nests are seen the latter part of June, but the greater number of the main



FIGURE 8.—The bag-worm. Natural size.

brood do not appear until August and September. The feeding is done within the web which encloses the food leaves. After these have been eaten, the web is enlarged to include fresh leaves



FIGURE 9.—Nests of fall web-worm. (After Slingerland.)

which in turn are devoured. In this way sometimes an entire branch is enclosed in the nest of the fall web-worm, which is always first formed at the end of a branch, as is shown in figure 9.

The apple-tree tent-caterpillar is also mistaken for the forest tent-caterpillar, but the difference and relationship are explained below.

#### THE FOREST TENT-CATERPILLAR AND HOW IT DIFFERS.

The forest tent-caterpillar, *Malacosoma disstria* Hbn., makes no nest or tent and during most of the larval period the cater-

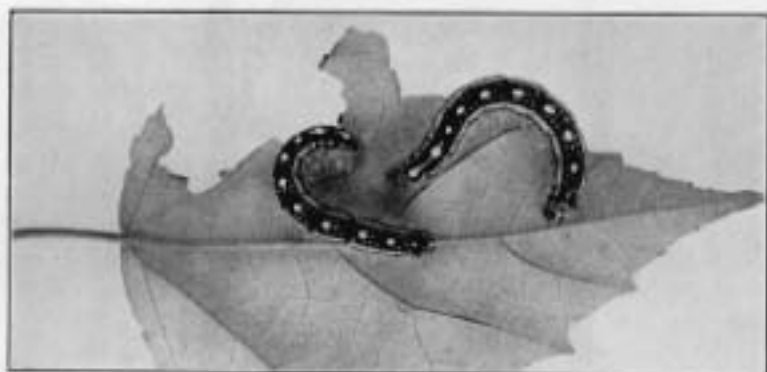


FIGURE 10.—Forest tent-caterpillars. Natural size.

pillars feed singly or independently. When nearly full grown, however, they cluster on the trunks of trees in much the same manner as the apple-tree tent-caterpillars gather on the outside of the nest. The forest species feeds upon fruit, shade and forest trees, and at various times it has defoliated large areas in Vermont, New Hampshire and Northern New York. In fact there has been injury in New York and on Long Island the present season.

The forest tent-caterpillar is generally light blue in color with a row of white keyhole-shaped spots along the back instead of a stripe. The caterpillar is shown in figure 10 and the egg-cluster shown in figure 11 has the ends squared off and less pointed than that of the apple-tree species shown in figure 12.

## NATURAL ENEMIES.

The tent-caterpillar is usually held in check by its natural enemies; in fact, but for them it would be much more abundant and destructive each season. Its abundance the present season and in other "caterpillar years" is undoubtedly due to a comparative scarcity of natural enemies, thus allowing the species to multiply unchecked.

Conspicuous among these enemies are the four-winged ichneumon flies and a bacterial disease called "wilt."



FIGURE 11.—Egg-cluster of forest tent-caterpillar. Natural size.



FIGURE 12.—Egg-cluster of apple tree tent-caterpillar. Natural size.

Quaintance\* mentions three egg parasites, *Telenomus clisio-campa* Riley, *Pteromalus* sp. and *Platygaster* sp., which attack the egg-clusters of the apple-tree tent-caterpillar. Most of the parasites attack the larvae and pupae and Fiske† recorded 24 species of insects reared from the tent-caterpillar. Some of these were undoubtedly secondary or hyper-parasites, but four species of *Pimpla*, three species of *Apanteles*, and one two-winged fly, *Frontina frenchii* Will., are probably primary parasites.

\* Bureau of Entomology, Circular 98, page 5, 1908.

† New Hampshire Agr. Exp. Sta., Technical Bulletin 6, page 2, 1903.

The Pimplas are common parasites in Connecticut, *P. conquisitor* Say shown in figure 13 being one of the commonest. Of 354 cocoons collected at Stonington this season, 140 gave ichneumon flies, 7 Tachinid flies, and the moths emerged from 207 cocoons.



FIGURE 13.—A parasite *Pimpla conquisitor* Say. Natural size.

The bacterial disease or "wilt" has been very common and the caterpillars are sluggish and flabby, and die on the outside of the trees or nests in a shrunken condition. Several predaceous insects, including the larger ground beetles of the genus *Calosoma*, and the soldier bugs of the genus *Podisus*, as well as two other sucking bugs, *Perillus claudus* Say, and *Diplodus luridus* Stal., feed upon the caterpillars.

Birds are important factors in the control of this pest, the cuckoos playing a prominent part. The crow, chickadee, oriole, chipping sparrow, yellow warbler, and red-eyed vireo are other birds that feed upon the caterpillars.

#### CONTROL MEASURES.

*Destroying the Eggs.* Much can be done through the winter months in destroying the egg-masses. When the trees are bare these can be seen near the ends of the twigs, and may easily

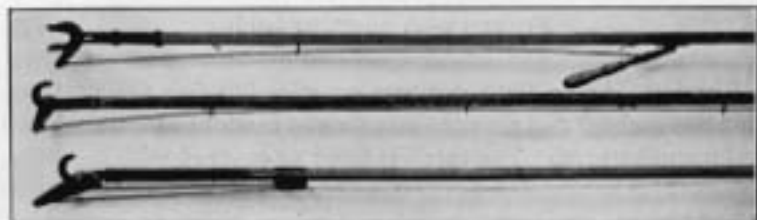


FIGURE 14.—Tree pruners.

be clipped off by means of a tree pruner having a long handle, (see figure 14), which enables the operator to reach and cut off the egg-masses while standing upon the ground. These should then be gathered and burned.

#### *Removing the Nests.*

*Brushing.* Many years ago the writer used to be sent through the orchards with a brush mounted on the end of a pole to remove the nests from the trees in the early morning or on a cloudy day when the caterpillars were in them.

The brush was made of stiff bristles twisted in heavy wire and trimmed to the shape of a cone about six inches long. It was made for the purpose, and worked admirably.

The operator stands upon the ground, inserts the point of the brush in the nest and gives it a few turns, and the entire nest with contents is wound upon the brush. The caterpillars may then be easily destroyed by crushing upon the ground.

During recent years I have not been able to find this brush on the market, but Geo. S. Leiner & Co. of 1250 Brook avenue, New York, has been making some samples after my specifications and will be prepared to manufacture it in the future if there is a demand for it. The cost will be less than fifty cents at wholesale or even in dozen lots. Local dealers and seedsmen should procure a supply and be ready to sell them to fruit growers next spring. The appearance of the brush is shown in figure 15.

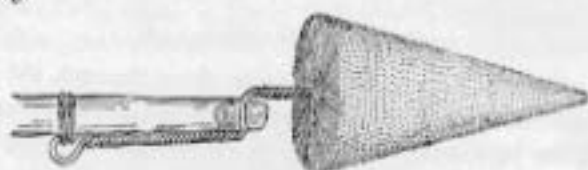


FIGURE 15.—A caterpillar brush.

*Burning.* Some fruit growers practice burning the nests on the trees and for this purpose an asbestos torch has been designed and manufactured. The torch is filled or covered with kerosene, lighted, and held under the nest when the caterpillars are inside. We do not recommend burning, because there is danger of severe injury to the tree. Where the nests are near the ends



of the branches the damage may be very slight, but as the tent-caterpillars often make their tent at the fork of comparatively large branches, it cannot be burned without danger of killing these branches. Brushing off the nests with a caterpillar brush is just as expeditious as burning and there is no danger of injuring the trees.

#### *Spraying.*

Where the orchardist practices early spraying no other remedy need be considered. Lead arsenate or Paris green, with or without Bordeaux mixture, applied to the foliage will kill the caterpillars. The chief difficulty lies in the fact that some of the caterpillars hatch and begin feeding as soon as the first leaves appear and before there is really any leaf-surface to poison; some damage may be done before spraying begins. But, as the caterpillars eat very little at first, this damage is not liable to be serious. These early colonies may be brushed from the trees, and the spray depended on to kill the later ones.

Three pounds of lead arsenate or half pound of Paris green should be used for each 50 gallons of water or the same quantity of Bordeaux mixture. Where Paris green is used without Bordeaux mixture, three pounds of fresh lime to one of poison should be used to prevent burning the leaves. As the Bordeaux mixture contains plenty of lime, no more is needed in connection with it. Lead arsenate is perfectly insoluble in water, does not injure foliage, and therefore does not need the addition of lime. Paris green contains a little free acid which is soluble in water, and which unless neutralized may burn the foliage.

#### COMMUNITY EFFORT.

Through coöperation any insect pest can be checked. It is usually the careless man who breeds destructive insects for his neighborhood. Each property owner and tenant should take care of such matters on the land which he owns or controls. In some European countries, he is compelled to remove all destructive pests from his trees and shrubs, and similar laws are in force in Massachusetts, New Hampshire, and Maine regarding the gypsy and brown-tail moths. If the owner or tenant fails to do this, it is done by the town or by the state and he pays the cost as taxes.

Many writers advise the destruction of the wild cherry and seedling apple trees, which harbor the tent-caterpillar along the hedgerows and roadsides.

If not destroyed, the owner should certainly care for these trees to the extent of keeping them free from insects, and not



FIGURE 16.—Sacks filled with nests ready to be burned. Newtown.

allow them to be a menace to his neighbor or the orchards of the vicinity.

Professor Weed recommends that children be given a small bounty for gathering egg-masses and cites a case in Newfield, N. H., where they were offered ten cents per hundred clusters, by the village improvement society. 8,250 egg-masses were collected, and if each cluster contained 150 eggs, which is a small average, 1,237,500 eggs were destroyed at a cost of \$8.25.\*

An interesting contest was conducted in 1913, by Mr. Leonard M. Johnson, principal of the high school at Newtown, Conn., who offered a prize of \$5.00 to the boy or girl bringing in the greatest number of nests. Second and third prizes of \$3.00

\* Division of Entomology, U. S. Dept. Agriculture, Bull. 17, new Series, page 77, 1898.

and \$1.00 respectively were also offered. All nests were to be cleaned up carefully and gathered at dusk or early morning when the caterpillars were in them. The results were very satisfactory. It was a hard fought contest and 16,864 nests were gathered weighing about 1,300 pounds. The winners were:—

Robert Fairchild, 1st prize,	4,000	nests.
Willbur Olmstead, 2d "	3,675	"
Russell Wheeler, 3d "	3,416	"

Mr. Johnson took charge of the nests brought in each morning and burned them at a bonfire. Figure 16 shows the sacks of nests brought to a school at one time.

A similar contest in gathering the egg-clusters during the winter might be held in every country school and would materially check the pest.

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#### SUMMARY.

1. The apple-tree tent-caterpillar, a native insect and one of the chief leaf-eating enemies of the orchard, has been very abundant throughout Connecticut the present season and has injured fruit trees by defoliating them in May. Wild cherry is probably the natural food of the species, but when abundant it attacks apple and other fruit trees.

2. Eggs are laid on the twigs of the food plant in summer and hatch the following April. After a few days the young caterpillars form on the branches a nest in which they live, going out from it to feed. They are always within the nest at night and in cloudy weather. They become full-grown in six weeks and spin white silken cocoons from which the adults emerge two weeks later.

3. The small grey eggs are deposited in masses of 200 or more encircling the twigs, and are covered with a brownish substance. The full-grown caterpillar is over two inches long, black above and below, and blue on the sides, with a white stripe along the back. It is thinly covered with light brown hairs. The white cocoon is about one inch in length and half an inch in thickness. The adult is a reddish-brown moth with two whitish stripes extending obliquely across each fore wing.

4. The species is usually held in check by its natural enemies, which consist of several kinds of birds, parasitic insects and a bacterial disease.

5. The remedies are: to gather and destroy the egg-masses during the winter months; an effective method of accomplishing this is to offer a bounty or prizes to school children for them; spray when the

leaves appear, using three pounds of lead arsenate or one-half pound of Paris green to 50 gallons of water or Bordeaux mixture; if impracticable to spray, brush off the nests as soon as they can be found, choosing the early morning or cloudy weather, when the caterpillars are inside the nest; burning the nests on the trees is not to be recommended.