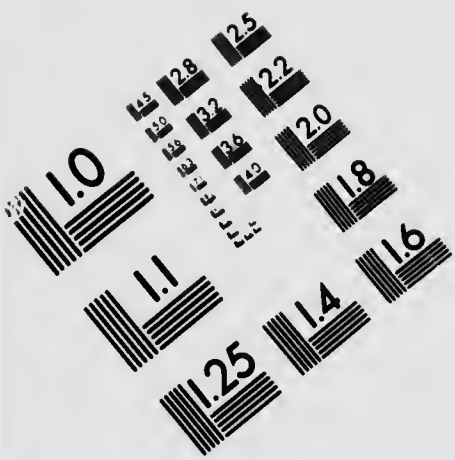

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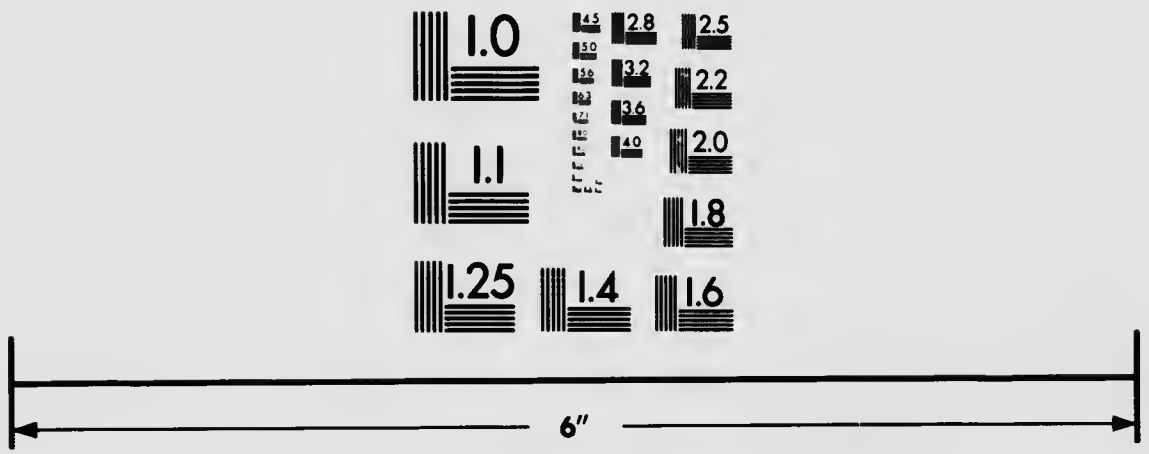

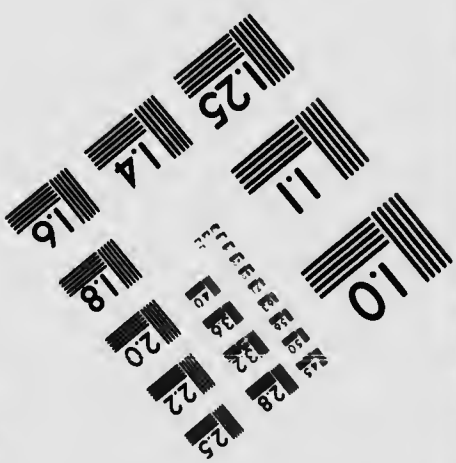

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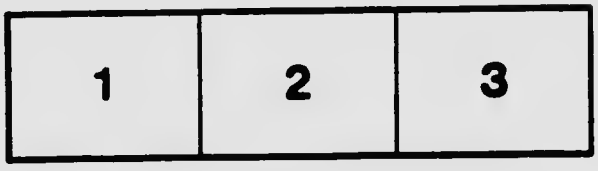

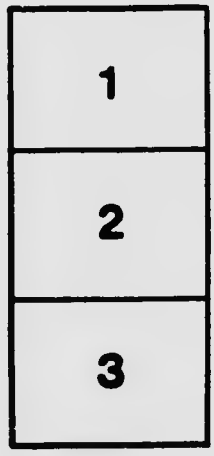

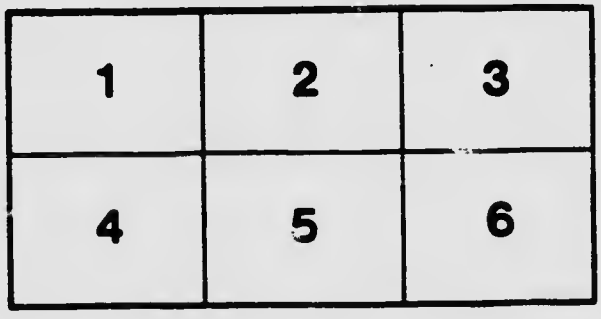

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS

DIVISION OF ENTOMOLOGY

TENT CATERPILLARS

BY

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The name and address of the sender should be written on the outside of the package, and a letter giving as full details as possible should in all cases accompany insects sent in for report.

THE TENT CATERPILLARS.

(Malacosoma americana Fabr., and *M. disstria* Hubn.*)*

From time to time outbreaks of the Tent Caterpillars occur in different parts of Canada. Not infrequently these outbreaks attain serious proportions owing to the absence of natural or artificial means of control, in which cases the caterpillars are severely destructive to orchards, shade trees and hardwood forests. During the past two years outbreaks of Tent Caterpillars have occurred in the provinces of New Brunswick, Quebec, Ontario and British Columbia, and serious defoliation of forest and orchard has resulted. In localities where such outbreaks have occurred unless the natural enemies such as parasitic insects and disease are sufficient to control the pests, a recurrence of their depredations may usually be expected. This circular has accordingly been prepared to render timely advic as to the methods of destroying the eggs and early stages of the caterpillars in loc lities where it is found that the natural means of control have not been effectual.

The Nature of the Injury.—The caterpillars appear in spring and feed upon the leaves of broad-leaved trees of many species. The American Tent Caterpillar (*Malacosoma americana*) is most common on fruit trees, wild cherry, and hawthorn, but when very abundant it readily attacks a variety of shade and forest trees. Its conspicuous tents, constructed during April and May, are familiar to everyone. The Forest Tent Caterpillar (*Malacosoma disstria*) prefers poplar, birch, elm, oak, maple and other forest trees, but it is also found in orchards, particularly in years of great ndance. During the season of 1912 these two species, but particularly the Forest nt Caterpillar, have stripped many thousands of trees in infested districts of Quebec, Ontario and New Brunswick. Square miles of poplar and birch have been completely defoliated by the hordes of caterpillars. After the foliage of an area is destroyed the caterpillars sometimes march in great armies in search of new food, defoliating the trees and shrubs along their route. It was not uncommon last summer for the trains on the Gatineau River line of the Canadian Pacific railway, in Quebec, to be stopped by myriads of these caterpillars swarming on the rails, which were effectively greased by their crushed bodies. The engine men were kept busy in many places sanding the rails and sweeping away the crawling masses of caterpillars in front of the engine; while the latter was often covered with hundreds of the creatures, after passing through the infested districts. Similar instances of the stoppage of trains by the caterpillars have been reported from New Brunswick and British Columbia. By the end of the first week in June large areas of poplar and birch, notably in the Gatineau Valley and in the Eastern Townships of Quebec, were stripped as bare of foliage as though it were mid-winter. Towards t middle of July the moths collected in myriads about the arc-lights of the city at Ottawa, and the females were depositing immense numbers of egg-masses on the twigs of the city shade trees, and upon objects of all kinds.

Outbreaks of these caterpillars have been common in eastern Canada and the United States from the earliest times. Both are native species. The Tent Caterpillar, now injurious in our apple orchards, probably had as its original food-tree the wild cherry, which it apparently still prefers. Outbreaks were recorded from Massachusetts as early, possibly, as 1646, and at recurring intervals and in varying localities these species have appeared throughout Eastern America as destructive pests to orchards, shade-trees and forests.

THE AMERICAN TENT CATERPILLAR.

(*M. americana* Fabr.)

This is the tent-building species so common in orchards during May and June; it should not be confused with the Fall Webworm, which constructs larger tents during the latter part of the season.

FIG. 1. Small Tent of American Tent Caterpillar. Half natural size.

The adult (see Fig. 4) is a medium-sized moth, with a wing expanse of one and one-half inches or less, reddish-brown in colour, with two oblique white bands across each fore-wing near the middle. The male is distinctly smaller than the female and has densely feathered antennæ or feelers.

The caterpillar, Fig. 6, when full grown is about two inches in length. It is black, sparsely clothed with yellowish hairs and has a whitish band bordered with reddish-brown lines along the middle of the back. There is a row of blue spots along each side, with reddish-brown and yellow lines and markings on the sides below.

The Egg-mass.—The eggs are usually deposited in thick ring-like masses about the twigs (see Figs. 2, 3 and 5). Each greyish-black mass contains from 150 to 350 eggs firmly embedded in, and completely covered by, a glue-like liquid which hardens and holds the egg safely in position until they hatch in the following April, and often for long afterwards. The ends of the egg-masses are usually noticeably more sloping than those of the Forest Tent Caterpillar.

Life-history and Habits.—The egg-masses of this species are found near the tips of the twigs during the winter. The young caterpillars hatch from the eggs during the first warm spring days, just as the apple buds are opening, in fact often before any leaves have appeared. They feed first upon the varnish-like covering of the egg-masses, if the buds have not opened, and soon attack the opening buds or young leaves. The caterpillars from each egg-mass begin at once the construction of a silken tent in a nearby crotch (see Fig. 1). During fine weather they feed at intervals upon the neighbouring foliage, and take shelter within the tent when not feeding

and particularly during cold or stormy weather. Layer after layer of silk, spun in threads through the mouths of the caterpillars, is added to the tent; so that it usually presents a neat appearance, and increases in size to accommodate the fast growing caterpillars.

FIG. 2. Egg-masses of Tent Caterpillars: *M. americana* at the right, *M. disstria* at the left. (About natural size.)

FIG. 3. Eggs of Tent Caterpillars on Maple Twigs: 1, old egg-mass from which larvae have escaped; 2, normal egg-masses; 3, egg-masses which were not covered with the glue-like substance. (Enlarged.)

On a single medium-sized wild cherry tree at Chelsea, Que., thirty-seven of these tents were counted last summer. Each such tent shelters from about one hundred to two hundred and fifty caterpillars. The caterpillars feed for about six weeks, and become mature during the last two weeks of June or earlier, according to the season and locality. They then wander restlessly about seeking a suitable shelter for pupating. They come to rest, finally, in some crevice, under loose bark, in a folded leaf, in an angle of a fence or building, or even among the silk of the tent, or on the side of a house. Each caterpillar spins about itself a tough sack or cocoon of white silk and attaches it firmly to the object upon which it rests by a mass of more loosely spun silken strands.

A fluid ejected by the caterpillar upon the cocoon dries and produces a characteristic yellow powder, which is dislodged readily when the cocoons are disturbed. Within the cocoon the caterpillar enters upon a resting or pupal stage. The outer skin dries and splits, and a brownish, apparently legless and wingless object emerges therefrom. This form of the insect is called the pupa. It lies almost motionless within the cocoon while the organs of the adult moth are developing within its hard outer skin. The cocoons are spun mostly during the last two weeks of June, and the

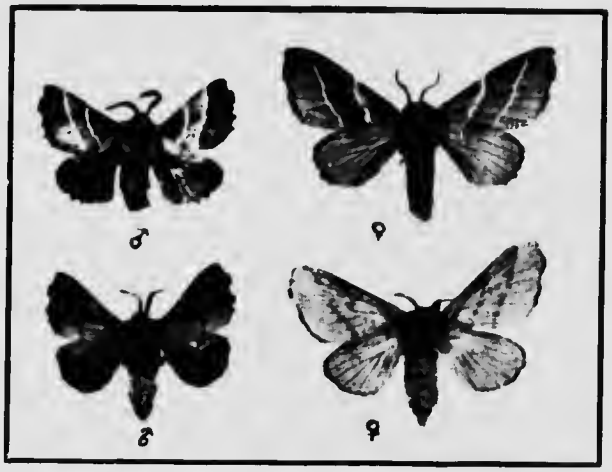

FIG. 4. Moths of the Tent Caterpillar. *M. americana* above; *M. disstria* below; ♂, male; ♀, female.

pupal stage lasts from ten days to two weeks. When the moth has fully developed within the skin of the pupa, the (pupal) skin splits and allows it to emerge. At one end of the cocoon the fibres of silk are so arranged that the moth can work its way through without injury, and it thus escapes in perfect condition. The males and females fly during the evening and, after mating, the latter proceed to deposit their eggs. The young caterpillars are fully formed within the eggs before the end of the season, but remain there until hatching-time in the following spring.

THE FOREST TENT CATERPILLAR.

(Malacosoma disstria Hubn.*)*

Although the caterpillars of this species construct no tent, they are so closely allied to the tent-building caterpillar of the apple that they receive the same general name. The adult or moth, Fig. 4, is very similar to that of the American Tent Caterpillar, but instead of the two white bands on the fore-wings of that species it has two dark lines in nearly the same position.

FIG. 5. Egg-masses of Tent Caterpillars on Maple Twigs.

The Caterpillar, Fig. 6, is about two inches long when full grown. The ground colour of its body is bluish or nearly black, and it has a series of conspicuous white or cream-coloured spots along the middle of the back, with two brownish-yellow bands along the upper part of each side. The row of spots along the middle of the back distinguishes this species from the American Tent Caterpillar, which has a continuous whitish band as previously described.

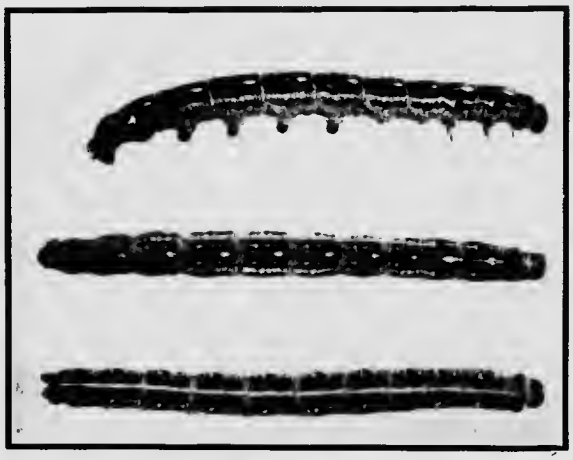

FIG. 6. 1, the American Tent Caterpillar; 2 and 3, the Forest Tent Caterpillar. (Slightly enlarged).

The Egg-mass, Figs. 2, 3, and 5, is deposited in a ring-like band usually surrounding the smaller twigs of the trees upon which the caterpillars feed. When the moths are very abundant the egg-masses are laid promiscuously upon almost any available surface. Normally, the egg-mass surrounds the twig as a shining, thick, dark-coloured band containing from 150 to 350 eggs imbedded in a glue-like substance which hardens and holds them in place. The masses are very similar to those of the American Tent Caterpillar, but are more squarely cut at the end.

Life-history and Habits.—The general life-history is similar to that of the American Tent Caterpillar. The winter is passed in the egg-stage on the twigs. The caterpillars emerge from the eggs in early April about the time the leaf buds are bursting, and feed upon the opening buds and leaves. The caterpillars from each egg-mass usually keep together and feed in congress. They spin an almost invisible silken thread wherever they go, but construct no tent. At intervals, particularly during cold weather, they crowd closely together on the trunk or upon the side of a large branch; and when they are half grown or over, these patches of caterpillars are quite conspicuous. The majority of the caterpillars become full grown during the latter half of June and spin their cocoons commonly in a folded leaf; but when these are scarce, as is unfortunately too often the case, they utilize any hiding-place convenient. The moths appear from the cocoons during the first half of July, and may be found flying and ovipositing at the same time as the moths of the American Tent Caterpillar. The egg-masses are deposited on the twigs during July, and hatch in the following April. The time of appearance of the moths and the time of hatching of the eggs vary considerably with the season and with the locality.

As the caterpillars increase in size they molt, or change their skin, several times. The dry cast skins are often found clinging in clusters on the bark, commonly where the caterpillars have been resting in congress. Any sudden jar causes these pests

to drop from the branches or leaves. Some fall to the ground, and others hang suspended by a thread of silk, spun from the mouth. This habit of dropping when disturbed is sometimes utilized in their control.

FIG. 7. Cocoons of Forest Tent Caterpillar. (After Lowe, *Geneva Experiment Station.*)

NATURE'S METHODS OF CONTROL.

Outbreaks of these caterpillars occur at intervals; during the intervening years, owing chiefly to the activity of their natural enemies, they are much less numerous or at times are even almost rare.

Insect Parasites.—Certain minute four-winged insects of the Order Hymenoptera lay their eggs within those of the moths, and the resulting minute larvae, small white grubs, develop within the Tent Caterpillar eggs and destroy them. Certain other parasites of the Orders Hymenoptera and Diptera breed within the Tent Caterpillars and their pupæ, and are most active agents in their control.

Several species of predaceous beetles and bugs are known to feed upon the caterpillars; and mites have been found destroying the egg-masses.

Birds.—Many species of birds feed to a greater or lesser extent upon the eggs and caterpillars, and undoubtedly assist considerably in reducing their numbers. The following have been recorded by various writers as feeding on the caterpillars: Black-billed cuckoo, yellow-billed cuckoo, Baltimore oriole, blue jay, crow, robin, catbird, American redstart, white-breasted nuthatch, wood thrush, chewink, black and white creeper, different vireos, flicker, scarlet tanager, yellow-bellied sapsucker, bronzed grackle, chipping sparrow, towhee, English sparrow, chickadee, and cedar w. ing. Certain of these also feed upon the eggs, and others to a small degree upon the moths. *The protection and encouragement of our native birds would go far towards reducing the numbers of many injurious insects of orchards, shade trees and forests.*

Diseases.—A bacterial disease at times destroys many of the caterpillars and effectively aids in their control. Those affected by this disease often remain attached to the bark by a portion of the body. The internal organs are largely reduced to a dark-coloured fluid, which exudes when the skin is broken.

A second disease, fungous in its nature, is sometimes prevalent. The affected caterpillars become dry and rigid, and remain for some time with a portion of the body attached to the bark or twigs.

Both these diseases were noticed during 1912 in the Gatineau Valley, Quebec, but relatively few caterpillars were affected.

FIG. 8. Cluster of caterpillars of *M. disstria*; after Lowe, (*Geneva Experiment Station, Bull. 189.*)

ARTIFICIAL METHODS OF CONTROL.

The control of these insects on wide areas of forest lands is not at present to be considered. The following directions apply to the protection of shade-trees, orchards, parks and wood-lots.

The Destruction of Egg-masses.—While the trees are bare of leaves the egg-masses may be very easily distinguished on the twigs. From each egg-mass, approximately 150 voracious young caterpillars will emerge in the following April. Much good can, therefore, be done by removing these egg-masses from small and medium-sized trees, and burning them before the first of April. This practice is profitable only on the more valuable fruit and shade-trees. Ten egg-masses destroyed during the winter rid a tree of from 1,500 to 2,500 caterpillars for the following spring. Those left may be more easily controlled.

Jarring.—The Forest Tent Caterpillar usually drops to the ground when the parts of the tree near it are jarred or shaken. By striking the branches near the clusters of caterpillars with a long-handled, padded mallet, the greater part of the caterpillars can be removed from small trees and from those of medium size. The trunks must then be banded with one of the adhesive mixtures described in the next paragraph, to prevent the creatures ascending to their old feeding grounds. It has been recommended to spread a large sheet beneath the trees before jarring, and to gather and destroy the caterpillars which fall.

Banding.—Uninfested trees frequently need to be protected from wandering caterpillars which have fallen from their original food-trees, or have been "jarred" therefrom, or are seeking new feeding grounds. These caterpillars can be prevented from climbing trees by banding the trunks, five or six feet up, with cotton, or tree

tanglefoot. A band of cotton batting, eight inches wide, fastened about the trunk with a string at the middle of the band, with the upper part of the cotton turned down over the string, has been recommended as an effective obstacle to the passage of the caterpillars. It is effective only when the cotton is dry.

The most convenient band is made of some sticky substance such as tree tanglefoot or tar. Strips of thick wrapping paper, a foot or more in width, are tied about the trunk, five or six feet above the ground, with two strings and well smeared with "tree tanglefoot," tar mixed with two parts of raw oil, or a mixture made by boiling together equal parts of resin and castor oil. Axle grease, lard and sulphur, cottolene, and "raupenleim" are also used. The sticky substance must be renewed or extended as it dries or becomes covered with the caterpillars.

Destroying Tents and Clusters of Caterpillars.—The nests of the American Tent Caterpillar may be removed while small, and the contained caterpillars destroyed. This may be done with the aid of long-handled tree-trimmers or with a brush, or the nests may be burned with a torch while the caterpillars are within them. The torch may be made of a mass of rags or cotton waste soaked in kerosene (coal oil) and tied on a long pole. Asbestos fibre soaked in kerosene and placed in a tin can nailed to the end of a pole makes an excellent torch. The flame should be passed below the nest so as to destroy it and the contained caterpillars, care being taken not to injure the bark of the branches, a rather difficult operation. The nests should, of course, be destroyed while the caterpillars are within them. The clusters of the Forest Tent Caterpillar may be removed when they are massed on the lower branches or trunks of the trees by means of a torch or by brushing them off with a stiff wire brush, or they may be killed by a strong spray of kerosene emulsion applied directly to the caterpillars.

Gathering Cocoons.—After the caterpillar stage is past and the cocoons are spun, the latter may be gathered and thus the escape of the moths which emerge will be prevented. The collected cocoons should be placed in a box covered with a coarse wire netting, about three-sixteenths of an inch mesh. This will allow the useful parasites to escape but retain the moths, which may be destroyed later.

Spraying.—When spraying apparatus is available the simplest and most convenient method is the application of Paris green in the proportion of one pound to 160 gallons of water, or lead arsenate, two pounds to 40 gallons of water, to the infested trees or parts of trees, as the caterpillars are appearing from the eggs. Orchards which receive the regular poison sprays for the codling moth and the plum curculio rarely suffer from tent caterpillars. The young caterpillars are killed by the poison before they are able to do much damage. After they are more than half grown it is much more difficult to kill them by arsenical preparations; and they should, therefore, always be attended to early in the season. When it is necessary to spray specially for these pests, it is usually sufficient to apply the mixture to the foliage on the particular branches which are attacked. Lead arsenate is perhaps to be preferred on account of its adhering qualities.

FORMULÆ FOR SPRAY MIXTURES.

Paris Green.—Paris green, 1 lb.
Best grade quick-lime, 2 lbs. (Prevents burning.)
Water, 160 gallons.

Preparation.—The Paris green is made into a paste with a little water. The quick-lime is slaked with sufficient water and strained free from hard lumps. The Paris green paste and the slaked lime are then stirred into the required amount of water. The Paris green particles are heavier than water and the spray mixture must be constantly stirred while spraying is in process. When the caterpillars are over one-third grown 120 gallons of water should be used.

Lead Arsenate.—This insecticide may be obtained in quantity in the form of a paste. This must be worked up in a small amount of water before being diluted. It is used on fruit and shade trees at the rate of two pounds mixed in forty gallons of water. This strength will readily control young Tent Caterpillars, but the older ones, one-third grown and over, need a stronger spray, four pounds per barrel (40 galls.) of water. Lime is not needed with this insecticide.

When the hatching caterpillars are *extremely* numerous the stronger sprays may be used with advantage.

In orchard practice these poisons are added to the fungicide used, at the rate given above. Paris green may be added to Bordeaux mixture; lead arsenate to either Bordeaux or lime-sulphur wash.

It must be remembered that both Paris green and lead arsenate are violent poisons.

Shade trees may be most easily protected by spraying the infested branches with lead arsenate as soon as the caterpillars appear, and promptly banding the trees with "tree tanglefoot" or a similar preparation, as previously suggested, to prevent reinfestation. When spraying apparatus cannot be obtained, other means, recommended above, may be employed to remove the caterpillars from the trees.

THE DESTRUCTION OF USELESS TREES.

It too often happens that useless and neglected apple, wild cherry, and hawthorn trees are allowed to live in the neighbourhood of apple orchards. On these the Tent Caterpillars, other leaf-feeding caterpillars, certain boring-beetles, and fruit pests breed undisturbed, and readily spread to nearby orchards. Particular attention should be paid by orchardists to the removal of these useless and dangerous trees, and, as already suggested, to the protection of our native birds.