

REPORT  
OF THE  
STATE GEOLOGIST  
AND  
CURATOR

1875-1876

H. A. Cutting

REPORT  
OF THE  
GEOLOGIST

AND CURATOR STATE CABINET,

For 1875 and 1876,

WITH SOME SUGGESTIONS AND DIRECTIONS

AS TO HOW WE MAY

PROTECT OURSELVES AGAINST INSECT ENEMIES.

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By **HIRAM A. CUTTING, A. M., M. D.,**  
STATE GEOLOGIST AND CURATOR.

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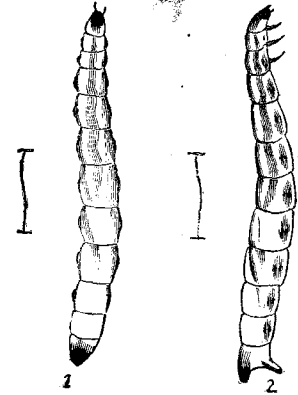
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TEN-LINED POTATO BEETLE—COLORADO POTATO BEETLE—*DORYPHORA DECEMLINEATA*.—*Say*.

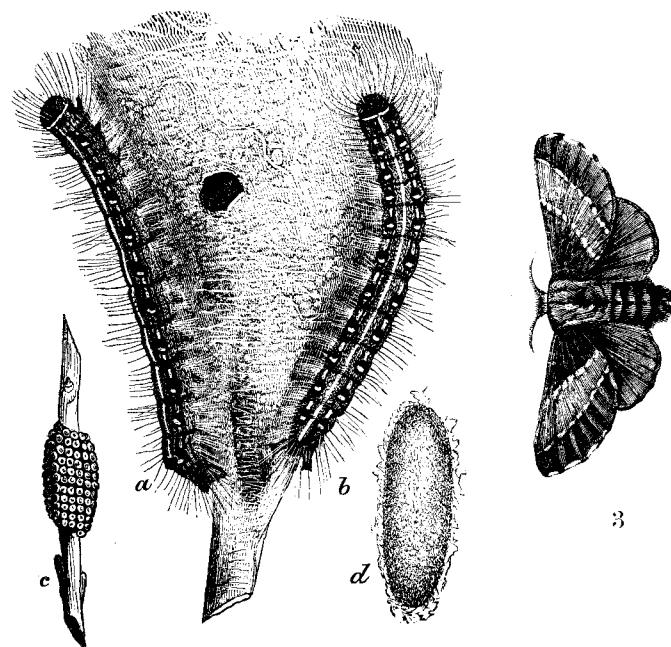
a, a, eggs ; b, b, b, larvæ of different ages ; c, pupa ; d, perfect insect ; e, right wing cover enlarged ; f, leg enlarged.

See page 11.



STRIPED SQUASH BEETLE — *DIABROTHICA*  
*VITTATA*.—*Fabr.*

FIG. 1. Back view of the grub that eats the root and stalk. FIG. 2. Side view; both magnified. The marks show the actual length. Beetle natural size. See page 17.

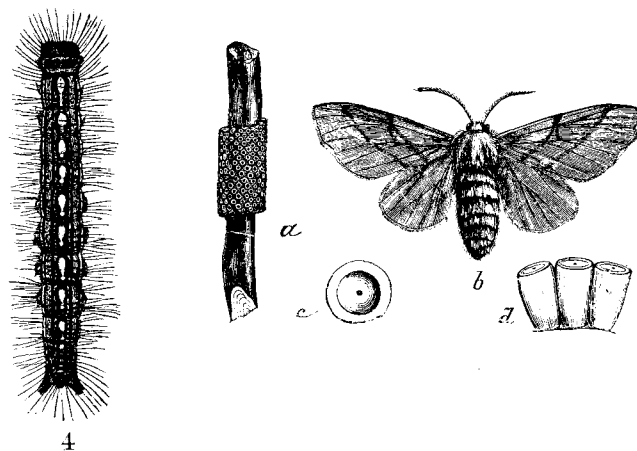


TENT CATERPILLAR OF APPLE TREES—CLISIO-  
CAMPA AMERICANA.—*Harris.*

All natural size ; a, larva full grown, side view ; b, larva full grown, back view ; c, cluster of eggs on a twig ; d, cocoon.

FIG. 3. Moth, color, reddish brown.

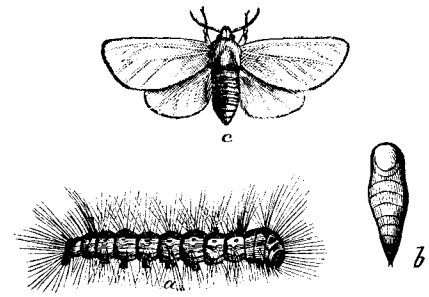
See page 19.



FOREST TENT CATERPILLAR—CLISIOCAMPA  
SYLVATICA.—*Har.*

FIG. 4. Caterpillar full grown ; natural size.  
a, eggs ; b, female moth, natural size ; c, enlarged view  
of egg from top ; d, enlarged view of eggs from side.

See page 21.



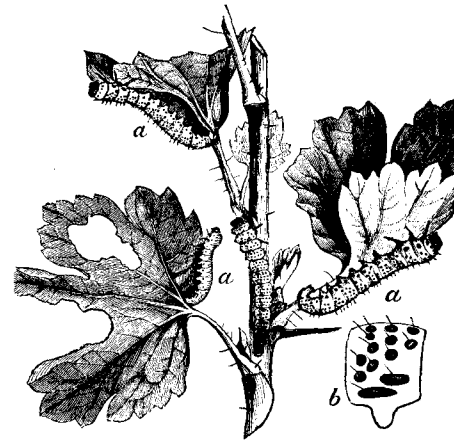
WEB WORM—HYPHANTRIA TEXTOR.—*Harris.*

All natural size. a, caterpillar ; b, chrysalis ; c, moth.

See page 22.



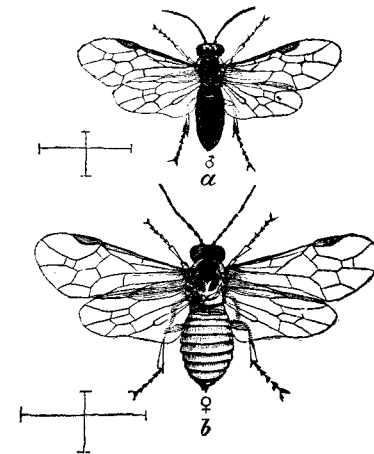
FIG. 1.



THE CURRANT WORM—*NEMATUS VENTRICOSUS*.—*Klug.*

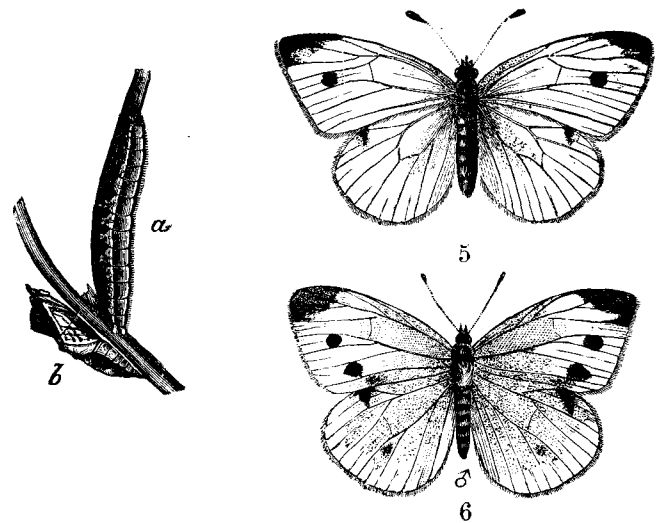
a, a, a, different stages of growth ; b, a single segment of the caterpillar magnified.

FIG. 2.



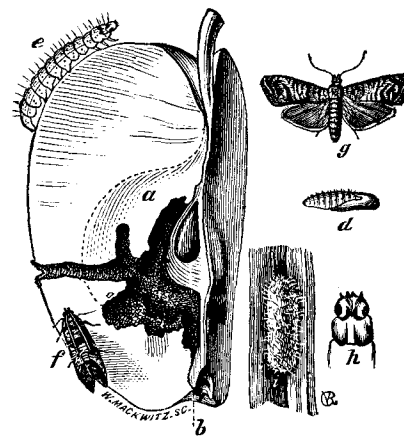
Adult specimens enlarged. The marks at the side represent the actual measurement with wings spread. a, male ; b, female.

See page 22.



CABBAGE WORM—PIERIS RAPÆ.

FIG 5. Butterfly of the cabbage worm, male. FIG. 6. Female. The female is distinguished from the male by having two round spots, rarely three, on the wings. The body of this butterfly is black above, with white wings. a, cabbage worm; b, chrysalis. See page 23.

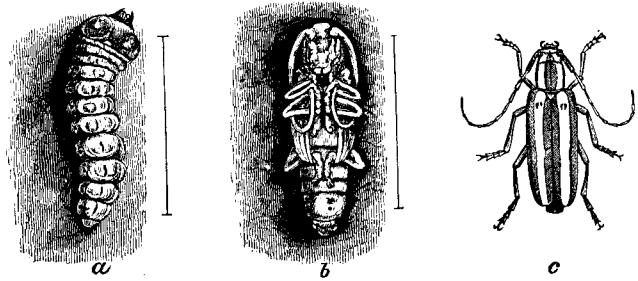


CODLING MOTH—CARPOCAPSA POMONELLA.

—Linn.

a, apple eaten by larva; b, spot where egg is laid and the young worm enters; c, cavity made by larva; d, chrysalis; e, larva full grown; f, moth with wings folded; g, moth with wings expanded; h, head and first joint of larva (enlarged); i, cocoon.

See page 24.



ROUND HEADED APPLE TREE BORER—SA-  
PERDA BIVITTATA.—*Say.*

Figures all natural size. a, larva full grown; b, pupa;  
c, perfect beetle.

See page 25.

## REPORT OF THE STATE GEOLOGIST.

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*To His Excellency, ASAHEL PECK,*

*Governor of Vermont :*

SIR :

I have the honor to present the following report in relation to my department, for the years 1875, and 1876. As there is no appropriation by the Legislature, to enable me to examine the mining sections of the State, or even collect the statistics of the same, I am, of course, unable to give a definite report.

The marble interests, notwithstanding the hard times, are still, as they must be for years to come, on the increase. They pay reasonable profits on investments made, and as the marble improves with depth in most of the quarries, the future prospect is flattering.

The quarrying of granite, and porphyry, has been on the increase, and it is found that our granites when polished are scarcely inferior to the Scotch granites, so much used in Europe, and recently in this country. Among the more promising granite quarries may be mentioned those of Blue Mountain in Ryegate, the quarries in Barre, Craftsbury, Brownington, Newport, Kirby, Victory, and Brunswick. Preparations are now being made to quarry porphyry in St. Johnsbury, and Waterford.

During the two years here reported I have been conferred with by letter, or otherwise, in one hundred and sixty-three cases, in relation to supposed recent finds of minerals in Vermont. In most cases the amount was too small to be of value, but in some the ore was good, and appears to be in sufficient quantity, and quality, to warrant further examination and development. This will in most cases doubtless be made as soon as the revival of business and prices of metals favor the outlay. An extensive bed of iron ore (Magnetite) in Concord gives great promise.

There are, at present, enquiries by several parties for white silicious earth, and as there may be various deposits unopened in the State, I would suggest that parties owning such send me samples; and if of good quality, I may be able to put them in communication with purchasers.

#### ADDITIONS TO THE CABINET.

We have been enabled to make the usual increase in our specimens. Many of them have been through the courtesy of friends, and we are still indebted to the various railroads, not only in the State, but elsewhere, for their aid in bringing those collections together. It would give us pleasure to be more personal in our thanks, and give the names of all rendering aid in this collection, but it is hardly possible.

#### MINERALOGY.

In this department we have received various specimens from different localities in the State, and to aid in the collection of Vermont specimens I have purchased some beautiful geodes from Illinois, which I will give in exchange for

any Vermont specimens desired. It is often that, in the homes of our citizens, I find a specimen or two that should be in our State collection; but they are unwilling to part with them, as they are kept for their beauty. I shall now be enabled to exchange, giving specimens foreign to Vermont, and more beautiful to grace our homes, for specimens desired in the State collection.

#### ORNITHOLOGY.

The following are the names of the birds, in part, that have been added, or in other words are the specimens added in 1875. Those of 1876 are not yet in order for names, and as no full list can be given, I give none of this year's acquisition.

No. Specimens.	COMMON NAMES.	SCIENTIFIC NAMES.	AUTHORITY
1	Bunting, Snow	<i>Emberiza nivalis</i> ,	Linn.
2	“ Towhe	<i>Fringilla</i> ,	Gm.
1	Bittern, Least	<i>Ardea exilis</i> ,	“
1	Bobolink,	<i>Emberiza oryzivora</i> ,	Linn.
1	Cuckoo,	<i>Coccygus Americanus</i> ,	Linn.
1	Duck, Oldwife	<i>Anas glacialis</i> ,	Wilson.
1	“ Velvet	“ <i>fusca</i> ,	Wilson.
1	“ Ruddy	<i>Erismatura rubida</i> ,	Bona.
2	“ Barrows' Golden eye	<i>Bucephala Islandica</i> ,	Baird.
1	Eagle, Bald	<i>Falco leucocephalus</i> ,	Linn.
1	“ Osprey	“ <i>haliaetus</i> ,	Linn.
1	Godwit, Hudsonian	<i>Limosa Hudsonica</i> ,	Swainson.
1	Hawk, Pigeon	<i>Falco columbarius</i> ,	Linn.
2	Kinglet, Golden	<i>Regulus satrapa</i> ,	Coues.
1	Martin, Purple	<i>Hirundo purpuria</i> ,	Linn.
1	Meganser, Red-breasted	<i>Mergus serrator</i> ,	Linn.
1	Nuthatch, Redbellied	<i>Sitta Canadensis</i> ,	Linn.
1	Owl, Acadian	<i>Strix passerina</i> ,	Linn.
2	“ Great horned	“ <i>Virginiana</i> ,	Gm.

No Specimens.	COMMON NAMES.	SCIENTIFIC NAMES.	AUTHORITY
1	Pewee,	<i>Muscicapa nunciola</i> ,	Wilson.
1	“ Wood	“ <i>virrens</i> ,	Linn.
2	Plover, Piping	<i>Charadrius hiaticula</i> .	Wilson.
1	“ Ringneck	<i>Agialitis semipalmatus</i> ,	Coues.
2	Redpoll, Yellow	<i>Fringilla linaria</i> ,	Linn.
2	“ Lesser	“	
1	Rail, Carolina	<i>Porzana Carolina</i> ,	Saml.
1	Sparrow, Java	<i>Fringilla</i> ,	Linn.
1	Sandpiper, Solitary	<i>Fringa solitaria</i> ,	Wilson.
1	“ Spotted	“ <i>macularia</i> ,	Wilson.
1	Teal, Green-winged	<i>Anas crecca</i> ,	Wilson.
1	Tern, Least	<i>Sterna minuta</i> ,	Wilson.
1	Thrush, Wilson's	<i>Turdus mustelinus</i> ,	Wilson.
1	“ Wood	“	
1	“ Golden crowned	<i>Motacilla aurocapilla</i> ,	Linn.
1	Vires, Yellow-throated	<i>Muscicapa sylvicola</i> ,	Wilson.
1	Warbler, Black and yellow	<i>Sylvia magnolia</i> ,	Wilson.
1	“ Yellow	<i>Motacilla petechia</i> ,	Linn.
1	“ Cape May	<i>Sylvia maritima</i> ,	Wilson.
1	Yellow Bird,	<i>Fringilla tristis</i> ,	Linn.

We still desire specimens of rare birds killed in Vermont, and wish such when killed sent to us immediately by express. As there is an appropriation to pay express charges, such charges need not be prepaid. Should it be the desire of parties donating the birds that their names should appear on the specimens, a letter stating that fact, with name and residence, must be sent by mail. If birds are caught in traps, do not send them alive, as their plumage will be spoiled, but kill by pouring a spoonful of chloroform down their throats, and then wrap up in a paper before boxing, so as to retain their feathers in the most natural position.

## \* OÖLOGY.

Though we have much increased our collection of eggs, more are wanted, and we should be glad to make arrangements for the same in different parts of the State. As soon as possible they will be mounted on the stands with the birds, and we hope soon to show the egg of every species, as well as the nests.

Nothing forms a more attractive feature in a museum, or is more acceptable to amateurs, than the nests and eggs of birds. These should be collected whenever they are met with, and in any number procurable for each species, as they are always in demand for purposes of exchange. Dozens of eggs of *any* species with their nests (or without, when not to be had) will be gladly received.

Nests require little preparation beyond packing so as to be secure from crumbling or injury. Each one should be placed in a box or ring of paper just large enough to hold it. The eggs of each nest, when emptied, may be replaced in it and the remaining space filled with cotton.

Eggs, when fresh, and before the chick has formed, may be emptied by making small pin-holes on opposite sides, and then blowing or sucking out the contents. Should hatching have already commenced, an aperture may be made in one side by carefully pricking with a fine needle round a small circle or ellipse, and thus cutting out a piece. The larger kinds should be washed inside, and all allowed to dry before pack-

\* A pamphlet has been published by the Smithsonian Institution in regard to the collecting of nests and eggs, which may be obtained upon application.

ing away. If the egg be too small for the name, a number should be marked on it with ink corresponding to a memorandum list. Little precaution is required in packing, beyond arranging in layers with cotton and having the box entirely filled. It is always better to wrap each egg in a loose coat of cotton before arranging in layers, and they should be packed in small wooden boxes.

Cracked eggs should have strips of tissue paper pasted over the line of fracture ; or the crack may be painted over with collodion while the sides are pressed together.

#### CRANIOLOGY.

We now desire, to complete our set of Vermont mammals, the skull of the wolf, (*Canis lupus*), and catamount, (*Felis concolor*). If any party will furnish them, we will make fair remuneration.

#### CONCHOLOGY.

I am glad to report an increase in the number of our shells, which will soon be arranged for exhibition. We have now nearly one hundred named species. We trust the friends of this specialty will not forget that they can send them nicely through the mail, and that we will exchange, giving specimens from other localities, as soon as we can get them named and in order for distribution.

#### ENTOMOLOGY.

In this department many additions have been made, and as there is much interest in relation to injurious insects at this time, I deem it best to answer in this report, in part at least, the numerous letters I receive ; by a description of

such of our insect enemies as I am so often enquired of in relation to ; and notices of such means of destruction as are deemed best for their extermination. In a letter before me, I am asked: "What is science good for, if scientific men are baffled by one little insect which they cannot devise means to exterminate?"

Science is not baffled, but, like Hercules in the old fable of the wagoner, can help you, and will help you, only when you help yourselves. I may now hear you ask: "How we may help ourselves?" or how Vermont alone can help herself. We may safely calculate that the insect ravages in Vermont for the year 1877, will exceed three millions of dollars. Now is it too much to say that a concerted action on the part of all agriculturists would decrease this damage one half? Did science have full control of our legislature, law would require, and enforce, the necessary concert of action ; and while agriculturists would groan under imaginary tyranny, they would reap the reward. As the agricultural interests control the legislature, ought they not and will they not take their best interests under consideration, and do something for themselves?

First, then: A law should be passed authorizing the selection, and providing for the payment, of a competent commission ; perhaps of three persons, for this State ; to be selected for their merit and ability for the work ; not for political influence. This commission should sub-divide their work in such manner as to thoroughly investigate the habits, and times of appearance of agricultural pests ; the effects upon them of all cheap materials which have been, or may be used as destroying agents ; and to fully determine the



proper times of applying the same. The members of this commission should have sufficient remuneration for time and labor, so that, if necessary, they could temporarily abandon other pursuits without damage to their pecuniary interests.

It is only by the association of several careful observers and investigators that the most useful results can be obtained.

Secondly. When this information has been accumulated, it should, in compact form for easy reference, be widely published in newspapers, and in pamphlets, for a general distribution to all farmers.

Thirdly. When such information has been made general, compel by legislation, and impress the acts and the beneficial results of the same upon the community, through your agricultural societies, the Board of Agriculture, and the newspapers of the State. You already protect your birds by law, which is one step in the right direction. Can you, in fact, find an intelligent farmer in the State to-day, that would not cheerfully obey a judicious law to concertedly counteract the injury of the advancing potato bug? The rights of the intelligent who are disposed to help themselves and each other, can only thus be protected against their indolent neighbor who allows his fields to be the nursery of insects of destructive tendency, which overrun surrounding farms to such an extent that no industry can protect against them.

This, then, allow me to say to the agriculturists of Vermont; that a successful campaign against your insect enemies can only be brought about by the demand of yourselves; and that legislative enactments must furnish the

means and give the power of action. Further: It must also protect this concerted action from the thriftless ignoramus that don't care for himself or neighbors. The fact is, that the ravages of hostile insects represent a condition of war, and it is only by organization, and appropriate weapons, that they can be conquered. The proper subjects for consideration are the materials to be used, the best time to make the attack in force, and the weapons to be employed. It is entirely useless for us to fold our arms and exclaim: "It is the will of God!"

#### THE COLORADO POTATO BEETLE.

*Doryphora decemlineata*, Say.



a, a, eggs; b, b, larva in different stages of growth; c, the pupa; d, beetles; e, elytron magnified; f, leg magnified.

This pest is now really in our midst, and though not as yet in sufficient numbers to do much harm, its previous history ought to give us warning. The great interest felt on account of this intruder has been manifest by the countless bugs of all descriptions that I have received by mail this

season, with the enquiry: "Whether it is a potato bug." Nine times out of ten I could say it was not; but the number of actual potato beetles has led me to the belief that there is hardly a town in the State that has not in it the dreaded pest; in small numbers, it is true, but yet if not immediately attended to, two seasons more will blight our crop of potatoes as elsewhere. That all may recognize this pest, I will give something of its appearance, history and habits.

This bug, so called, is, strictly speaking, a beetle, and is known to naturalists under the name of *Doryphora decem-lineata*. Like other higher species of the Coleoptera, it passes through a complete metamorphosis, but, unlike many other beetles, it confines itself during its entire life to the same species of vegetation, and, unhappily, selects as its first choice the potato. This beetle, however, is not, like many of our pests, an importation, but an original native of the far West. Its name would indicate Colorado as its birth-place, but historical facts do not confirm it, as the bug committed severe depredations in Nebraska and Kansas before it was ever seen in Colorado, and the farmers there consider it of Eastern origin. It is, however, described by naturalists as a native of the Rocky Mountains, from whence it came as soon as the cultivation of the potato offered a stepping stone to civilized life. I am, however, from its history which I have traced back as far as possible, of opinion that, if it came from the Rocky Mountains, it came down the fertile valley of the Missouri, or some of its branches, rather than across the desert of near five hundred miles intervening between the cultivated lands of Colorado, and the fertile

plains of Kansas; and it is quite as likely that it had its origin in some of the fertile valleys or grassy plains of Nebraska.

That its native place is far west of the Mississippi no one can doubt. That it is a great lover of the potato plant is equally certain; yet it can exist upon other food when potatoes fail, but first selects the tomato and other plants nearly allied in properties to the potato leaf; but such plants are seldom attacked until the potato fields are fully devastated. The eggs of this beetle are deposited, to the number of seven or eight hundred, by each female, at intervals during from twenty-five to forty-five days, on the leaves of the potato, in regularly arranged clusters of from twenty to thirty eggs each. They are of an orange color, and always on the under side of the leaf. In about one week after they are deposited they hatch into larvæ, which feed upon the foliage about two weeks, though some fix the period at seventeen days. Their growth is quite regular, and when full grown they are three-eighths of an inch in length. Upon their sides they have two rows of slight protuberances tipped with black, ten in the lower row and nine in the upper; when full grown there is a faint trace of a third row below the two, and four black dots, forming the back of the neck, or thorax as it is more properly called in the insect. Its head is also black, and it has a black ring round its thorax. It has six legs, the first pair coming out of the thorax, and the others immediately behind, or on the front part of the abdomen. Its body is cream color. When full grown they descend to the ground, where they change into a pupa state

near the surface. The perfect beetle appears in a little less than two weeks, pairs when about one week old, and a week later commences the deposits of eggs, as before described. From three to four broods will be hatched in a season. The statements of time are, however, liable to vary, being longer or shorter, according as the weather is more or less favorable to their development.

The mature beetle, as its name indicates, has ten lines of black lengthwise of its wing covers, five on each side, the ground being a medium yellow. It has several black spots upon its head and thorax, also six legs, and pink gauze wings under the striped wing covers described. It passes the winter in the perfect beetle state, burrowing in the ground beneath the frost, coming out unimpregnated in the spring, just in season to lay its eggs on the young potato plant.

Bad as these beetles are, they are not so bad as popular opinion makes them. Their first onset is the most severe, and farmers accustomed to give up to imaginary evils will talk about the extermination of the potato. Of that there is no danger from this cause. In Iowa, in 1870, the beetles were very abundant, so much so that they swarmed over barns and outhouses, and also entered dwellings so that you could hardly sit down or walk without crushing them, yet the crop of potatoes was the largest ever known, and they were retailed in the streets for twenty-five cents per bushel. This abundant crop was raised by every one planting in anticipation of high prices, thus bringing the opposite result.

By some this beetle is considered poisonous, but from no

just cause, as it can be picked from the potatoes day after day, by whole families, with no bad result. Large quantities of them in the state of putrefaction, like all other animal matter, is disagreeable, and, doubtless, unhealthy, and they should never be left to putrefy, but be burned or destroyed with boiling water, and then buried. As they are voracious feeders, they may be killed with poison, like arsenic or Paris green, mixed with flour, and dusted on the potato leaves. As these substances are very poisonous if swallowed or inhaled, great care should be taken in their use.

As regards their depredations in the New England States, of course we have much to fear, and yet we have some things in our favor. First, its natural enemies. The "lady bird," which, perhaps, is more generally known as the lady bug, has been very abundant this season, causing the destruction of myriads of plant lice, and they need but encouragement to assist the farmer in the destruction of the potato beetle, as they are a deadly enemy. The eggs of the "lady birds" are very much like those of the potato beetle in color, but are smaller and not so many in a cluster, but always laid in close proximity to those of some other insect. As soon as they hatch, they commence their war of extermination, and, as they are voracious feeders, they follow it up almost unceasingly. This lady bug is about two-thirds the size of the potato beetle when fully grown, of a yellowish red color, with two or more black markings on each wing cover, being shorter and more thick-set than the potato beetle. In fine, they are about the size and shape of a half pea. There are several varieties, but all are the

friends of the farmer, and should have special protection. The spined soldier bug and the banded robber bug also prey upon the larvæ of the potato beetle, as well as at least six other cannibal foes common to New England, although those enumerated are the most important.

Secondly. Our winters are more severe than the winters West. Jack Frost creeps deeper into the ground, and must overtake many of the ten liners that supposed themselves safe from cold. This year brings skirmishing parties into our midst, and in two years it is probable the main army will test our potatoes and our climate, so let us be ready to give them a *warm*, if not a welcome reception.

The material used in the warfare against this intruder has generally been Paris green dusted on the leaves when wet with dew, while the beetles are in their larval state, or mixed with water at the rate of one tablespoonful of the green to a pailful of water. When applied dry it is better to mix with ten parts of flour; and great care should be taken not to inhale the dust, as it is very poisonous. When in solution it must be almost continually stirred, or the green will sink to the bottom of the sprinkler, as it is not soluble in the water.

C. V. Riley, of Missouri, says that quite as good results may be obtained in using the ingredients from which green is made, as from the finished article. The Paris green costs say  $37\frac{1}{2}$  cents per pound, and the demand is often so great that it cannot be obtained just when wanted, especially in back towns. The following directions for making green, from Brande's Chemistry, are practical: Dissolve two pounds of sulphate of copper (blue vitriol, costing fif-

teen cents per pound, or thirty cents,) in a gallon of hot water, keeping it in a stone jar. Dissolve in another large jar, one pound of common white arsenic (costing about six cents,) and two pounds of saleratus or pearlash, (cost sixteen cents,) in forty-four pounds of hot water, stirring well till thoroughly dissolved. These articles, costing fifty-two cents, will make about five pounds of Paris green, costing about \$1.88.

This can be kept in solution and mixed in proportion of one part of the first and five of the last solution, as they are needed. The green immediately begins to precipitate in a fine powder, and is much more convenient for use in solution than the dry article. Prof. Riley says that Paris green can be in this way used without danger, and all agree that in solution or mixed with flour when dry and dusted on it is the unfailing remedy.

Dr. Le Conte advises the use of large atomizers for not only the destruction of the potato beetle, but of all insects that can be killed by a solution. This idea is worthy of consideration, and it may, doubtless, prove invaluable.

Next to the potato beetle in number of enquiries comes the

#### STRIPED SQUASH BEETLE.

##### *Diabrothica vittata, Fabr.*

This beetle appears on cucumber and squash vines, as soon as they are through the ground, and frequently devours them all in spite of the usual preventives used. They need little description, as they are well known by the yellowish stripes upon each wing cover. They lay their eggs in June, or soon after their appearance, and the larva arrives at ma-

turity in about a month after the egg is laid. The larva remains in the pupa state about two weeks. We usually have but two generations in a season. It remains through the winter in the pupa state. The grub often hollows out the stem of the squash or cucumber vine, below the ground, the last of June or first of July, and sometimes eats the upper portion of the root. Should this food get short they may be found in the stem above ground. They, however, do not do great damage either in the second generation, or in their grub life. Covering the vines with a box covered on top with muslin, has been considered the only sure remedy; though powdered charcoal, lime, and sometimes ashes, can be used with benefit. In many cases, however, the material sprinkled on the leaf is as bad as the beetle. If a handful of shavings be burned near the hills in the evening, many of them will fly into the flames. After various experiments, I have become satisfied that covering the hills with common newspapers, is much the best means to be used; besides, you get an accelerated growth of the plants. Just as soon as they break ground, or, perhaps better, a day or two before the plants appear, open a newspaper to its full size, and spread it over the hill, letting it lie close on the ground, and fasten it in place by hoeing the dirt on to the edges, so that no gusts of wind can disturb them. The plants thus covered will grow at least a third faster than those not covered, are safe from the beetles, and more healthy in every way, producing blossoms several days sooner than those not covered. It is seldom that once covering will not answer all purposes, but should one be torn off from any cause, it can easily be replaced. I have tried

different colors of paper, and find white or blue paper best adapted to the purpose. Other colors seem to give a paler green or sickly appearance to the plants. Newspapers are easily obtained, and are just as good as clear white paper. It will be seen, also, that this is a protection against late frost, and I believe that every person that tries this method of protection will ever use it with entire satisfaction.

#### THE TENT CATERPILLAR.

##### *Clisiocampa Americana, Harris.*

This caterpillar is well known to all, yet all do not understand its habits. The eggs are laid by a night flying moth, in August, or in the southern part of the State, doubtless, in the last part of July, in oval rings, round the smaller twigs. These egg rings contain some three hundred eggs each, and are covered over with a mucilaginous coating which answers the double purpose of keeping out the water, and food for the young when they hatch, to give them sufficient strength to crawl down the limb to the first fork, where, by crawling back and forth, they weave from a spinneret in their mouth, the tent in which they live. From this tent they sally forth twice a day for food, eating voraciously. On an average, each caterpillar will eat two apple leaves a day, and no tree can long live under such a vital drain. As the weather gets warm, when they return from a meal, instead of going into their tent, they will go to rest upon the outside. Those coming in later and finding no room, will crawl over the sleepers, spinning all the time until they are covered, and another story is added to their tent. Thus from time to time it is increased with their

growth until their food gives out, or their caterpillar life is spent, when they lose their social habits, and wander off to find other food, which they are seldom able to do, or find suitable places in which to spin their cocoons. These are light colored, with a tinge of yellow, and may generally be found attached horizontally, to the under side of fence rails, or other protected places. They remain in these about three weeks, when such as have not fallen a prey to the ichneumon fly, as many do, come forth to lay their eggs, as before described. The question so often asked is: "How to destroy them?" I will first tell you how you ought not. Some flash gunpowder on their nests; others burn them with a torch; while some put on kerosene and burn, and others saturate with oil, to kill them. All these methods are destructive to the trees, and should never be employed. Upon a moment's reflection it will be seen that the quickest and easiest way is to cut off the twig containing the eggs. After the leaves have fallen, on a frosty morning, the eggs may be readily seen as a dark band on the twigs, as the frost does not so readily adhere to them. When you cut them off always burn them. If this method is neglected, watch your trees when they first hatch, and with a stick remove the entire nest early in the morning, or just at night, as they feed and are consequently scattered over the branches both in the middle of the forenoon and middle of the afternoon, and some stragglers are absent all day. If they are still neglected, as they should not be, there is no sure way to rid your trees of them but to put on gloves and clean them off with your hands. You can kill by crushing, or have an attendant with a pail of hot water, and put in

such branches as you can cut away, or do not crush. Every tent found, whether on orchard or forest tree, should be destroyed.

Nearly akin to this insect is

THE FOREST TENT CATERPILLAR.

*Clisiocampa sylvatica*, Harris.

This caterpillar, for some years past, has been destructive to forest trees as well as apple orchards, yet what I have previously said will equally well apply to this species, only its eggs which surround the twig in the same manner, form a complete cylinder, holding its full size from one end to the other, uniform in diameter, and cut off squarely at each end, while the egg masses of the other are oval rings, rounded at each end of the mass. They are a more hardy species, and after having stripped one tree of its leaves, will travel in troops to another, ascend, and there make their home. This can easily be prevented by putting tar or printer's ink about the trunks of trees not infested. The habits of this insect are not the same as those of the other. While they spin a thread they do not form a tent between the branches, but, resting upon the smooth side of the trunk or branch, their thread lies between and beneath them, so it does not make much show. They feed night and morn, sometimes in the night, and are more voracious than the former. While the former appear almost every year, this species is seldom plenty but a year or two at a time. They will hardly be seen for three or four years, and then reappear in abundance as before.

The reason for this seems to be that their natural ene-

mies increase more rapidly upon abundance, than they do, and, after overpowering them, almost die out also, and then the caterpillar gains ground again. The same means of killing should be employed as before.

Next to the caterpillar comes the

#### WEB WORM.

##### *Hyphantria textor, Harris.*

This is often supposed to be the second brood of the Tent caterpillar, but is a different species altogether. The last of July a small white moth lays her eggs upon the end leaf of a branch, which soon hatch. The young enclose the end of the branch in their web, feeding only upon the pulpy parts of the leaf, leaving the skeleton behind. They extend the web over other leaves as soon as they are needed for food. When fully grown, they descend the tree, and pass the winter in the pupa state in the ground.

The best way to rid your trees of this pest, is to clip off the end of the branch as soon as the worm appears. On no account delay, as if you do, they will slip through your fingers, and much increase your labors the next season. If they are neglected until they cover more than you desire to prune away, kill as you do the Tent caterpillar. This you can do at any time, as they never leave their tent as the others do, but extend it as they desire more food.

#### THE CURRANT WORM.

##### *Nematus ventricosus, Klug.*

This, like the caterpillar, needs no description, as it may be found in its season upon currant and gooseberry bushes, in all parts of the State.

The perfected insect lays its eggs on the under side of the leaves, generally beside the veins, but sometimes in clusters. In from six to eight days, according to the weather, they hatch, and commence feeding. They continue their work upon the bushes, until they are bare of leaves, and then, whether fully grown or not, go down into the ground and form little black pupæ, varying in size according to the way the worm is fed. Emerging in about two weeks, they lay their second brood, which pass the pupa state in the ground as before, but do not emerge until the following spring. Powdered white hellebore is, perhaps, generally used for their destruction, but is no better than any other dust. Any dust that touches them is lodged in their spiracles, or breathing-pores, and soon produces death. Dust from the road, dried fine plaster of Paris, or any finely pulverized substance, will answer. The Grafton fertilizer, which was finely pulverized quartz, was the best material I ever saw for killing them. It possessed the requisites of great fineness and perfect dryness, so it would make a dust easily. The hellebore is an excellent preparation for the purpose, but might poison the fruit. Gum aloe is, when fine, equally penetrating, and less dangerous.

#### CABBAGE WORM.

##### *Pieris rapæ.*

Twenty years ago this centennial year, this obnoxious European insect landed in Quebec, and from that beginning has made itself familiar with not only New England, but most of the United States, as well as Canada.

It is susceptible to the dust treatment, but as that gets into the cabbage head and injures it, it cannot be used to

advantage. There is, however, a little parasite, *Pteromalus puparum*, Linn., which deposits its eggs in the pupa of the cabbage butterfly, and the young find food enough to develop forty or fifty from one pupa, to again feed upon this obnoxious insect. This parasite is not found in all places where the cabbage worm is, as they are not so rapid travelers, but, doubtless, soon they will be held in check by this little friend of mankind.

#### THE CODLING MOTH OR APPLE WORM.

*Carpocapsa pomonella*, Linn.

This is another imported insect, but is, doubtless, found everywhere where apples are raised, and so has become domesticated in its American home. About the first of July, in this State, the night flying moth comes from his silken cocoon, which was hid under some bit of bark, or sliver on the fence near by. After pairing the male dies, but the female may be seen in the dusk of night flitting around the apple tree, laying her eggs in the blossom end of the little apples.

In about a week the egg hatches, and the worm eats his way into the apple, where it lives for about a month, when it bores its way out through the side, and escapes to some sheltered place, where it builds its cocoon, as stated; but this time coming out in about twelve days, laying eggs as before, this brood giving us the wormy apples in the fall. What worms survive build cocoons as before, to come out perfected the next summer. The first brood is very small, but the second is fifty to one of the first, or even more.

Our protection against this insect is very difficult, and so most people do nothing. Putting wisps of straw round the

tree, to furnish shelter for cocoons, and then taking off and burning, or scalding it; removing all rubbish from near the trees, which could afford shelter; allowing cattle or pigs to run in the orchard to pick up the fallen fruit, and many other things are devised, but all fail in keeping them only temporarily in check. It is a great task to do all this, but in the spring the destruction of one cocoon, and many may often be found where apples have been kept through the winter, saves at least one hundred apples from contamination. It will be seen that their destruction is of great importance.

#### THE APPLE TREE BORER.

*Saperda bivitata*, Say.

This is a native American, born and bred in the mountains, feeding upon the wild crab, mountain ash, and various other trees. It comes out of the trunk, usually in June, and always in the night, in its perfect state. Resting by day, in the night time it flies from tree to tree for food and companions. Though they feed upon the bark of branches where it is tender and succulent, they lay their eggs on the bark at the foot of the tree, where the young, as soon as hatched, commence to burrow in the bark. For the first year they live mostly in the bark, but, towards the last of the season, advance into the sap wood. Frequently in young trees the bark over them will crack and allow their castings to fall out, and thus they may be detected. They remain in the tree three years. As the time comes for their exit, they eat their way to the bark, thin that somewhat, and go into the pupa state to emerge perfected in about four weeks.



The best remedy is to prevent the successful laying of eggs, which may be done by smoothing and then soaping the bark. If such is done near the ground only, they will lay their eggs at the junction of the largest limbs, or higher up on the trunk, so the scraping and soaping wants to be thorough. If the borers are really in the trees, there is no way except to kill them, or cut them out one at a time. A small piece of whalebone is the best to kill them with, by pushing it into their hole. A piece of wire will answer. When the bark is killed over them it is just as well to cut them out. The application of the soap is necessary in May. Either soft or hard soap will do, but if hard soap is used a thin piece had better be crowded down into each principal crotch of the tree, so that the rain may wash it down the trunk. Do this, of course, after having washed the tree with strong suds.

Though many other insects have been enquired after, the foregoing are the principal ones. As in times past, I shall be willing to give, by letter, to the enquirer, such information in relation to insects as I may be able to impart, yet would advise that all study the habits of pests; and when they are enabled to fight one with success, let it be known through the press, that all may profit thereby.

Most respectfully yours,

HIRAM A. CUTTING, M. D.,

State Geologist and Curator State Cabinet.

Lunenburg, Vt., August 31, 1876.