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# Maine Agricultural Experiment Station

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NOVEMBER, 1904.

## BROWN-TAIL MOTH AND OTHER ORCHARD MOTHS.

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This bulletin contains an account of the brown-tail moth, and notes upon a few common orchard caterpillars together with some insect eating birds.

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## BROWN-TAIL MOTH AND OTHER ORCHARD MOTHS.

EDITH M. PATCH.

It is not the well kept orchard that will serve as a shelter and breeding place for any serious pest. It is the apple tree down the lane, too old and decrepit to yield fruit, but still able to put forth leaves enough for a spring crop of bud moths and tent caterpillars, or a summer brood or two of tussock moths. It is the group of old pear trees, apparently owned by no one, with their branches hung with undersized pears cracked to the centre with scab disease, and later, when their fungus-mottled leaves fall, festooned with nests of the brown-tail moth. It is the wild cherry bushes in the back ground that show in the winter for the menace they are, when they are seen to be distorted with black knot and hung with old caterpillar webs and tents, besides being decorated by brown egg rings and white egg clusters in provision for next season's caterpillars. It is the deserted or neglected trees that are to be feared, for in them many species of caterpillars dangerous to the orchard trees breed unnoticed, perhaps for years, until they become numerous enough to make conspicuous ravages. Then one orchardist cries, "It isn't much use to try to raise apples with a new sort of caterpillar creeping in every year," and another says, "The fact is, it doesn't seem reasonable to expect a clean orchard with twenty or thirty pests lurking in the outskirts," and turns his attention to neighboring breeding places as well as to his orchard, and markets his crop in spite of the "new pest."

BROWN-TAIL MOTH. *Euproctis Chrysorrhæa*.

## HISTORY (1734-1904).

European laws have been in force for one hundred and seventy years requiring land owners to destroy the winter nests of the brown-tail moths found on their trees, and this moth was described as a common pest in the earliest works on orchard insects.

About seven years ago the first outbreak of this pest occurred in Somerville and Cambridge, Massachusetts, the centre of the infested region being a florist's establishment where large numbers of shrubs had been imported from France and Holland. It is thought that the brown-tail moth was accidentally introduced upon some of these foreign plants and had become established in the vicinity before it was noticed.

Since 1899 this insect has been introduced,—probably repeatedly,—into Southern New Hampshire, where the infestation is now extended enough to cause alarm.

Five years ago the moths were captured on Cutts Island, Kittery Point\* and the same season the caterpillars were reported from South Berwick where they were supposed to have been imported on rose bushes from Somerville, Mass. The colony at South Berwick was evidently destroyed and the moths on Cutts Island did not at this time continue to breed.

Late in March, 1904, Kittery was found to be badly infested, the winter nests being common in the pear trees in the village, while a few were located in wild cherry fringe on Badger's Island. Many of these winter nests were gathered and burned by the owners of infested trees and those that remained were destroyed by an expert under the direction of the State Commissioner of Agriculture, so that the ravages of the caterpillars were effectually prevented for this season.

Unfortunately, however, last July, during the time when the moths were on the wing, strong southwesterly winds occurred and the insects are reported to have appeared in great numbers

\* Maine Agr. Exp. Sta. Bul. No. 61, pp. 36-39.

NOTE. The account of this insect is written with reference to Mass. Crop Report, Vol. 17, No. 3; Mass. State Board of Agriculture, Bulletin of information, The Brown-tail Moth 1898; New Hampshire College, Agr. Exp. Sta., Bul. 107; Me. Agr. Exp. Sta., Bul. No. 61. It is also a record of observations made this season at Kittery.

in Portsmouth and Kittery, the electric lights about the navy yards being the centre of attraction on the Maine side of the river.

While many of the moths were killed, without doubt enough escaped to distribute eggs all about that vicinity, and though the young caterpillars do practically no harm in the fall, there is every reason to believe that they will be present in alarming numbers another spring, unless the winter nests are removed as they were last season. Such a wholesale immigration of winged forms might never happen again, but while there is a chance of its occurring any summer, and an almost certain danger of small and less conspicuous immigrations, it is well to understand the situation and conditions about Kittery, especially in view of making it less vulnerable to orchard pests.

#### DESCRIPTION AND HABITS.

*The moths.* (Figure 27.) The moths, expanding from one and one-fourth to one and three-fourths inches, are white except for the abdomen, which is tinged with brown and tipped with a tuft of brown hairs. This tuft is small and dark in the male, but the large golden-brown tuft in the female is conspicuous enough to be the most striking characteristic of the moth, and has won for this insect its descriptive name of "brown-tail." These moths are on the wing in July, and unlike some closely related pests,\* the brown-tail females as well as the males are strong fliers. They are active at night and as bright lights have an attraction for them they sometimes fly a long way toward a lighted district.

*The eggs.* The female usually selects a leaf near the tip of the branch, on which to deposit from one hundred and fifty to three hundred eggs. Some of the brown hairs from the abdominal tuft adhere to the egg-mass and give it the appearance of a brown felt lump. While the moths have a preference for pear trees, wild cherry, apple, and white oak prove very attractive and other trees are not scorned.

*The caterpillars in the fall.* By the middle of August most of the eggs are hatched and the young caterpillars spin a slight

\*The weak-winged female gypsy moth and the wingless females of certain tussock moths.

web over the leaf near the egg cluster. From this protection they advance side by side, sometimes two hundred tiny caterpillars feeding in an unbroken line, though they huddle together beneath the web when disturbed in any way. When they have eaten all but the skeleton of the first leaf, they draw another into the web and repeat the process at intervals during the late summer. They feed slowly, however, and spend so much time spinning their web that they do comparatively little damage to the trees in fall, and they are still very small when cold weather comes on, those removed from the winter nests being only about one-fourth of an inch in length.

*The winter nests.* (Figure 19.) In the fall the young caterpillars weave additional layers of silk about their retreat, fastening it securely to the branch by the web, and pass the winter thus in colonies of one hundred and fifty to three hundred. These nests, which look like a cluster of dead leaves hanging from the branches, are readily seen after the other leaves have fallen. This is a very unusual yet most commendable habit in a caterpillar pest, for they can be killed, hundreds at a time, simply by destroying the nests in which the colonies hibernate.

*The caterpillars in the spring.* Early in the spring the young caterpillars emerge from their winter nests and feed upon the opening leaf buds. Until about the middle of June they feed greedily upon the leaves, completely stripping the trees where they are numerous.

When full grown the caterpillars are about one and one-half inches long. They are dark brown with a sprinkling of orange. Long fine reddish-brown hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red eversible tubercles on the top of the sixth and seventh abdominal segments.

*Poisonous qualities of the caterpillars.* Were the caterpillars to be feared only for their ravages upon orchard and other trees, the situation would be alarming enough, but not less serious is the physical discomfort experienced by people living in infested districts. When the minutely barbed hairs of the caterpillar come in contact with the skin they cause an eruption similar to and in many cases worse than ivy poisoning. These hairs are



brittle and where the caterpillars are numerous few people are likely to escape, as the caterpillars drop from the branches and creep about, even entering houses. Direct contact with the insects themselves is not necessary, however, for when the caterpillars shed their skins, the molts are blown about widely scattering the barbed hairs. Thus in infested districts it is no uncommon occurrence for whole families to suffer from the rash caused by the hairs which settle upon clothes hung out to dry. Children gathering cherries are badly "poisoned," and near Everett, Mass., people have been obliged to leave their homes for uninfested places in order to recover from attacks of the "caterpillar itch."

"So severe is this affection that in many cases people have been made seriously ill by it. The best remedy for it is the liberal use of cooling lotions, or, what is more satisfactory, even if less pleasant, the free use of common vaseline." \*

*The cocoon.* The caterpillars are usually full grown in June. They then spin loose cocoons, attached commonly to leaves, though sometimes other shelter is sought. Within these they transform to brown pupæ about three-fourths of an inch long. From the first to the twentieth of July the moths with pure white wings and brown-tipped abdomens emerge from these cocoons to deposit eggs for the next generation of troublesome caterpillars.

#### MANNER OF DISTRIBUTION.

New localities may become infested in various ways. When startled, the caterpillars have a habit of letting themselves down from the branch and hanging by a frail silken thread. They may so swing against the clothing of a person, or drop upon a passing car or wagon and be carried long distances.

Egg laden moths may be attracted to the lights in trains and electric cars and be borne into uninfested localities before they flutter off to deposit their eggs. In New Hampshire the new localities were generally found along the lines of cars coming from badly infested regions. †

\* Mass. Crop Report, Vol. 17, No. 3, p. 39.

† N. H. College Agr. Exp. Sta. Bul. 107, p. 59.

"A reliable observer, Mr. A. M. Cobb, Malden, Mass., reports that when the Bangor boat of the Eastern Steamship Line was passing some miles off Marblehead, early in July, 1904, a large swarm of the brown-tail moths came aboard and completely covered parts of the vessel."\* Dr. James Fletcher, entomologist, Central Experiment Farms, Ottawa, Can., reports that a single specimen of the brown-tail moth was taken at St. John, N. B., in the summer of 1902. Such occurrences suggest the advisability of watching each fall the ports along this line for winter nests.

About the middle of July, 1904, the morning after a strong southwesterly wind, the telegraph poles and the sides of some of the buildings near the Kittery Navy Yards were reported to be white with the white-winged brown-tail moths. The town was alarmed and great numbers of the moths were washed down with hose and destroyed, but that many escaped and deposited eggs, the neighboring trees (especially the pears and wild cherries) bear abundant evidence.

Thus strong winds, lighted trains and boats, and vehicles of all sorts are seen to be among the factors which hasten the natural spread of this dreaded pest.

#### REMEDIAL MEASURES, DIRECT AND INDIRECT.

##### *Destruction of certain breeding places.*

The vicinity of Kittery, the entering point for the pest in Maine, is overgrown with wild cherry tangles, caterpillar-haunted † and distorted with black-knot fungus. Old and worthless trees, either fruitless or bearing scabby pears and apples, straggle neglected along the lanes and hang half dead branches over every wall. Inasmuch as such trees are a menace to the orchard interests of York county and to the State, it is desirable that they be cut down and burned. Some large and carefully tended orchards (one near Elliott yielded 1,300 barrels in 1902) which are within ten miles of the infested district should be protected against needless risks.

\* Mass. Crop Report, Vol. 17, No. 3, p. 38.

† Among the most destructive being the tent caterpillar, two species of tussock moths, the fall web worm and the brown-tail moth.

The argument for such destruction is four-fold. It is in just these trees that the winter nests would longest escape detection, it being especially difficult in a dense growth of wild cherry to ascertain whether every dangling dried leaf is attached to a winter nest. The fruit trees in question being already worse than useless, it would mean apparently a needless yearly tax, either locally or upon the State, to keep them free from brown-tail moths. There will remain enough trees worthy this attention. This remedy, though indirect, would lessen the labor of direct search for and destruction of winter nests over this ground, if not for always, yet for many years to come. Since the infested area is still comparatively small, the cost of the cutting and burning ought not to be great.

#### *Cutting and burning the winter nests.*

This is the most important of the direct remedies because it is the easiest, cheapest, and, if thoroughly done, a sufficient protection against the ravages of this pest. The webs and leaves that compose the nest are woven tightly to the tips of the branches and hang there like dead leaves all winter. With so many months for inspection there is no excuse for harboring the hibernating caterpillars on shade or orchard trees. After they are cut from the branches, the nests should be burned, as this is the simplest way of destroying the colony within.

"As showing how cheaply webs may be gathered where a general campaign is made the figures of work done by employees of gypsy moth committee in 1899 are of interest. At that time over nine hundred thousand webs were destroyed at the total outlay of nine thousand seven hundred dollars."\* This would mean, accounting for the variation in the number of the caterpillars per nest, the destruction of from 15,000 to 30,000 caterpillars for each dollar's outlay.

#### *A bounty put upon the winter nests.*

Last winter in Portsmouth, N. H., the City Improvement Society placed \$50 with the superintendent of schools, who paid five cents a dozen for winter nests. Hundreds of nests were brought in by the children and burned in the school furnace. In March groups of Portsmouth newsboys were to be seen scanning the branches overhead and darting off eagerly for

\* Mass. Crop Report, Vol. 17, No. 3, p. 39.

“brown-tail nests.” In reply to a question one bright-eyed youngster stopped long enough to say, “O we cleaned ’em all out on —— street and then we came down here.” About the same time a Kittery urchin was heard to remark somewhat wistfully, “The Portsmouth kids are makin’ their fortune pickin’ brown-tails.”

#### *Instruction in public schools.*

It would be a simple matter to teach in an elementary way a few things about the important insects in the vicinity. A little observation and a little reading would prepare any teacher to do this. A single lesson would enable a child to distinguish the winter nest of the brown-tail moth from the webs of the fall web worm and tent caterpillar or from the various cocoons which are attached to leaves. All these things are brought into Kittery with the question “Is this the brown-tail nest?” and the fact that many people within the infested district do not know what to look for suggests the need for preparing the children of Maine to watch intelligently suspected areas for the occurrence of this pest. If nothing else were accomplished, it would be worth while to have every child know at least that the insects are not “just bugs that happen to be around,” but forces of vital importance both for good and for evil in the agricultural interest of his state and nation. It seems rather a pity to leave a few such things as the relation of the white grub to the May beetle or the bumblebee to red clover, mysteries to be solved in a college course.

#### *Spraying.*

The caterpillars are readily killed by arsenical sprays. This remedy is most effective when applied as soon as the leaves develop in the spring. Of course where the winter nests have been destroyed there will be no need of this remedy and it is much easier to kill about two hundred caterpillars enclosed in a nest than to wait until they are scattered over the tree.

#### *State Legislation.*

Every state needs a statute enabling authorities to treat as common nuisances neglected property which is infested by dangerous fungus diseases or insect pests; and state appropriations should be sufficient to control conditions which are of more than local importance.

"The habit of the caterpillar in wintering over in webs at the tips of the leaves gives a key to the simplest and cheapest remedy, which is merely to cut off and burn webs during the fall, winter or spring. This preventive means is most effective, and gives such excellent results that in Germany, France and Belgium there is a law making it obligatory on property owners to destroy the webs during the winter season. Where citizens neglect to carry out this work it is done for them, and the sum thus expended added to their tax levy."\*

THE GYPSY MOTH. *Porthetria dispar*. A FOREWORD.

The gypsy moth has not yet been found in Maine. The entrance of this pest, however, is probably only a matter of time. Unlike the brown-tail moth, the female gypsy moth is weak-winged and is thus unable to deposit eggs far from the cocoon from which she emerges. It is due to this in part that this moth has not yet found its way here, for it has been in eastern Massachusetts for thirty-six years and its ravages for the past sixteen years are well known.

In a district badly infested by the caterpillars of the gypsy moth no garden vegetable except the onion is safe; flowers and grass are eaten, and practically all fruit and forest trees are defoliated, pines and other coniferous trees dying as the result of a single stripping and deciduous trees not being able to withstand a three years' attack.

There is no such simple and comparatively inexpensive means of combating the gypsy moths as with the brown-tail moth, for they do not hang their colonies in plain sight all winter, but pass this season in the less conspicuous egg stage, the egg clusters being hidden in any crevice the infested area offers. These caterpillars are more resistant to poison sprays than those of the brown-tail moth and the problem is in many ways more difficult. It is the wise man who looks ahead and an additional argument for clearing out the growths which are already overrun with orchard caterpillars, (the brown-tail moth among them), is presented by the fact that southwestern Maine is the point where the first infestation of the gypsy moth would naturally occur. Nothing by way of watchfulness, instruction or

\* Mass. Crop Report, Vol. 17, No. 3, p. 39.

provisional care that can be done to guard the State against these twin pests should be neglected.

"The gradual spread of the gypsy moth up to the caterpillar plague of 1888-89 is a matter of record. Equally well known is the work of the gypsy moth committee of the Massachusetts Board of Agriculture, which finally succeeded in reducing the numbers of the insect to a minimum and thoroughly controlling the pest. Since the abandonment of the state work in the early part of the year 1900, the moth has had ample opportunity to increase to a point where it is to-day more numerous, and occupying a larger area in this state, than ever before.

"Both the gypsy and brown-tail moths can be controlled by a thorough campaign over the infested municipalities. The work of the former gypsy moth committee has shown that the damage and annoyance from these pests can be practically eliminated by the application of thorough remedial measures over the entire infested districts. It is greatly to be hoped that some effort to systematically control the spread of these pests may be instituted to the end that property owners may be spared the annual visitation of the caterpillar scourge."\*

#### ORCHARD CATERPILLARS IN WILD CHERRY.

In March, 1904, a wild cherry growth, just outside the district infested by the brown-tail moth, presented such strong evidence of being a common caterpillar breeding place that during the summer a few observations were made to ascertain something of the orchard pests there and whether the brown-tail moths would let another season go by without being enticed by this attractive caterpillar commonwealth. Among the insects found there, only those of importance are mentioned; and, as most of these are fully described in *Apple Insects of Maine*,† the general discussion is not here repeated.

#### ORCHARD TENT CATERPILLAR AND FOREST TENT CATERPILLAR.

##### *Clisiocampa americana* and *Clisiocampa disstria*.

Both these caterpillars are present. In wild growths they are commonly held in check by birds, parasites and disease. Sometimes their ravages are serious for a season or two, and a watch

\* Mass. Crop Report, Vol. 17, No. 3, pp. 32 and 40.

† Me. Agr. Exp. Sta., Bul. No. 56.

has always to be kept for them in the orchard, for the colonies are large and ravenous. Orchardists are everywhere familiar with the dark brown egg-masses found upon the twigs and gather and burn them during the winter. Where these escape detection, the caterpillars can be killed in the spring by arsenical sprays. The orchard tent caterpillars construct a nest in a fork of the branches where the whole brood spends nights and cold or cloudy days. These nests, while small, are easily torn out and the colony within destroyed; or, if neglected then, the caterpillars may be killed by giving the nest a thorough soaking with kerosene early or late in the day, when the caterpillars are at home. A kerosene swab tied to a long pole is convenient for high nests. A strong alkali, whale-oil soap, or washing powder solution may be used instead of the kerosene.

#### FALL WEB WORM. *Hyphantria cunea*.

Another nest-building caterpillar is at present even more commonly seen in this vicinity than the tent caterpillar. Their unsightly webs are stretched in every neglected orchard and the cherry tangle is full of them. These nests are made much later in the season than those of the tent caterpillars and are easily distinguished from them, as they are looser structures and very irregular, being woven over all the leaves which the brood feeds upon. Arsenical sprays on the leaves near the nest poison the supply next to be enclosed by the web, and the caterpillars feeding upon them are killed. Sometimes, however, the webs are discovered too late in the season for poisons to be used on bearing trees. Usually the nests are so situated on the branches that while still small they can easily be removed and destroyed. Kerosene or strong alkaline applications can be made as with the tent caterpillars.

There is no need of confusing the nests of tent caterpillars or fall web worms with those of the brown-tail moth, as the greater size and looser texture of these ungainly webs are distinctive marks. Moreover, unlike those of the brown-tail moth, they contain no living caterpillars in the winter.

WHITE-MARKED TUSSOCK MOTH. *Notolophus (Orgyia)*  
*leucostigma.*

OLD TUSSOCK MOTH. *Notolophus antiqua.*

WELL-MARKED TUSSOCK MOTH. *Notolophus definita.*

The moths of this *Notolophus* group are closely related to the gypsy and brown-tail moths. The caterpillars resemble these two pests in having bright red tubercles on the sixth and seventh abdominal segments. The female moths are wingless and usually cling to the cocoons from which they emerge and deposit their egg clusters there. They winter in the egg stage and where they are numerous, the white, rather conspicuous egg clusters (figure 24) are gathered and burned during the winter. The caterpillars may be killed in the spring by arsenical sprays.

Caterpillars of all three species were collected in Maine this summer, the white-marked and the old tussock moths (figure 25) being common in the orchards and cherry growths at Kittery.

The white-marked tussock moth has proven a serious pest in several New England cities. For the last few years Portland has been especially troubled by them. Not long since the park board had the egg-laden cocoons gathered "by bushels" and destroyed. The same proposition faces them this year, for many of the tree trunks along the Western Promenade and vicinity are lined with this season's cocoons, the egg supply on some of the young elms being great enough to forbode defoliated trees in the spring.

HICKORY TIGER-MOTH. *Halisidota caryæ.*

This shaggy black and white caterpillar (figure 23) which grows to nearly an inch and one-half in length does not confine itself to hickory but is commonly seen late in summer feeding freely on many trees, the wild cherry and apple among them.

RED-HUMPED CATERPILLAR. *Ædemasia concinna.*

More of these have been sent to the Station this summer than any other insect. The caterpillars (figure 26) are striking in appearance having fine longitudinal stripes of black, white and



yellow; bright red heads, with a humped first abdominal segment to match; and short black spines arranged in rows. The broods are gregarious and if found while the caterpillars are young, the whole colony can frequently be removed with a small branch on which they are clustered, and destroyed. By jarring the branch they can be brought to the ground and killed there. Arsenical sprays will kill them, but as the caterpillars occur from July to October, the presence of ripe fruit often debars the use of poison.

These caterpillars were reported this season from Skowhegan, Farmington, Dexter, Eliot, Kittery, Sebago Lake, Turner, Wiscasset and Orono. Hymenopterous parasites were bred from all the specimens received from Eliot, but none of the caterpillars from the other places were attacked, although they were nearly full grown at the time they were collected.

PROMETHEA MOTH. *Callosamia promethea*.

CECROPIA MOTH. *Samia cecropia*.

These two large and beautiful moths are included, not because they seem likely to do much harm in the State, but because their cocoons, found upon trees in the winter, are frequently mistaken for the winter nests of the brown-tail moth. Figures 20, 21, and 22.

Fifty-three promethea cocoons, gathered from wild cherry and barberry bushes, were brought into Kittery last March for brown-tail moth nests. The collector, a bright little lad, was told that each contained a single brown object which would change to a large moth in the spring, and not a lot of little caterpillars such as the winter nests held. "But," he protested "I *did* open one and there was *not* just one big thing in it, but a whole lot of little ones." A second cocoon opened in his presence revealed, indeed, not a single brown pupa, but nineteen tightly packed cells, each containing the pupa of a Hymenopterous parasite. Only nine of the fifty-three cocoons yielded moths. All the rest were parasited,—twenty-two red and black Ichneumon flies emerging from a single cocoon which had been placed alone in a glass. Evidently there is no immediate danger from the promethea moth!

The cocoons of the closely related species, the cecropia moth, are frequently sent in, but the fact that they are usually accompanied by the explanation that "only one was found in the orchard," indicates that they, also, are held in check by natural enemies.

In concluding the list of orchard pests found in cherry growths in the vicinity of Kittery it may be well to state that the observations made were neither frequent nor exhaustive. Other important caterpillars, for example those of the bud moth,\* might easily have grown there undetected, for the vicinity was not visited during the time they are at work.

The brown-tail moth was not found in the cherry tangle selected in March, but the succeeding generation was found to be established there in August.

Perhaps in this connection people who have sent orchard insects to the Station may be interested to know that all the living apple-leaf-eating caterpillars, which were received this season, together with what different species were found about Orono, were reared on wild cherry leaves. This was done simply as an illustration of a well known fact, and is significant only where orchards are supplied with pests from neighboring cherry growths.

#### SOME BIRDS THAT FEED ON ORCHARD PESTS.

When a few particular species of insects become sufficiently numerous to be considered pests and artificial means for controlling them are required, the question is always suggested: How does it happen that the closely related insects just as prolific, just as ravenous, and with similar habits, do not also overrun the orchards? An answer is found in the fact that there are enough natural enemies (as birds, parasites and disease) to hold in check many insects which would otherwise call forth arsenical sprays or other artificial remedies. The fact is not always appreciated, however, that these co-workers, even where they fail to hold some particular insect in check, lessen the labor of man in his battle of spraying machines and other appliances against even the most troublesome species. The woodpecker for instance, pulls out more borers each year than man is able to destroy with knife and wire, yet this bird is not always wel-

\* *Tmetocera Ocellana*.

came to the orchard. It is purposed merely to mention here a few birds that destroy great numbers of insects, the orchard caterpillars discussed in this bulletin among them. The passages which follow are quoted from the popular and valuable Farmers' Bulletin No. 54, "Some common birds in their relation to agriculture."

"While it has long been known that birds play an important part in relation to agriculture, there seems to be a tendency to dwell on the harm they do rather than on the good. \* \* \* The practical value of birds in controlling insect pests should be more generally recognized. It may be an easy matter to exterminate the birds in an orchard or grain field, but it is an extremely difficult one to control the insect pests. \* \* \* If birds are protected and encouraged to nest about the farm and garden, they will do their share in destroying noxious insects. \* \* \* A few hours spent in putting up boxes for bluebirds, martins, and wrens will prove a good investment. In many states birds are protected by law. It remains for agriculturists to see that the laws are observed."

"About 14 per cent of the quail's food for the year consists of animal matter (insects and their allies). Prominent among these are the Colorado potato beetle, the striped squash beetle, the cotton boll weevil, the chinch bug, grasshoppers, cutworms, and other pests of agriculture. \* \* \* An examination of the stomachs of 46 black-billed cuckoos, taken during the summer months, showed the remains of 906 caterpillars, 44 beetles, 96 grasshoppers, 100 sawflies, 30 stink bugs, and 15 spiders. In all probability more individuals than these were represented, but their remains were too badly broken for recognition. Most of the caterpillars were hairy, and many of them belonged to a genus that lives in colonies and feeds on the leaves of trees, including the apple tree. One stomach was filled with larvæ of a caterpillar belonging to the same genus as the tent caterpillar, while others contained that species. \* \* \* From two-thirds to three-fourths of the food of two common woodpeckers consists of insects, chiefly noxious. Wood-boring beetles, both adults and larvæ, are conspicuous, and with them are associated many caterpillars, mostly species that burrow into trees. \* \* \* It is estimated that the 87 stomachs of night hawks examined contained not less than 20,000 ants; and these were not half of

the insect contents. \* \* \* The insects that constitute the great bulk of the food of the king bird are noxious species, largely beetles—May beetles, click beetles (the larvæ of which are known as wire worms), weevils, which prey upon fruit and grain, and a host of others. \* \* \* There is hardly a more useful species about the farm than the phœbe, and it should receive every encouragement. \* \* \* In his insect food the crow makes amends for his sins in the rest of his dietary. \* \* \* June bugs, and others of the same family constitute the principal food during spring and early summer, and are fed to the young in immense quantities. \* \* \* Grasshoppers are first taken in May, but not in large numbers until August, when, as might be expected, they form the leading article of diet. This shows that the crow is no exception to the general rule that most birds subsist, to a large extent, upon grasshoppers in the month of August. \* \* \* May is the month when the dreaded cutworm begins its deadly career, and then the meadow-lark does some of its best work. \* \* \* Observation both in the field and laboratory shows that caterpillars constitute the largest item of the fare of the oriole.”

Among the other insect-eating birds discussed in this same bulletin are the mourning dove, the jays, the bobolink, the black birds, the sparrows, the grosbeaks, the swallows, the cedarbird, the catbird, the brown thrasher, the chickadee (that does much good by eating the eggs of tent caterpillars), and the robin.

“The Baltimore oriole and the English sparrow have been seen feeding upon the caterpillars of the brown-tail moth and the latter bird also attacks the moths.” \*

“Thirty-eight species of birds have been identified when feeding upon the gypsy moth in one or more of its forms.” †

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\* Mass. State Board of Agriculture. Bulletin of Information. The Brown-tail Moth. 1898.

† Mass. Board of Agriculture. The Gypsy Moth. 1896.



Fig. 19. Winter nest of brown-tail moth, collected at Kittery, March 30, 1904.

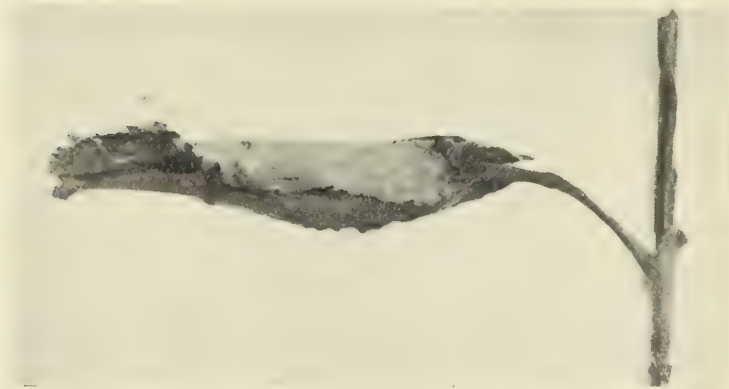


Fig. 20. Cocoon of promethea moth, collected at Kittery, March 30, 1904.



Fig. 21. Cocoon of cecropia moth, collected at Kittery, March 30, 1904.





Fig. 22. Promethea moth. Female.



Fig. 23. Caterpillar of hickory tiger moth, collected at Kittery, Aug. 22, 1904.





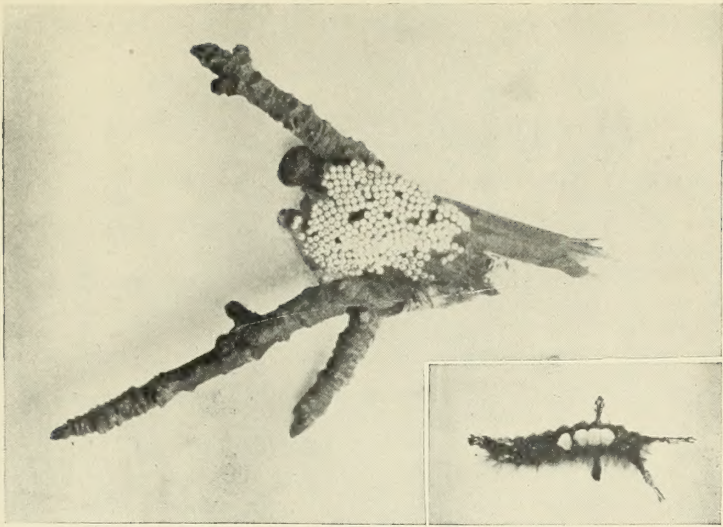


Fig. 24 Cocoon of old tussock moth covered with eggs, collected at Kittery, March 30, 1904.

Fig. 25. One of the caterpillars that hatched from the eggs shown in the accompanying figure.

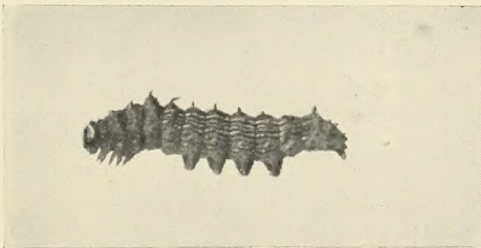


Fig. 26. Red-humped caterpillar.

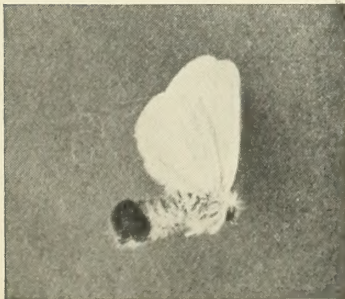


Fig. 27. Brown-tail moth. Female.





