





LIBRARY OF

Dr. Z. P. Metcalf

1885-1956

[FROM THE 42D REPORT OF THE NEW YORK STATE MUSEUM OF NATURAL HISTORY.]

FIFTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK.

Made to the Regents of the University, Pursuant to
Chapter 355, of the Laws of 1883.

By J. A. LINTNER, Ph. D., STATE ENTOMOLOGIST.

ALBANY:
THE TROY PRESS COMPANY, PRINTERS.
1889.



De Z

[FROM THE 42D REPORT OF THE NEW YORK STATE MUSEUM OF NATURAL HISTORY.]

FIFTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK.

Made to the Regents of the University, Pursuant to
Chapter 355, of the Laws of 1883.

By J. A. LINTNER, Ph. D., STATE ENTOMOLOGIST.

ALBANY:
THE TROY PRESS COMPANY, PRINTERS.
1889.

STATE OF NEW YORK.

No. 68.

IN SENATE,

FEBRUARY 28, 1889.

FIFTH REPORT

OF THE

STATE ENTOMOLOGIST ON THE INJURIOUS AND OTHER
INSECTS OF THE STATE OF NEW YORK.

OFFICE OF THE STATE ENTOMOLOGIST, }
ALBANY, *February 25, 1889.* }

To the Legislature of the State of New York:

I have the honor to present to the Legislature, my Fifth Report on the Insects of the State of New York, which is also presented to the Regents of the University, as required by law.

Very respectfully,

J. A. LINTNER.

CONTENTS.

	PAGE.
TRANSMITTAL.....	151
REMEDIES AND PREVENTIVES OF INSECT ATTACK:	
Cutting out the Squash-Vine Borer.....	155
Change of Soil for Strawberry Plants.....	156
Brine for the Currant-worm.....	156
Saltpetre not a Preventive of Cabbage-fly Attack.....	157
Preventives of Cabbage-fly Attack.....	158
Beans for Repelling the Striped Cucumber Beetle.....	159
Gas-lime for the Woolly-Aphis.....	160
How to Kill the Apple-tree Aphis.....	160
Tobacco Dust for Aphis Attack.....	162
A Lime Wash for Bark-lice.....	163
INJURIOUS HYMENOPTERA:	
<i>Nematus Erichsonii</i> <i>Hartig</i> —The Larch Saw-Fly.....	164
<i>Nematus salicis-pomum</i> <i>Walsh</i> —The Willow-apple Gall Saw-fly..	173
INJURIOUS LEPIDOPTERA:	
<i>Darapsa Myron</i> (<i>Cramer</i>)—The Green Grapevine Sphinx.....	174
<i>Alypia octomaculata</i> (<i>Fabr.</i>) and <i>Eudryas grata</i> (<i>Fabr.</i>)—The Eight-spotted Forester and the Beautiful Woodnymph.....	179
<i>Phobetron pithecium</i> (<i>Sm.-Abb.</i>)—The Hag-Moth Caterpillar.....	183
<i>Anisota senatoria</i> (<i>Sm.-Abb.</i>)—The Senatorial Oak Moth.....	192
<i>Agrotis saucia</i> (<i>Hübner</i>)—The Variegated Cut-worm.....	200
<i>Mamestra picta</i> <i>Harris</i> —The Zebra Cabbage Caterpillar.....	206
<i>Mamestra grandis</i> (<i>Boisduval</i>)—A Poplar-feeding Cut-worm.....	210
<i>Penthina nimbatana</i> (<i>Clemens</i>)—The Rose-leaf Tyer.....	213
<i>Incurvaria acerifoliella</i> (<i>Fitch</i>)—The Maple-leaf Cutter.....	215
INJURIOUS DIPTERA:	
<i>Hæmatobia</i> (<i>Lyperosia</i>) <i>serrata</i> <i>Rob. Desv.</i> —The Cow-horn Fly... ..	220

INJURIOUS COLEOPTERA :

PAGE.

Dynastes Tityus (<i>Linn.</i>)—The Spotted Horn-bug.....	227
Oberea bimaculata (<i>Oliv.</i>)—The Raspberry-cane Girdler.	231
Galeruca zanthomelæna (<i>Schrank</i>)—The Elm-leaf Beetle	234

INJURIOUS HEMIPTERA :

Clastoptera obtusa (<i>Say</i>)—The Alder Spittle-Insect.....	242
Siphonophora avenæ (<i>Fabr.</i>)—The Grain Aphis	246
Myzus cerasi (<i>Fabr.</i>)—The Cherry Aphis.....	253

INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS :

The Canker-worm — Anisopteryx vernata (<i>Peck</i>).....	258
Abundance of Geometrid Larvæ	259
The Apple-leaf Bucculatrix.....	260
The Clover-seed Midge — Cecidomyia leguminicola <i>Lintn.</i>	262
The Hessian-fly — Cecidomyia destructor <i>Say</i>	263
Sciara sp. ? Occurring on Wheat.	264
The Cabbage-fly — Anthomyia brassicæ <i>Bouché</i>	265
A Lady-bug Attack on Scale-insects	266
The Carpet Beetle — Anthrenus scrophulariæ (<i>Linn.</i>).....	267
The Oak-pruner — Elaphidion parallelum <i>Newm</i>	268
Oviposition of Saperda candida <i>Fabr.</i>	269
Orthaltica copalina (<i>Fabr.</i>).....	271
The Clover-leaf Weevil Destroyed by a Fungus Attack.....	272
Pœcilocapsus lineatus (<i>Fabr.</i>)	273
Attack on Young Pears by a Plant-bug.....	275
An Experiment with the Thirteen-year Cicada.....	276
White Scale-insect Attack on Ivy — Aspidiotus nerii <i>Bouché</i>	278
The Black-knot of the Plum-tree and its Guests.....	280
Collections in the Adirondack Region, et al.....	281
Collections in the Adirondack Region in 1885	283

ACARINA AND MYRIOPODA :

A Mite Attack on Garden Plants.....	287
A Parasitic Mite of a Sexton Beetle.....	289
A Parasitic Attack on the Colorado Potato-beetle	289
The Cheese-mite Infesting Smoked Meats — Tyroglyphus siro (<i>Linn.</i>)	291
The Cheese-mite Infesting Flour.....	294
Food of Cermatia forceps (<i>Raf.</i>)	295
Julus cæruleocinctus beneath Carpets	296

APPENDIX:	PAGE.
(A.) LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.....	299
(B.) CONTRIBUTIONS TO THE DEPARTMENT	324
GENERAL INDEX.....	327
PLANT INDEX.....	345

REPORT.

OFFICE OF THE STATE ENTOMOLOGIST, }
ALBANY, December 11, 1888. }

To the Honorable Board of Regents of the University of the State of New York:

GENTLEMEN.—In accordance with chapter 355 of the Laws of 1883, I beg leave to present to your honorable board the following report embracing, results of my studies and observations on the Insects of the State of New York during the year 1888:

Interesting insect attacks of an unusual number have presented themselves for study, of which by far the larger number have been upon our fruit crops. While it is evident to all who are engaged in agricultural pursuits that insect depredations are annually increasing in our country, both in the number of pests and in the aggregate of the losses that they occasion, it is equally evident to the entomologist, who is specially charged with the study of these depredations, that the increase in new forms of attack lies largely in the direction of fruit pests. A sufficient reason for this may be found in the increasing attention that is being given to fruit culture, and its remarkable extension, as a commercial interest, year by year. How such extension in the production of special crops tends to augment insect ravages in still greater proportion, has been shown by me in former reports and needs not to be repeated at the present.

Several of the new attacks are still under study and have not progressed sufficiently to warrant present report upon them. Of these are two forms of insect injury to fruits and fruit trees which have for years been an enigma to us, but have found their explanation during the past summer, although not yet assigned to the particular species which cause the injury. In one, the young fruit of the apple and pear, and perhaps the quince, are pitted, become gnarled, often distorted, and fail of development even when they remain upon the tree; in the other, the trunks and

limbs of fruit trees show areas of different sizes, varying from a fraction of an inch to several inches, in which the sapwood is killed so as to disclose patches of the dead inner wood from over which the bark has broken away, leaving deeply depressed dead portions, around the margin of which the annual growth of sapwood following the injury builds up an irregular wall.

An extraordinary multiplication of a common fruit-tree pest, the apple-tree tent-caterpillar, *Olisiocampa Americana*, during the past summer in the State of New York was such a phenomenal event as to draw wide-spread attention to it. There is no record of its ever having appeared before in such enormous numbers over so extended a territory. Apple orchards in the eastern counties of the State, and in portions of New England and New Jersey, were only saved from defoliation through much earnest labor. Where it had not been thought necessary to contend with the caterpillar, as in its occurrence on the wild cherry and other trees upon which it feeds, the leaves were eaten to the last fragment, and the defoliation was as complete as if they had been swept by fire. In passing through the country a prominent feature of the landscape was the multitude of these leafless trees in midsummer, bearing in the forks of their branches the white web nests to the number often of from twenty to forty in a single tree, which the caterpillars had built up for their shelter at night and during rains.

In connection with the above reference to fruit pests, it may be of interest to state that injuries from the same source have been reported in England the present year, to even a greater extent than with us. Miss Ormerod, the eminent entomologist of the Royal Agricultural Society of England has written me: "The orchards in our fruit-growing counties were in some cases devastated by the hordes of Lepidopterous caterpillars of various kinds that swept off the foliage — in some instances even killing the trees." Mr. Charles Whitehead, Agricultural Adviser to the Agricultural Department of England, has recently reported as follows: "In many of the principal fruit-producing districts, caterpillars have lately caused most serious injury to apple, pear, plum, damson, filbert, and other fruit trees, so that in some cases the whole crop has been lost. When the blossom buds and leaf buds began to unfold, it was seen that they were attacked by legions of caterpillars. Soon the blossoms and leaves were entirely devoured, or

so much injured as to be useless. The fruit plantations in parts of Kent, Hereford, Worcester, and some other counties where fruit is extensively grown, looked as if a hot wind had passed over them."

Grain nor grass crops have not suffered to any unusual extent. Injury to June grass (*Poa pratensis*) through a thrips attack, which has been noticed for several years, in which the larva extracts the juices from the upper joint of the grass at its base, causing its speedy withering and drying up, is apparently increasing and largely extending its range. A similar attack on Timothy grass (*Phleum pratense*) has been reported from Canada the present year, and has also been observed by me in Albany county. I have failed in my effort to rear the larvæ to the perfect stage, and thereby verify or disprove my belief that the Timothy insect is identical with that which for a long term of years has been infesting June grass,* to which Professor Comstock some time since gave the MS. name of *Limothrips poaphagus*, and has recently published its characteristic features.

A feature of the year has been a remarkable exemption from aphid injuries. The hop crop was unusually free from aphid presence — in striking contrast with its excessive abundance and destructiveness in 1886. Not a single complaint was received by me of aphid injury to apple trees at the opening of the season when almost annually the insect threatens the destruction of the starting buds and the unfolding leaves. In a few cases only was aphid attack of any kind reported, and then merely to some of the minor garden crops.

In several portions of the State, the Colorado potato-beetle was very abundant, showing that the pest is not disposed to abandon the territory which it has occupied for a number of years, and that it is still necessary to meet it persistently with the arsenical insecticides, which, properly used, are adequate to its control.

There has been a notable increase in the operations of the oak-pruner, *Elaphidion parallelum* Newman., in the southeastern portion of the State, in cutting off the ends of the branches and dropping them to the ground. A number of reports of its injuries — not only to oaks but also to maples — have been received from localities on Long Island. In one instance where the attacked

* Report of the State Entomologist to the Regents of the University, S. N. Y., for 1886, pp. 96-98.

trees were serving as ornaments of a lawn, it had been necessary to gather the pruned tips and branches from the ground from time to time, and carry them away by the cart-load for burning. From features shown in the excised material sent me, it is thought that more than one species of *Elaphidion* may have been engaged in these attacks. This will be ascertained when the beetles have been reared from the infested twigs.

From several sections of the State, as notably from Jefferson county, unusually severe attacks from the rose-bug, *Macroductylus subspinosus* (Fabr.), have been reported—in some instances destroying both the foliage and the fruit of the plum, the cherry, and the grape.

Fuller's rose-beetle, *Aramigus Fulleri* Horn, a destructive curculionid beetle, but fortunately of only local distribution, has occasioned considerable trouble in the rose-houses in Rochester, N. Y. Mr. W. J. Palmer states that the beetle is found in the morning sitting at the base of the leaves, and if disturbed, usually escapes by dropping to the ground and hiding.

The white grub, *Lachnosterna fusca* (Frolich), has inflicted much damage on pastures in Lewis county, by eating the roots of the grasses. On one farm, that of Mr. J. L. Seymour, near Lyons Falls Station, it had destroyed thirty acres of pasture, and its operations at the time the report was made, seemed to be spreading to several other farms in the vicinity.

I regret that the very brief time that has elapsed between the printing of my fourth report (issued November twenty-third) and the presentation to your honorable board of the present one, has not permitted the more careful preparation and arrangement of the following pages which they would otherwise have received, and the introduction of some desired original illustration. I would, therefore, beg the indulgence of my fellow entomologists, and of those who may be familiar with most of the figures presented, so long as they will be new and serviceable to many of the agriculturists whom they will reach.

Respectfully submitted.

J. A. LINTNER.

REMEDIES AND PREVENTIVES OF INSECT ATTACKS.

CUTTING OUT THE SQUASH-VINE BORER.

This pernicious insect—the larva of *Melittia cucurbitæ* (Harris)—of the injuries of which complaints are often received, was given an extended notice in the *Second Report on the Insects of New York*, pp. 57–68, and the remedies and preventives pointed out which were thought to be the most serviceable against it. In referring to protection by “cutting out the larvæ,” it was stated: “When, however, thousands of the larvæ have to be destroyed in order to insure the crop, the method is quite unsatisfactory. It certainly is not reliable under the great increase of the insect in recent years, as stimulated by the increased cultivation of the Hubbard squash.”



FIG. 1.—The Squash-vine borer, MELITTIA CUCURBITÆ.

I would now recommend its adoption *in the manner detailed below*, in connection with the means which Mr. Goff, of the New York Agricultural Experiment Station, found so successful, viz., “wetting the stems at a distance of two feet from the base of the plants with water containing Paris green at the rate of half a teaspoonful to a gallon, after every rain, from the middle of July to the first of September;” and as preventive of egg-deposit, placing in each hill four or five corn cobs dipped in coal tar, and redipping them from time to time during July and August.

With these methods faithfully employed, there would seem to be no necessity for failure in maturing a crop of squashes, so far as dependent upon the attack of its greatest enemy.

We give below an extract from a communication to the *Country Gentleman* of August 12, 1886, from Mr. H. C. Schmitz, of Albemarle county, Va., in which his manner of detecting the presence of the “borer,” its extraction, and subsequent treatment of the vine, are detailed. The success that attended these measures are a sufficient recommendation for their general adoption.

Walking through the plantation at regular intervals, to operate immediately when action was wanted, I noticed the following signs as a certain indication of the presence of the borer.

The vine assumes a more or less yellow color, often the whole, sometimes only the portion near the main root; the leaves droop,

sometimes wilt badly. Generally the borer enters the main stem near the root, but often at the apex of the lower leaves, which then discolor, droop and wilt. If the borer has entered the main stem, now below the surface after repeated workings of the soil, the earth must be scraped away to the depth of two inches, more or less. The main stem on being pressed between the fingers, will be found soft and hollow, often nearly girdled from the inside. Here, with a penknife, I slit the stem, and proceed upward until the inside shows normal growth again. Often I have extracted from such a slit two or three specimens, measuring from one-fourth of an inch or less to one inch or more, some in the main stem, others having proceeded into side branches, even into the peduncles of the leaves. Next working with the knife downward in the direction of the root, you may find more. Let your work be thorough; be not satisfied with finding only one borer; lay bare to your eyes the whole inside of the stem as far as the borer has been feeding. One single borer left will absorb nearly all the sap flowing upward to feed the plant.

The squash vine calloses speedily if some dry dust is rubbed on the wound; then covering the injured stem with a little mound of fine soil, the sap flows again in its natural direction, and the plant recuperates soon. I have plants growing finely now where repeated incisions (the work was not done thorough from the start) had not left more than one-eighth of an inch of bark. If not layered already, layer immediately. The vine strikes root rapidly in mellow moist soil, and as yet I have never found a borer above the layer, nor a second attack in a callosed stem; and it might be a good preventive to slit the stem of the young plant from the root to the third leaf, sprinkle with mellow soil, and layer at the fourth leaf. Then again, I saw to-day some layered plants growing thriftily, where by repeated incisions and workings the main stem had been severed from the main root.

CHANGE OF SOIL FOR STRAWBERRY PLANTS.

At a meeting of the American Horticultural Society, Mr. Smith, of Wisconsin, stated that insects had been a great hindrance to him in raising strawberries, until he practiced setting the plants in soil that had not grown strawberries in several years, kept them well cultivated, raised one crop, and immediately plowed the vines under as soon as the crop was gathered, when he had no more trouble with insects. (*Country Gentleman*, Oct. 7, 1886, p. 753.)

BRINE FOR THE CURRANT-WORM.

I am indebted to Mrs. Lucy T. Chrisman, of Chrisman, Va., for the communication of the following method of protection from the currant-worm, *Nematus ventricosus* Klug.

∩ I have for three seasons gotten the better of the currant and goose-berry-worm by sprinkling the bush thoroughly, so as to wet each worm and the eggs under the leaves, with brine. It requires a pretty

strong brine to kill the worms—so strong as to kill the bush also unless it be washed off at once by a good wetting with pure water, when no harm is done to the foliage.

This method, if effectual, would be desirable for use against the second brood of worms that makes its appearance in July, if there is fear that the fruit might be dangerous for use from the application of hellebore.

SALTPETRE NOT A PREVENTIVE OF CABBAGE-FLY ATTACK.

In the *Second Report on the Insects of New York*, 1885, page 28, in consideration of statements quoted from agricultural journals of the complete efficacy of a solution of saltpetre in protecting from cut-worms and insects attacking squash and cucumber vines, it was recommended that experiments with this solution be made upon our smaller root insects, such as the radish, cabbage and onion maggots.

At my request, Mr. E. S. Goff, of the N. Y. Agricultural Experiment Station, has kindly made experiments with it upon the most injurious of the above insects, viz., the cabbage-maggot, with the following results:

I dissolved one pound of saltpetre in two gallons of water and poured about a gill of the solution around each plant, leaving alternate rows untreated. This was done on the first indication that the plants were infested, which was on May thirty-first. The application was repeated on June fourth, tenth and sixteenth. On June eighteenth, twenty-nine of the treated plants and twenty-six of those not treated were examined. On the former 124 maggots were found, and on the latter twenty-five. The treated row was the outside of the plat, which may account for its having been infested more than the others. I have frequently noticed that outside rows are more injured by injurious insects than the others. The experiment proved conclusively that nitrate of potash used in the strength and manner described, is not destructive of the maggot, as I repeatedly found the young, apparently just hatched, on the treated plants, as well as of all other stages of development.

In order to see if a stronger solution would avail, solutions of varying degrees of strength were tried, up to saturation, but the larvæ were able to endure the strongest.

We also tried the effect of mixing air-slacked lime with the soil at the time of setting the plants, but with no better success.

In view of the above experiments, it is not probable that the value of the saltpetre solution as a preventive of cut-worm injury, would be sustained by experiments as carefully conducted as were those of Mr. Goff. Its insecticidal properties, if it possesses any, have evidently been overstated.

Z. P. HETCALF

PREVENTIVES OF CABBAGE-FLY ATTACK.

The "cabbage-maggot"—the larva of the cabbage-fly, *Anthomyia brassicæ*, has proved a difficult insect to control. Various remedies and preventives have been given and suggested, none of which have been found to serve the desired purpose of affording entire immunity from its injuries in all localities. As the injury done to the plant is beneath the surface of the ground, it is evident that the efficacy of the proposed remedy may be materially affected by the character and condition of the soil in which it is employed. Several of the methods that have been found successful in preventing or lessening the losses from this great pest, or that promise success, will therefore be mentioned.

1. Tobacco dust, to be procured from tobacco factories, sprinkled freely over the young plants, is said to prevent the deposit of the eggs by the fly.

2. Mr. Peter Henderson claims that he has been able to prevent the ravages in his sample grounds where all the varieties of cabbages and cauliflowers are tested, by preparing the ground with a dressing of 150 bushels of oyster-shell lime to the acre. In one year when this had been neglected, and a formidable attack was made upon the plants about the middle of May, it was at once arrested, by scraping the soil from the stem of each plant, dusting lime around it and drawing up the ground again to the stem. In addition a handful of guano was dusted around every five or six plants. Strong roots were made above the wounds from the maggots, and the crop was saved. The lime preventive was the result of fifteen years employment in successful cabbage culture. Where the oyster-shell lime is not attainable, its equivalent in stone-lime may be quite as efficient. (*Rural New Yorker*, June 27, 1886, p. 433.)

3. When gas-lime can be obtained as a refuse from gas-works, if worked into the ground at a moderate depth after its exposure for a proper time, it will effectually prevent the operations of the maggot.

4. Ammoniacal liquor, another refuse from gas manufacture—diluted with twice its volume of water and poured around the infested plants in sufficient quantity to reach the roots, will kill the attacking larvæ. It will be a fine fertilizer, also.

5. A contributor to the *New England Homestead* has given this remedy: "Take green burdock leaves and stalks, run them through a hay-cutter, put them in a kettle or tub, and mash them with an old ax or mall, adding water and pounding them to a pulp. Let it stand overnight. Have the decoction strong, and when you see the first sign of

the maggot, use it, and you will find it a dead shot for the maggot. Apply it with a sprinkler, taking off the nose, and pour the solution along the rows. I seldom have to apply it a second time." "The same remedy is recommended for the onion-worm, and it has, to my certain knowledge, been proved effectual against the attack of the white-grub on strawberry plants.

6. A strong decoction of common tansy, where it is abundant, would probably be about as serviceable as the burdock.

7. A preventive of attack that has been used in England with good result, is, dipping the plants in a puddle of cow-dung or night soil, so as to smear the roots and stems well up to the leaves with the mixture.

8. Another English preventive is to dip the stems in thick soot and water. It appears to impart a bitterness to the plants that the maggots do not relish, and it is also found to ward off attack from grubs and cut-worms.

9. Hellebore gives promise of being as useful against the cabbage (and onion and radish) maggot, as it has proved in protecting tobacco plants from cut-worms. In the latter case, the young plants were dipped before setting out, in a solution of white hellebore in water—one-fourth of a pound in ten quarts of water. A gentleman in West Meriden, Conn., on June twenty-second, set 3,000 tobacco plants, and on the following morning he took from a row of 180 plants 214 cut-worms. On June twenty-fourth, he set out over 2,000 plants treated with the hellebore as above, of which he subsequently found but one plant eaten and that but slightly.

10. Avoid the use of fresh barnyard manure on cabbage ground, as that is believed to invite deposit of the eggs of the fly and to offer protection to the maggot.

Other remedies and preventives are mentioned in the *First Report on the Insects of New York*, 1882 (p. 190), in which an extended notice of the insect is given.

BEANS FOR REPELLING THE STRIPED CUCUMBER BEETLE.

The recommendation has often been made of planting beans in each hill with the cucumber seed, to repel the striped beetle. A writer in the *New York Tribune* has given his method of growing beans and cucumbers on the same ground, at first solely with the object of economizing space and labor by getting two crops from the same ground, but which gave the additional result of freedom from the beetle attack. The ground was marked three feet apart each way with a corn plow, and butter beans and cucumbers or melons were

planted alternately in one row, and in the next all beans, thus making the melons six feet apart each way. The string beans were out of the way in time for the melons to occupy the ground. Previous to adopting this method, it had been found necessary to go the rounds every morning before sunrise and kill the beetles, and even then they could not be kept under control.

GAS-LIME FOR THE WOOLLY-APHIS.

It appears from Bulletin No. 55 of the University Experiment Station at San Francisco, Cal., that the experiments made with gas-

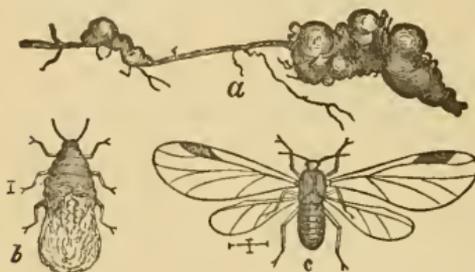


FIG. 2.—The apple-root plant-louse, SCHIZONEURA LANIGERA; a, the knotted root; b and c, wingless and winged larval forms.

lime for destroying the woolly-aphis of the apple tree, *Schizoneura lanigera* (Hausm.), the root form of which is represented in Fig. 2, have shown the value of this insecticide for the destruction of a pest, hitherto almost beyond our control. In the experiments made about four years ago, an application of ten

pounds of the lime to a tree had killed the aphis infesting the roots, but at the same time, some of the trees standing on shallow soil had been killed by the application, and the general results were therefore reported as not satisfactory, the more so, as the aphis was subsequently seen descending to the roots. Since that time it has been found that only the badly located or weak trees had been killed, and that the aphis had not reinfested the roots, but existed only at the surface of the ground. Later experiments with the gas-lime differently applied, gave very satisfactory results, in entirely arresting the aphis attack, without injury to the trees. Instead of removing the soil and putting the gas-lime in close contact with the tree, as done the first time to the corrosion of the bark, about a shovelful and a half (two or three pounds) in a dry state were distributed over the surface in a radius of four feet, trusting to the rain to carry it into the soil. A few shovelfuls of fresh ashes were piled close about the trunk to prevent the aphis from congregating on the crown.

HOW TO KILL THE APPLE-TREE APHIS.

A correspondent had asked for an effectual cure for green lice or aphides on the leaves of apple-trees. He had used kerosene, tobacco and strong soap-wash, each of which had killed the lice, but others appeared very soon in apparently greater numbers than at first.

Answer was returned that it was not difficult to kill the apple-tree aphid, *Aphis mali* Fabr., shown in Fig. 3, and to arrest the attack, if the means be used at the proper time, with proper apparatus, and in the right manner, as herewith given:

1. *The proper time* to attack the aphid is early in the spring, before the trees are in leaf. Later, many of the insects will be so protected in the folds and curls of the leaves that the applications can not reach them, and contact with the insecticides is essential to their destruction, since they can not be killed by poisoning the foliage of the tree, as their food consists only of its sap. The best time to reach the pest is during the late autumn or winter, when, if the leafless trees be thoroughly sprayed with a kerosene emulsion, the eggs will be killed. The emulsion may be made by violently agitating (through the use of a force-pump or otherwise) until in a homogeneous mass, two gallons of kerosene to one gallon of a hot soap solution, made by dissolving half a pound of common soap in one gallon of water. For use, dilute with nine parts of water—a quart of the emulsion to nine quarts of water, or in the same proportion.

The best time to kill the aphid, if it has been neglected in the egg stage, is just after its hatching, while still gathered upon the unopened buds and portions of twigs adjoining. Without the work of preparing the kerosene emulsion, which involves considerable labor, most if not all may be killed at this time by spraying with strong soap-suds or a tobacco solution, say half a pound of tobacco to a gallon of boiling water. As these solutions often fail to kill the old matured aphid, and as it matures in about ten or twelve days after hatching, a second spraying, and a third if found to be necessary, should follow at about a week's interval.

2. *The proper apparatus* to be used is a force-pump of sufficient power (no farmer or fruit-grower can afford to be without this implement), and a nozzle which will distribute the liquid in a fine spray or mist. There are a number of nozzles which will accomplish this which have been made for use in large orchards. Among these, the most popular ones are the Nixon Climax nozzles, made by the Nixon Nozzle Company, at Dayton, Ohio; the Boss nozzle, and the Graduating Spray nozzle. The Hallowell Brass Company, of Lowell, Mass., have recently put upon the market an atomizer and a nozzle which promises very efficient

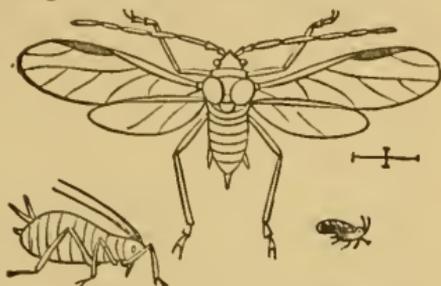


FIG. 3.—Apple-tree aphid, *APHIS MALI*;
winged and wingless forms.

work. Suitable pumps may be had of the Field Force Pump Company, of Lockport, N. Y.; Goulds Manufacturing Company, at Seneca Falls, N. Y.; Rumsey & Company, also of Seneca Falls, and P. C. Lewis, of Catskill, N. Y. Each of the above firms will readily send illustrated circulars giving style and prices of their pumps and spraying apparatus from which selection may be made.

3. *The right manner* of applying the insecticide, when employed against plant-lice, is, that it shall be made to reach every insect. This is not essential when the canker-worm and other caterpillars which feed by means of cutting jaws upon the poisoned foliage are to be killed. The finer the spray can be delivered from the nozzle, the more effective is it against the aphids. Other advantages of fine spraying are, economy in the material used, and, in the case of arsenites, less danger of poisoning stock that may enter the orchard before heavy rains have occurred, by the dripping of the liquid from the trees upon the grass. If London purple be used instead of Paris green (with which it is equally effective) of a dilution of one pound to 150 gallons of water, and the spraying be discontinued as soon as the trees commence to drip, danger in this direction will be very little, if any.

TOBACCO DUST FOR APHIS ATTACK.

Mr. Peter Henderson, the experienced and well-known horticulturist of Jersey City Heights, N. J., has lately published his method of dealing with the plant-lice or Aphides that are so injurious to roses, grapevines, chrysanthemums, and hundreds of other species of plants cultivated both in the open air and under glass. While the antidote used by him is not new, his method of application may not be generally known. It is as follows:

“A certain remedy is to apply tobacco dust with a bellows when the leaves are wet, at least once a week — twice is better. We have used this as a preventive remedy for many years with the most excellent results on all plants subject to aphids.

“The main reason why remedies fail is owing to the fact that they are rarely long enough persisted in. One or two applications may check the trouble, but will check it only. My rule for these pests is prevention, which need never fail, if the remedy is steadily applied.

“In our new practice every kind of plant that we know to be liable to be attacked by aphids is dusted over with tobacco dust twice each week from June to October. Of course at such times as the roses or chrysanthemums are in flower, or when the fruit of grapes is ripening, it must not be used, but these conditions only occur for a short season, and there is no necessity for using the dust in winter, as then

fumigation with tobacco stems kills the aphids." (*Popular Gardening*, for December, 1887, iii, p. 50.)

We have omitted from the above the references to prevention of mildew, by mixing one part of black or virgin sulphur to nine parts of the tobacco dust.

A LIME WASH FOR BARK-LICE.

The following application has been recommended for the destruction and removal of scale insects infesting fruit trees. The materials named are certainly sufficiently powerful to accomplish the purpose, and the omission of one or two of the number would not, it would seem, impair the efficacy of the wash. It is as follows:

Slake stone lime, as for whitewash, and to two-thirds of a bucketful add one pint of gas-tar, one pound of whale-oil soap dissolved in hot water, one pound of common soft soap, one pound of potash or one pint of strong lye from wood ashes, and also clay or loam enough to make the wash of proper thickness to be applied with a whitewash brush.

It is also claimed for the above that it is an effectual remedy and preventive of the peach-tree borer, if the earth be removed from the collar of the tree and thoroughly applied about the base; also, that if the trunks of apple trees are coated with it, it will prevent the operation of the striped apple-tree borer.

INJURIOUS HYMENOPTERA.

Nematus Erichsonii Hartig.

The Larch Saw-fly.

(Ord. HYMENOPTERA : Fam. TENTHREDINIDÆ.)

- HARTIG: Die Familien der Blattwespen und Holzwespen, 1837, p. 187, No. 9 (original descr.); in Stett. Ent. Zeit., i, 1840, p. 22.
- RATZBURG: Forstinsekten, iii, 1844, p. 121, pl. 3, f. 4.
- HAGEN: in Canad. Entomol., xiii, 1881, p. 37 (identified in U. S.); in Rept. Comm. Agricul. for 1883, p. 141-2.
- PACKARD: in Rept. Comm. Agricul. for 1883, p. 138, pl. 3, f. 1, pl. 13, figs. 1-4 (history, habits, descr.); Bull. No. 3, Div. Entomol.—U. S. Dept. Agricul., 1883, p. 29 (in Maine); in Rept. Comm. Agricul. for 1884, p. 377 (operations); in Amer. Nat., xviii, 1884, pp. 293-296, figs.; in Rept. Comm. Agricul. for 1885, p. 321 (operations); in Bull. 13, Div. Ent.—U. S. Dept. Agricul., 1887, p. 20; Entomology for Beginners, 1888, p. 166, f. 207.
- FLETCHER: in Canad. Entomol., 1884, p. 215 (distribution in Canada; in Rept. Min. Agricul. for 1884, p. 215 (distrib.); in 15th Rept. Ent. Soc. Ont., 1885, p. 22 (ravages of), pp. 72-77; Rept. Entomol. for 1885, p. 28; id. for 1887, p. 35.
- FYLES: in 14th Rept. Ent. Soc. Ont., 1884, p. 17 (in Canada); in Canad. Entomol., xv, 1884, p. 216.
- PROVANCHER: Addit. Faun. Hymenop. Can., 1885, p. 5, f. 1; in Nat. Canad., xv, 1885, pp. 45-53, figs. 8-11 (general notice).
- HARRINGTON: in Canad. Entomol., xxiii, 1886, p. 39.
- LINTNER: in Entomolog. Amer., iii, 1887, p. 121 (in N. Y.); 4th Rept. Ins. N. Y., 1888, p. 16; in 18th Rept. Ent. Soc. Ont., 1888, p. 32.
- JACK: in 17th Rept. Ent. Soc. Ont., 1887, p. 16.
- CRESSON: Synop. Hymenop. N. Amer., 1887, p. 158.
- SAUNDERS: in 18th Rept. Ent. Soc. Ont., 1888, p. 31 (in Nova Scotia and New Brunswick).

The larch saw-fly is a recently introduced pest, having been brought from Europe, it is believed, into Massachusetts not long prior to the year 1880 on some European larches. It has displayed a disposition for rapid distribution, as it has within the decade spread and carried its ravages over a large part of New England, Canada, and the State of New York. It will in the near future probably extend its range over all that portion of the country where its food-plant, the larch, occurs. Originally feeding in Germany on the *Larix*

Europæa, it seems to have found our native species, *Larix Americana*, commonly known as the tamarack or hackmatack, particularly adapted to its tastes, as shown in the havoc which it inflicts in the tamarack swamps of New York and New England.

The insect is illustrated in Fig. 4. For details of life-history, and its description, reference may be made to the writings of Dr. Packard in the reports of the Commissioner of Agriculture, above cited. For

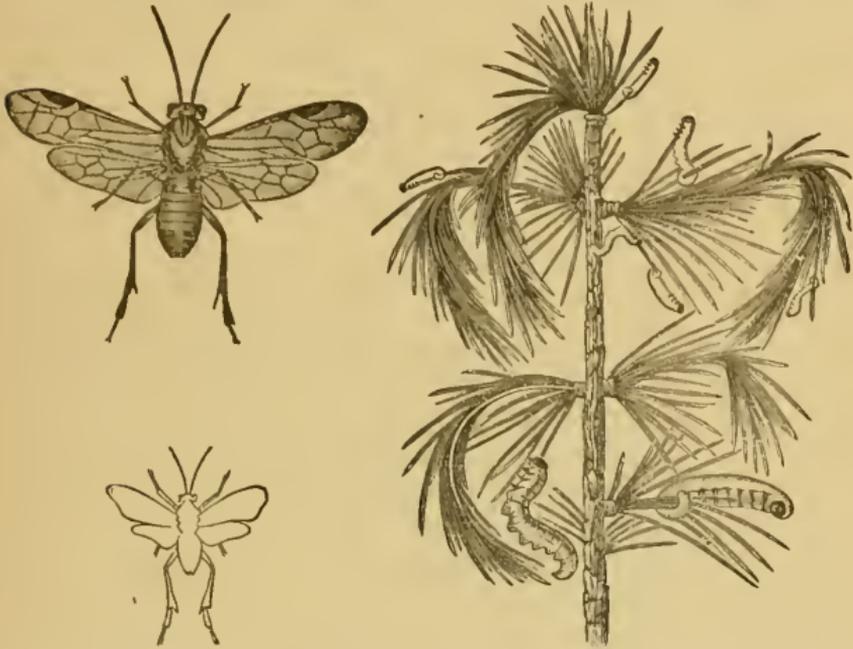


FIG. 4.—The larch saw-fly, *NEMATUS ERICHSONII*, in natural size and enlarged, and the larch worm of different ages, in natural size. (From Packard.)

the present it will suffice to say that the parent saw-fly emerging from her cocoon in the month of May, probably not long thereafter resorts to the larches and inserts its oval, cylindrical eggs, according to Dr. Packard, in two rows of incisions in the terminal shoot or one of the side shoots, causing a twisting and deformity therein from the presence and growth of the eggs. The larvæ, hatching in June, mature rapidly, "in from five to seven days, or not more than ten," when they descend from the trees and inclose themselves within their elongate oval cocoons beneath moss or other convenient shelter. This occurs the last of June or in early July, in New York. They remain unchanged within the cocoon during the winter and assume the pupal form the following spring, as is the habit of many of the *Tenthredinidæ*.

The Insect in Europe.

Ratzeburg, in his celebrated work on Forest Insects, notices the occurrence of this insect in Germany and in other parts of Europe. It had appeared on the larch in the Hartz mountains and in the plains of Holstein, in sufficient numbers to attract the attention of forestry officers, and it was feared that it might become injurious. According to Dr. Hagen, it had only been observed as obnoxious to the larch twice before 1840, and was very rare in Europe. It was not among the extensive collections of European insects brought thence by him to the Cambridge Museum.

Its Appearance in the United States.

In the year 1880, Professor C. S. Sargent, Director of the Arnold Arboretum at Brookline, Mass., discovered larvæ feeding upon some European larches, *Larix Europæa* growing in the vicinity. They were submitted to Dr. Hagen, of the Museum of Comparative Zoölogy at Cambridge, and identified by him, from the description and figures of Ratzeburg, as *Nematus Erichsoni* Hartig. This is the first record of the appearance of this saw-fly in this country, which soon thereafter developed destructive powers entirely foreign to its European character.

Its Spread throughout New England.

It is reported as having been injurious to larches in the State of Maine, in 1881, and in 1882 its operations were observed by Dr. Packard, during the month of August, in the vicinity of Brunswick, Me., as detailed in his "First Report on the Destruction of Evergreen Forests in Northern New England," *loc. cit.* The same year, it also appeared in New Hampshire.

Its Occurrence in New York.

The following year (1883) about July twenty-fifth and early in August the effects of the insect were observed at Horicon and Pottersville, Warren county, and at Schroon lake in Essex county. By the first of August the trees had been defoliated. The region affected was very extensive, covering many square miles in different swamps. It was also reported "from Schroon lake to North Elba and about Mount Marcy." (Packard.)

During the years 1884, 1885, and 1886, the same attack upon the larches, or tamaracks, as they are more generally called, was observed by State Botanist Peck, in several of the counties of Northern New York. The notes kindly given me of the place, time and degree of injury wrought, were intrusted to a friend for his use and have been unfortunately lost, so that the details can not now be put on record.

In St. Lawrence county.—June 29, 1887, larvæ of this species were received for name from Dr. E. L. Sturtevant of the State Agricultural Experiment Station, which had been sent to him by Mr. E. Phelps of De Kalb Junction. When the package was opened the following day, one of the larvæ had already inclosed itself in its cocoon. It is believed that this is the earliest recorded date of larval maturity. The following notice taken from the *St. Lawrence Republican* of July 27, 1887, will give some idea of the immense number in which the "worm" made its appearance:

Mr. David Page of Jerusalem Corners, in this town, has given us an account of a remarkable pest of worms which recently infested his premises. There are three larch or tamarack trees growing in his door yard. About July seventh, very soon after the extremely hot weather set in, a few worms appeared upon them, feeding upon the leaves. The next day they had doubled in number, and in a day or two had become a countless host, completely covering the trees, so that the end of the finger could not be placed even on the trunk of one of them without touching one or more of the worms. They also covered apple and maple trees and shrubbery, and the grass beneath, but ate nothing, so far as could be discovered, except the leaves of the tamaracks. They swarmed upon the house and piazza, and it became necessary to sweep them from the latter every few minutes. They accumulated in little windrows along by the house. The countless hordes of worms became an object of great curiosity and interest to people of the neighborhood, and Mr. Page and his family became really alarmed as to the result of this invasion; but in scarcely a week from the time of their first appearance they disappeared as rapidly as they had come, and in a day or two none of them were to be found. The tamaracks were left as bare as in winter, but no other signs of damage were visible. Whether the worms had gone into the ground or what had become of them seems not to have been ascertained.

In Otsego county.—Other examples of the larva and two of the cocoons were received by the State Entomologist, July ninth, from Rev. Henry U. Swinnerton, of Cherry Valley. He has kindly furnished, on request, some observations made by him, extracts from which are herewith given, as showing interesting habits of migration, etc. of the larvæ, when occurring on isolated trees. Under date of July ninth, he wrote:

I send you specimens of a worm that has appeared in considerable numbers on a larch tree on the lawn of Mr. Lansing, my neighbor. They began dropping off in a pattering shower, and are migrating towards some maples not far off.

Additional particulars of the migration were furnished under date of July twelfth:

The larch saw-fly worm seems to have disappeared, and within a very limited distance from the tree from which they started. They crept in an easterly direction diagonally toward the street, about

thirty feet from the tree. Several maples in the track were invaded. Salt was strewn on the flagstones to kill them, but many reached the maples outside. I do not find that a single one crossed the road. Where they disappeared to I can not imagine.

I know of but four larches about the village — two of them fine, good-sized trees. Of two smaller ones, one quite small, had some of the worms upon it, and the foliage shows that it had been eaten, but only a little. The other is embowered among maples, and does not seem to show any injury. But the two large trees are very much stripped, only a few of the lower branches retaining any foliage. The second of them is on Miss Roseboom's place. * * * * * In this case also, the worus crept in an easterly direction, going up a pine, some hemlocks, and a horse chestnut — "millions of them," as I am told.

I had a man climb both the larch and a maple at Mr Lansing's in search of the saw-flies, but he could find hardly one. We then began to discover apparently dead ones, then a few living ones. But it seemed surprising that so few should be discoverable. Further search revealed more living ones just beneath the ground and among the moss at the roots of the tree, especially under the larch. Finally we were led to conclude that the brown cocoons, of which there seemed to be a great number, must belong to them. I inclose the whole collection in a box and send it to you. * * * * * It was only last Thursday (July seventh), that the worm was first observed.

A diagram of a portion of the village accompanied the above communication, showing streets, residences, the location of the trees, direction of the migrations, etc. — evincing the interest excited by the appearance and movements of the new visitor.

In *Schoharie county*. — The following paragraph from the *Country Gentleman* of July 14, 1887, refers, without doubt, to the operations of the larch saw-fly larva.

The tamarack trees in this section are infested with multitudes of rather small, green worms with black heads, which are stripping them of their foliage. — *Sharon Centre, N. Y.*, July 8, 1887.

Personal Observations in Hamilton County.

During a visit to the southern portion of the Adirondack region, July fourteenth to August fifth, the opportunity was offered of making a few observations on this insect. The season at this time was too far advanced to note the attack either at its commencement or its height. All of the larches within sight of the stage route from Newton's Corners, at the foot of Lake Pleasant, to Sageville at its head, a distance of four miles, had been almost entirely stripped at the earliest date above named. The trees of this species of which there are many, in some places it being the prevailing growth, could be recognized at the greatest distance from which they could be seen by their

nakedness, appearing as if dead, which undoubtedly some of them were, as the result of previous defoliation. The elevation above tide of Lake Pleasant is 1,800 feet.

No information could be obtained of residents of the time when the injury to the larches had first been noticed. To many it seemed quite new when their attention was at this time called to it, although it might probably have been observed during the two or three preceding summers.

Very few of the larvæ were to be found on the trees on the nineteenth July, and as most of these were apparently but about half-grown and of a pale green color, as if recently molted, it is not improbable that they were belated, sickly, or parasitized individuals which were destined not to attain maturity.

Not all of the larches in the vicinity had been wholly stripped. A large one of eighteen inches in diameter at three feet from the ground and reaching upward to a height of at least seventy feet, standing alone in a pasture lot, and throwing out long and thick branches, had its foliage less than one-half eaten. From a large number of larches of a moderate height — of fifteen feet and under — that were entirely free from harm, it appeared that the younger trees were not sought by the parent saw-fly for oviposition. Whenever they had been eaten, they were in the immediate vicinity of larger trees, which, having been stripped, the migrants from them, in their search for food, may have been able to ascend, with difficulty, in small numbers, such of the smaller ones as chanced to be in their way. The tips of these small larches, gave no evidence of oviposition in them.

Cocoons.—Cocoons, in some instances only, were found underneath the trees where search was made for them, but not at all commensurate with the immense number of larvæ that had evidently been present. Is it the habit of the larva to wander from the feeding-ground to some distance in search of a favorable place for pupation? Do they leave the tree for the purpose at about the same time, after the habit of some of the Lepidoptera, as, *Datana ministra* and *Ede-masia concinna*; and if so, is this the explanation of the "migrations" previously mentioned? Most of the cocoons collected were taken from underneath moss growing around the borders and in cavities of rocks. A large proportion — about ten per cent — had been eaten into at one end and the larva consumed.

Parasites and Enemies. — From the number of ants that were noticed in association with the cocoons, it was thought that the credit for this destruction might be due to them. With so active an enemy travers-

ing the soil in every direction, but few of the larvæ could be expected to survive the winter.

A *Podisus* pupa (one of the large plant-bugs) was taken July nineteenth from the trunk of a tree feeding on one of the saw-fly worms. It was subsequently fed in confinement on *Nematus* and *Haltica bimarginata* larvæ to the imago stage, which it assumed July thirtieth, when it proved to be *Podisus modestus* Dallas. In fastening upon its prey, in almost every instance observed its proboscis was inserted near the anal end of the larva. Full-grown forms of both species were fearlessly seized and firmly held by it until their fluids were exhausted. The larvæ collected were remarkably free from parasitic attack. A single small white cocoon, apparently of a *Microgaster*, was obtained from a half-grown example.

Larvæ failed to mature. — Although rather large collections were made of the cocoons (several hundred) at Sageville, not one of them gave the imago the following spring, although they were carefully secluded from light and given a damp atmosphere from water evaporated underneath the breeding-case during most of the autumn and winter. Failing to disclose the imago in due time, a number of the cocoons were opened, when each was found to contain the shriveled remains of the larva — none having reached the pupal stage.

The Hibernated Insect from Cherry Valley, N. Y.

In consideration of the above failure to obtain examples of the perfect insect for the State collection, request was made of the Rev. Mr. Swinnerton, of Cherry Valley, for some hibernated cocoons, if procurable, from underneath the infested larches of last year. A number were received, on May 1, 1888, which, upon opening a few, disclosed the living insect in its pupal stage. On May eighth, four of the saw-flies emerged, and the following day, eighteen others — all of which, except one, were females. No others appearing, the remaining cocoons were opened for examination, and gave a half-dozen dead matured females, and from one within a slight inner cocoon, the pale yellow-green pupa of a large ichneumon fly, believed to be a *Pimpla*, was taken, and cared for, but failed to develop.

That additional males, and knowledge of the relative proportion of the sexes, and perhaps other parasites, might be obtained, request was made of Mr. Swinnerton for another sending of cocoons, if not too late for finding them with living pupæ. The larger number were reported open at one end and empty. Of the few that were received on the eighteenth of May, twenty had given out the insect when

examined on the twenty-third, four on June first, and six others by the eighth of June — the latest date of emergence.

Disparity of sexes.—Of fifty-eight examples of the fly examined, only one was of the male sex. Is it possible that the cocoons were not received in season (May first) to secure the males, which ordinarily are the first to make their appearance? Still, in rearing, in July, 1888, from the larvæ collected on or about a poplar (*Populus monilifera*) a number of the poplar saw-fly, *Aulacomeris lutescens* Lintn., a marked disparity in sexes was also observed, although not so great as in the larch saw-fly, above. Of fifty-two examples of this species reared, only six were males. It is easy to carry through to its perfect stage the first brood of this insect, and the conditions, therefore, attending it within doors should so nearly approach those in nature that the results should be almost the same.

Injuries from the Insect.

In August, the larches observed in the Lake Pleasant region which, during the preceding month had been entirely denuded, had commenced to put forth new leaves. This was probably the second year's defoliation of many of the trees. It is doubtful whether they would be able to survive the repetition of the injury for another year. In Maine and Canada, where the insect has prevailed quite generally since 1884, the larches over large areas have been killed, and it is the opinion of foresters that the entire loss of the foliage in early summer, for three consecutive years, proves fatal with very few exceptions.

The addition to our list of insect pests of one which threatens the entire destruction of a tree so valuable as the larch, can not be regarded otherwise than in the light of a serious calamity. It would appear, at the present, that this evil is destined to become more general than the destruction of the spruce (the timber of which is of so great economic importance) in many localities in northern New York, for the latter, as yet, is but a local (?) disease, and may therefore prove, when satisfactorily accounted for, to be the result of purely local causes. There is hardly a doubt but that the range of this new pest will be almost co-extensive with that of the larch, viz., over a large portion of the northern United States and the adjoining British possessions, even into the Arctic region.*

* Northern Newfoundland and Labrador to the eastern shores of Hudson bay, Cape Churchill, and northwest to the southern shores of the Great Bear lake and the valley of the Mackenzie river within the Arctic circle; south through the northern States to northern Pennsylvania, northern Indiana and Illinois, and central Minnesota (Sargent's *Report on the Forests of North America.*)

The wood of the larch is given by Prof. Sargent as "heavy, hard, very strong, durable in contact with the soil; preferred and largely used for the upper knees of vessels, for ship timbers, fence posts, telegraph poles, railway ties, etc." L' Abbé Provancher, in his notice of the larch saw-fly above cited, in which he regards it as threatening the entire disappearance of this precious tree of the Canadian forests, since from the first notice of the insect in America in 1880, it had already in the year 1885 spread with such remarkable rapidity and destructiveness, that "from Halifax to Ottawa, and perhaps even beyond, there is not to be seen in July and August a single larch having its foliage intact"—has written as follows of this tree and its value :

It is known that this tree grows in wet or marshy lands, where the soil ordinarily is of poor quality. Among its roots, which it sends out horizontally at a moderate distance from the surface of the ground, there is always to be found, on one side or the other, one that is much larger than the others. It is often said that this tree has but a single root, the others being only ramifications of it. As this root forms a right angle with the trunk, and as the wood is very strong, very slightly brittle, and almost free from decay, it is the prized source for the elbows and knees that enter into naval constructions. In addition to its being an excellent fuel, this wood is also desirable for a multitude of uses, as for boat-bottoms, joists for buildings, fence posts, etc. The larch forms also a very handsome ornamental tree; its elliptical cones of about an inch in length, of a beautiful purplish-violet shade, and ordinarily a great number on the same tree, give a charming effect, when in June they join themselves to the delicate foliage, simulating fringes or sparkling bouquets of so lively a green that the sun seems powerless to change it. And besides the graceful picture that it presents, the tree perfumes all its surroundings with a resinous odor which is most agreeable.

Remedies.

When the larch occurs as isolated trees or in groups of moderate extent, it is an easy task to save its foliage from destruction by the saw-fly larva. The attack of its hosts is quickly noticeable, and if they are then shaken or beaten from the branches they may be crushed under foot or with a roller. Of those that may escape very few will succeed in ascending the trunk, since, although the *Nematus* larva is bountifully provided with legs, having twenty, while most of the caterpillars of butterflies and moths have but sixteen, yet these organs are not developed to the extent of making them suitable for easy climbing. Or, the worms may be killed by spraying the foliage with Paris green or London purple in water, according to directions so often given.

When large areas of the larch are infested, as tamarack swamps, it will be useless to attempt to compete with the enemy. Its destruction through any applications that might be made would be altogether too costly to warrant the outlay required. The best that could be done in such cases would be to fell the trees as soon as it is noticed that they are dead or doomed, and before decay has impaired their value, and use them for some of the many purposes for which the timber is available.

Nematus salicis-pomum Walsh.

The Willow-apple Gall Saw-fly.

(Ord. HYMENOPTERA : Fam. TENTHREDINIDÆ.)

WALSH: in Proc. Ent. Soc. Phil., vi, 1866, pp. 255-256 (description of gall, larva, imago, etc.).

NORTON: in Trans. Amer. Ent. Soc., i, 1867, p. 216-218 (description of larva and imago).

WALSH-RILEY: in Amer. Entomol., ii, 1869, pp. 45-49, f. 30 (general account).

CRESSON: Synop. Hymenop. Amer., 1887, p. 159 (cited).

The galls of this tenthredinid were observed June twenty-seventh, at West Albany, N. Y., on willow, *Salix cordata*. Several of them had been eaten into, making an irregular funnel-like cavity. One that was opened for examination had the interior wholly consumed and contained, instead of the *Nematus* larvæ, four small white, legless grubs, which were probably those of a "guest-beetle," named by Mr. Walsh, from its appropriating the gall of another insect, *Anthonomus sycophanta*; another, which had been but partly eaten, contained one of these larvæ. The eaten galls were more rosy-cheeked than the others. None of the larvæ were carried to maturity, their failure to mature being, doubtless, the result of the galls having been collected so early.

An extended account of this willow-apple gall (with illustration), and of the three guest-insects that usurp its shelter and its food, is to be found in the *American Entomologist* (loc. cit. sup.). In it, Mr. Walsh states that the eggs of *N. salicis-pomum* are deposited in a slit of the willow leaf toward the end of April. The larva attains maturity during the last of July; it pupates within the gall, where it, hibernates, and the winged insect emerges in April—from the sixteenth to the twenty-fifth, as in large numbers, reared.

INJURIOUS LEPIDOPTERA, ETC.

Darapsa Myron (Cramer).

The Green Grapevine Sphinx.

(Ord. LEPIDOPTERA: Fam. SPHINGIDÆ.)

- Sphinx Myron* CRAMER: Pap. Exot., iii, 1782, pl. 247, f. C.
Sphinx pampinatrix SM.-ABB.: Lep. Ins. Geo., i, 1797, p. 55, pl. 28.
Otus Myron HÜBNER: Verz. Schmett., 1816, p. 142, No. 1524.
Otus Cnotus HÜBN.: Zutr. 3d Hund., 1823, p. 23, figs. 321, 322.
? *Smerinthus Myron*: ST. FARG.-SERV.: in Encyc. Method., x, 1823, p. 441.
Everyx Myron BOISDUVAL: in Sp. Gen. Heteroc., i, 1836, p. 209.
Chærocampa pampinatrix HARRIS: in Sill. Journ., xxxvi, 1839, p. 301.
Darapsa Myron WALKER: List Lep. Br. Mus., Pt. viii, 1856, p. 183.
Ampelophaga Myron GROTE: in Canad. Entomol., xviii, 1886, p. 132.

Above are given the various names under which this common and injurious insect appears in our literature.* Of these, the name bestowed upon it by Dr. Harris was expressive of the appearance and habits of the caterpillar *chærocampa*, meaning, in the Greek, "the hog caterpillar," and suggested by the fancied resemblance of its front segments to the head and snout of a hog (see Fig. 5), and *pampinatrix* signifying, in the Latin, "a vine-pruner." Scientific names should, whenever possible, indicate some feature, character, habit, or peculiarity of the object or creature to which they are applied, and it is, therefore, to be regretted that the one selected by Dr. Harris for this insect could not have been retained, but in obedience to the law of priority, the specific name given to it by Cramer fifty years before must be substituted for it, although a mere chance-chosen proper name. The six different genera to which it has been referred since Cramer's time illustrates the lamentable want of fixity in generic appellations—an evil which we will have to endure so long as there are those among us who are seemingly goaded by an irresistible impulse to cut to pieces the old genera, and to endeavor to give vitality to new. It is a sore evil, fettering science, and tending to impede its progress instead of aiding in its advance. Favored above

* Other bibliography of the species is omitted in consideration of its extent.

many is he, who, as he scans these long lists of uncalled-for, short-lived, often still-born genera, can exultingly say: "I thank God that I baptized none of you!"

A Common Insect.

Darapsa Myron (as we prefer to call it for the present) has a distribution over a large portion of the United States, being found in all the region east of the Mississippi river, in some of the States west thereof, and in Canada. The caterpillar occurs oftener on the grape than any other of the Sphingides having the same food-plant, viz., *Thyreus Abbotii* Swainson, *Deilephila lineata* (Fabr.), *D. chamænerii* Harris, *Philampelus Pandorus* (Hübner), and *P. achemon* (Drury). It is made the more conspicuous by the parasitization to which it is peculiarly liable, and when in this condition its larval existence is considerably prolonged — not maturing and pupating as it otherwise would.* For these reasons it frequently comes under the observation of the grape-grower, exciting his curiosity, and causing it to be sent to the entomologist for information regarding it. The following notice will meet some of these inquiries.

The insect may be readily identified from the description and figures herewith presented.

Description of the Caterpillar.

Young Larva.—After its first molting it measures one-half inch in length. It is of a light green color, with the usual oblique lateral bands of the Sphingidæ running into a yellow subdorsal line. Along the body dorsally is a series of triangular yellow spots, which, on the sixth and seventh segments, are centered with orange. The caudal horn is green, straight, and two-tenths of an inch long; it continues to be straight through following moltings until after the last — the fourth molt, when it assumes the usual curved form.

Mature Larva.—The head is small, oval, pale green, with numerous yellow granules and four yellow perpendicular lines. The body is swollen on the third and fourth segments, tapering rapidly thence to the head. Its color is yellowish-green, speckled with numerous pale yellow dots. The seven oblique lateral bands cross the

* "It is one of those remarkable and not easily explained facts which often confront the student of Nature, that, while one of these hog-caterpillars in its normal and healthy condition may be starved to death in two or three days, another, that is writhing with its body full of parasites, will live without food for as many weeks. Indeed, I have known one to rest three weeks without food in a semi-paralyzed condition, and, after the parasitic flies had all escaped from their cocoons, it would raise itself and make a desperate effort to regain its strength by nibbling at a leaf which was offered to it." (Riley.)

spiracles and connect above with a white stripe which borders a dark green subdorsal line extending from the lateral stripes of

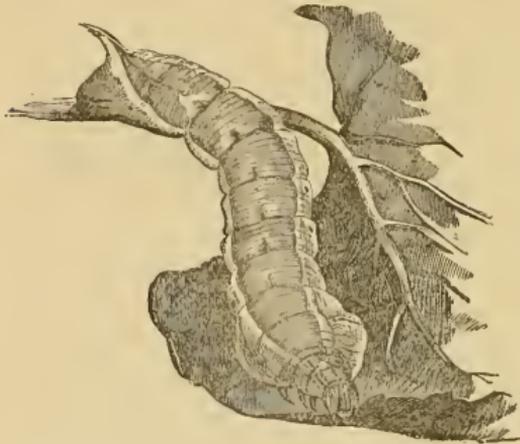


FIG. 5.—The grapevine hog-caterpillar, *DABAPSA MYRON*.

the head nearly horizontally to the tenth segment where it curves upward to the caudal horn; on the three anterior segments the subdorsal line is bordered beneath with yellow. Usually on the back are five or six pale green or yellow spots of which the base of each rests on the anterior portion of the segment, and the apex on the posterior, having within them a lozenge-shaped dull rose-red spot resting on the anterior margin. The spiracles are orange colored, with a white spot at each end. The caudal horn is curved, one-fourth of an inch long, bluish-green, granulated in black in front and in yellow behind, and with a yellow tip. Length of caterpillar, two inches.

A short time before its pupation, the color changes to a dull rose throughout, with the white lateral and the subdorsal bordering bands of a clearer rose. Previous to this change of color, I have observed the caterpillar to pass with its mouth over the entire surface of its body and of its horn even to the tip, applying to it a coating of what seemed a glutinous matter—the operation consuming about two hours.*

Its Injuries.

Although often a serious annoyance in vineyards, it does not in its general behavior merit the bad reputation given to it by Dr. Harris. He says of it: "Not content with eating the leaves only, it stops at every cluster of fruit and, either from stupidity or disappointment, nips off the stalks of the half-grown grapes and allows them to fall to the ground untasted. I have gathered under a single vine above a quart of unripe grapes thus detached during one night by these caterpillars."

* *Proceedings of the Entomological Society of Philadelphia*, iii, 1864, p. 663.

Usually Destroyed by a Parasite.

No effectual method is known by which to protect the grapevine from these caterpillars, and resort must therefore usually be had to hand-picking. But in collecting and destroying them care should be taken to save from destruction those which have attached to their body a large number of small oval white objects resembling eggs (see Fig. 6) and generally mistaken for them. They are not eggs but the pupal-cases of the parasite — the natural enemy of this caterpillar. So faithful is it to its mission that very few of the caterpillars



FIG. 6.—Caterpillar of *DANA PSEA MYRON* bearing the cocoons of the *Microgaster* parasite.

escape its persistent search and reach maturity. Perhaps nine out of ten are destroyed by it. The parasite is a small four-winged fly, belonging to the parasitic family of *Braconidae*, and is probably *Apanteles congregatus* (Say).* Having discovered one of the caterpillars, it pierces its body in numerous places, depositing an egg in each wound. These in due time hatch out into grubs within the caterpillar, where they feed upon its interior, instinctively avoiding the consumption of the vital parts that their food may continue to be suitable for them. Usually after the last molting of their host, while to all outward appearance it is uninjured and thriving, although careful observation may have shown it to have refrained from feeding for several days, all at once a host of little heads may be seen eating their way through the skin of its back and sides. Within an hour's time the entire brood of grubs — a hundred or more in number, have wriggled outwardly, and with their terminal segment fastened to the body by a few silken threads spun for the purpose, commence building about them their small firm, egg-like, snow-white cocoons, which, securely attached and standing on end are usually so numerous as to cover all of the upper part of the body and the sides of their victim. In two or three hours, they are all inclosed.† In about a week, the grubs have completed their rapid transformations, when a neatly fitted lid is pushed open at the top of each little cocoon, pressed to one side, and the

* I have had the same parasite from larvæ of *Thyreus Abbotii*, *Philampelus Pandorus*, and *Sphinx kalmia* — the last not a grapevine feeder.

† For an interesting account and graphic illustration of the peculiar manner in which these *Microgaster* cocoons are spun on the body of *Philampelus* (and probably on *D. Myron* also), see an article in the *American Naturalist* for 1878, vol. xii, pp. 558-560, by Mr. J. P. Marshall.

perfected parasite escapes. I have had them emerge as early as the twenty-fourth of August. The victimized caterpillar, now in a flaccid, shriveled condition, lives for a few days, without food or motion, and dies.

Insect Friends and Foes.

The above history should furnish an argument in favor of such a diffusion of entomological knowledge as may enable the agriculturist, fruit-grower and florist, to discriminate between his insect friends and foes. If, from ignorance, one should crush under foot one of these parasitized creatures believing it to be a ravenous caterpillar bearing hundreds of its eggs(!) upon its back, thinking thereby to check its increase (and this procedure we fear is the rule that prevails), he has taken the best possible means of promoting its multiplication by destroying the natural enemy whose special mission it is to prey upon it.

Pupation.

The larvæ that are so fortunate as to escape parasitic attack spin closely together a few leaves on the surface of the ground, within which they change to pupæ in three or four days.

The pupa is from one inch to an inch and two-tenths long and about one-third of an inch broad. It is without the projecting tongue-case of many of the sphinges. Its pale brown color is a distinguishing feature. The head-case is rounded, depressed, black-dotted and with a black crescent over the eye. The wing-cases are lighter brown, with numerous roundish, black, irregularly spaced spots on the nervures and a cluster near the base. The leg-cases and tongue-case are also irregularly dotted with similar spots, while the antennæ-cases are without them. The segments are dark brown at the incisures and are covered with numerous small indentations, of which some are black—those of the last two segments more conspicuous. The first spiracle has a black spot posterior to it, while the others are surrounded by black. The terminal spine is one-tenth of an inch long, curved, smooth, shining black, and minutely bifid.

The Moth.

The moth appears abroad from the middle of June to August. Mr. Saunders, in his "Insects Injurious to Fruits," represents it as double-brooded, but it is doubtful if it is so at the north. For some reason the imago develops very unequally, for, from larvæ collected at the same time and with their pupation under identical

conditions, I have noted a difference of between three and four months in the time of the emergence of the moths — in one instance 104 days. But not infrequently, as occasionally in *Macrosila quinque-maculata* and other one-brooded *Sphingidæ*, some of the earliest larvæ complete their transformations during the same summer, and appear abroad on the wing, but at too late a season for a second brood of larvæ to mature and attain pupation.



Thus Dr. Harris reports (*Entomological Correspondence*, page 283), that two matured larvæ taken by him on July thirty-first, entered the earth on August third, pupated on August sixth and seventh, and gave out the imago on August twenty-ninth.

The moth is so well pictured in the figure that it need only be added that the head and thorax are olive-green; the abdomen of a dull green, shaded with reddish; the front-wings greenish-gray, banded and shaded with olive-green; the hind-wings rust-colored, with some green at the internal angle.

Remedy.

The caterpillars of this species have never proved so abundant but that their depredations could be controlled by picking them from the leaves upon which they are feeding and crushing them under foot. In addition to the grapevine, it feeds also on the Virginia creeper, *Ampelopsis quinquefolia*.

Alypia octomaculata and *Eudryas grata*.

The Eight-spotted Forester and the Beautiful Woodnymph.

(Ord. LEPIDOPTERA: Fam. ?ZYGÆNIDÆ.)

Sesia 8 maculata FABRICIUS: Spec. Ins., ii, 1781, p. 155, No. 8; Ent. Syst., iii, pt. i, 1793, p. 381, No. 8.*

Zygæna 8 maculata FABRICIUS: Mant. Ins., ii, 1787, p. 106, No. 51.

Sphinx octomaculata SMITH-ABBOT: Lep. Ins. Geo., i, 1797, p. 87, pl. 44.

Agarista octomaculata LATREILLE: Encyc. Method., ix, 1819, p. 803, No. 3.—BOISDUVAL: Ann. Soc. Ent. Belg., xii, 1869, p. 68.—MELSHEIMER: in Harr. Entomolog. Corr., 1869, p. 116.

* The locality given by Fabricius for this insect, "India," would seem to be an erroneous one.

Alypia octomaculata HÜBNER: Zutr., 22, 1818, f. 119.—HARRIS: Entomolog. Corr., 1869, p. 285-6 (larva in different stages).—STRETCH: Zyg.-Bomb. N. A., 1873, p. 6, pl. 1, f. 7.—RILEY: 6th Rept. Ins. Mo., 1874, pp. 94-96, f. 25.—SAUNDERS: Ins. Inj. Fruits, 1883, p. 262-3, f. 272.—Et al.

Bombyx grata FABRICIUS: Ent. Syst., iii, Pt. i, 1793, p. 457, No. 158.

Eudryas grata BOISDUVAL: Spec. Gen. Lep., i, 1836, p. 14.—HARRIS: Ins. Inj. Veg., 1862, p. 427, pl. 6, f. 8.—STRETCH: Zyg.-Bomb. N. A., 1873, p. 147, pl. 7, f. 1.—RILEY: 6th Rept. Ins. Mo., 1874, pp. 88-90, figs. 22, 23.—SAUNDERS: Ins. Inj. Fruits, 1883, pp. 258-261, figs. 268-270.—Et al.

The caterpillars of the two species of moths above named occur on the grapevine and Virginia creeper (*Ampelopsis quinquefolia*), and are often referred to, and have been frequently written of, as "the blue caterpillars of the vine." Although they bear so strong a resemblance to one another as not to be distinguished apart by the ordinary observer, and with difficulty by the entomologist,* yet the perfect insects differ almost as widely in their general appearance as it is possible for moths to do. It is often of much importance that the winged form of insects which are injurious in their larval stage should be generally known, in order that, when seen abroad, they may be recognized as the precursors of the injuries which are to follow in their train, and either be captured for destruction or driven away from the plants that they infest, or insecticidal application made that will arrest the career of their young as soon as they emerge from the egg. Such knowledge should be of particular service in preventing the attack of the eight-spotted Forester, which is often disastrous to the grapevine, and most annoying to one who has been watching and admiring the vigorous growth of the graceful *Ampelopsis* in its upward climb, and finds too late that further progress for the season has been arrested by the unnoticed eating away of almost every one of the most thrifty and tallest tips. Its moth is often to be seen as a conspicuous object from its peculiar coloring, flying at all hours of the day, unlike most of the moths, and hovering with a motion that attracts the eye, over the foliage upon which it alights from time to time to deposit an egg.

The Moths.

The figures given of the two moths will serve for their ready recognition if in connection therewith their marked colors are mentioned.

Both pairs of wings and the fringes of *Alypia octomaculata* are

* In writing of *A. octomaculata* larva, Dr. Melsheimer has remarked: "It resembles the larva of *Eudryas grata* in its colorings and markings so much that before I was acquainted with its manners, I have frequently taken the one for the other, and was not aware of confounding them until the moths were disclosed." (*Harris Entomolog. Corr.*, 1869, p. 116.)

velvety-black; on the front pair, between the two spots before and below, and sometimes above the inner one and behind the outer, are lines or spots of violet-colored scales of a rich metallic lustre; the two spots of the front wings are pale yellow, and those of the hind pair, white. The thorax and abdomen are black, the former with a small yellow spot just behind the head, and yellow shoulder-covers shading paler toward their tip; the abdomen is marked with a small yellow tuft medially on its basal segment, and in the male with a few whitish hairs on the middle of each segment and a triangular-shaped white tuft on the segment before the last. The tibiae

(shanks) of the anterior and middle pairs of legs are clothed with long, deep orange-colored hairs. In the male, in front of the anterior legs, are two rather long, yellowish-white tufts.

In *Eudryas grata*, the anterior wings are pure white within. The stripe extending half-way across their front and the broad band crossing the outer margin are rusty-brown, bordered with olive-green; the band is traversed by wavy lines of violet-colored scales of a metallic lustre; on the middle of the inner margin is a large triangular spot of olive-green. The posterior wings are dull yellow, with their hinder margin bordered with brown. The head is black. The thorax is crested with black, interspersed with pearl-colored scales; the shoulder-covers are white. The abdomen is yellow, with a row of black spots centrally and on its sides.

The *Alypia* Caterpillar.

The *Alypia* caterpillar has frequently proved a serious pest in certain parts of New York city in almost entirely stripping the grapevines of their leaves, and continuing the injury for several years in succession. In some localities—in Albany and elsewhere, it is becoming, or has already become, quite injurious to the *Ampelopsis* in eating off its terminal shoots and thus arresting its extension. It may be readily recognized from the representation given of it in Fig. 8, at *a* and *b*, and the following statement of its principal colorational features. The head is yellowish, with about eight black dots on each side. The

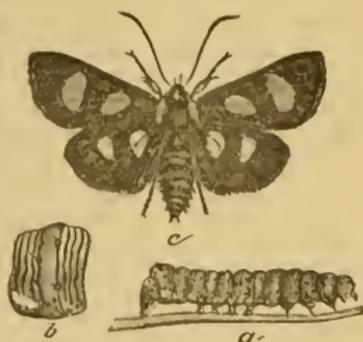


FIG. 8.—The eight-spotted Forester, *ALYPIA OCTOMACULATA*; *a*, the caterpillar; *b*, an enlarged segment of the same; *c*, the female moth.



FIG. 9.—The beautiful woodnymph, *EUDRYAS GRATA*.

collar on the first segment is pale orange, dotted with black. The second and third segments have a transverse series of black dots, but without an orange band; the other segments have each a broad, central, orange band, with four narrow black bands on each side, counting those that border the orange. From each of the black dots shown in the enlargement, a long white hair is given out, which is longer than represented in the figure. Below the line of the stigmata (breathing-pores) is a series of white spots on segments four to nine, just behind the orange band; a large white spot rests on the incisure of the tenth and eleventh segments. The legs are orange at their base, and black externally and at their tip, except the anal pair, which are orange dotted with black.

The caterpillar may be found upon the *Ampelopsis* from the first of June until the first of August—its long continuance making it quite difficult to control its operations either by hand-picking or by insecticidal applications.

The Flight of *Alypia*.

The moth is a day-flier, and has, of late years, become very common in Washington park, Albany, where almost every year it may be seen flitting abundantly about the blossoms of *Deutzia gracilis*, upon which it delights to feed. Not unfrequently from ten to fifteen of the prettily and conspicuously marked creatures may be seen hovering over or momentarily alighting upon a single plant. It flies as early as 9 o'clock in the morning and continues until 6 P. M., or later. Commencing to appear as early as the middle of May, it remains until the middle of June. I have also observed it, in the same locality, flying abundantly, on May twenty-eighth, about the flowers of the bush-honeysuckle, *Diervilla Japonica*.

The *Eudryas* Caterpillar.

Both the caterpillar and the imago of *Eudryas grata* are rare; the

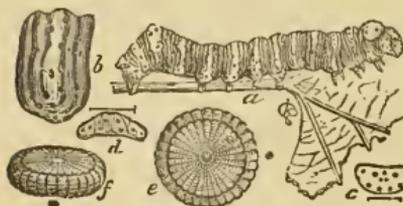


FIG. 10—*EUDRYAS GRATA*; *a*, the caterpillar in natural size; *b*, its fifth segment enlarged; *c*, its collar; *d*, markings of the hump on the eleventh segment; *e*, an upper view of the egg; and *f*, a side view, each enlarged from the natural size shown beside them.

Other features of it are shown in the figure, as also enlarged views of the egg from which it is developed.

former is so seldom met with that collectors experience difficulty in procuring specimens from which they may rear the beautiful moth for their cabinets. The caterpillar, *a*, in Fig. 10, is characterized by three black bands on each side of the central orange band, instead of the four in *A. octomaculata*; an absence of the lateral series of white spots, and the presence of a prominent hump on the eleventh segment.

Those who may desire further information of these two insects, and of two other species, of which the larvæ resemble them closely, are referred to an article in Professor Riley's sixth Missouri report, entitled "The Blue Caterpillars of the Vine," in which corrections are made of confounding of larvæ in preceding reports; and to one contained in my "Entomological Contributions, No. 3" (Twenty-sixth Annual Report on the New York State Museum of Natural History, 1874), entitled "On the Larva of *Eudryas unio* and Allied Forms."

Remedies.

Where the vines are not very large the conspicuously marked caterpillars of either of these two species can be easily discovered upon the leaves when they have attained a sufficient size to be of material damage. If those which can be reached from the ground or by the aid of a ladder, be gathered and destroyed the ravages will be greatly lessened. If the extent of the vine is too great for hand-picking, or the operation proves disagreeable from the green liquid that the *Alypia* caterpillar commonly ejects when handled, I would recommend, as the most economical and safest method of dealing with the caterpillars, showering while they are still young with hot water by means of a garden hose attached to the hot-water faucet of the kitchen, if accessible. The water, partly cooled by its passage through the air, will probably not retain sufficient heat to injure the plants, but quite enough to kill the caterpillars which it reaches, for as a rule the lepidopterous larvæ can not endure any great degree of heat. If insecticides need to be used, pyrethrum water or a kerosene emulsion would be efficient.

When nearly mature, numbers of the *Alypia* caterpillar can be made to drop to the ground if the vines that they infest be suddenly shaken or brushed, when they can be gathered and killed. Dropping them in a can containing a little kerosene is a convenient method of killing them, as well as all other hand-picked insects.

Phobetron pithecium (Sm.-Abb.).

The Hag-Moth Caterpillar.

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

Phalæna pithecium SMITH-ABBOT: Nat. Hist. Lep. Ins. Geo., ii, 1797, p. 147, pl. 74.

Ecnomiæda pithecium DUNCAN: in Nat. Lib.—Entomol., vii, 1841, pp. 183-186, pl. 21, f. 3 ♀, 4 larva.

Limacodes pithecium HARRIS: Rept. Ins. Mass., 1841, p. 304; Ins. New Eng., 1852, p. 324; Ins. Inj. Veg., 1862, p. 421, figs. 208, 209; Entomolog. Corr., 1869, p. 244-5.

- Limacodes pitheciium*. FITCH: in Trans. N. Y. St. Agricul. Soc. for 1856, xvi, p. 381; 3d Rept. (3d-5th) Ins. N. Y., 1859, p. 63, No. 85.
- Limacodes pitheciium*. MORRIS: Synop. Lep. N. A., 1862, p. 127.
- Phobetron pitheciium* PACKARD: in Proc. Ent. Soc. Phil., iii, 1864, p. 340; Guide Stud. Ins., 1869, p. 290; Ins. Inj. For.-Sh. Trees,—in Bull. No. 7, U. S. Ent. Commis., 1881, p. 47.
- Limacodes pithiciium*. RILEY: in Amer. Entomol., ii, 1870, pp. 25, 340, f. 209; 5th Rept. Ins. Mo., 1873, p. 126 (stinging power).
- Phobetron pitheciium*. LINTNER: Ent. Contrib. No. III—in 26th Rept. N. Y. St. Mus. Nat. Hist., 1874, p. 149 (on hazel); in Count. Gent., xlvii, 1882, p. 745 (general notice); id., liii, 1888, p. 725.
- Phobetron pitheciium*. SAUNDERS: Ins. Inj. Fruits, 1883, p. 112, f. 111 (habits, food-plants, etc.).
- Phobetron pitheciium*. DIMMOCK, A. K.: in Psyche, 1885, p. 280 (bibliography).
- Phobetron pitheciium*. HUBBARD: Ins. Affect. Orange, 1885, p. 142-3, figs. 62-3.

Perhaps the strangest, queerest looking caterpillar that is to be found among all of the known Lepidoptera of the United States, is the one named above as "the hag-moth caterpillar," and (imperfectly) illustrated in Fig. 11. It never fails to enlist attention and excite curiosity when for the first time its motion attracting the eye shows it to be a living creature; but its wonderful mimicry of bits of dead and curled or eroded leaves is usually the cause of its being passed over without observation. Its peculiar shriveled appearance together with its dark color, is thought by Dr. Harris, to have suggested to Sir J. E. Smith, who first described it in the beautiful and costly volumes on the "Rarer Lepidopterous Insects of Georgia," the specific name of *pitheciium*, the meaning of which is a shriveled and monkey-faced old woman. And from the same characters, undoubtedly, the common name that it bears of the hag-moth caterpillar has been drawn.

Description of the Caterpillar.

It belongs to a group of Bombycid caterpillars which, from their slug-like form and gliding motion, without apparent feet, are known as "slug caterpillars," and scientifically as *Cochlidixæ*. Indeed, some of the species, but for their bright and often varied colors and the broad spines that they bear, would naturally be mistaken for slugs. *Pitheciium* is about an inch in length, apparently headless as seen from above, thick-bodied, of the form shown in the figure, of a dark brown color, and clothed with a



FIG. 11.—The hag-moth caterpillar, *PHOBETRON PITHECIUM*, rings bear. Projecting from each side are four long, tapering, flattened, curling, velvety appendages, such as might suggest a miniature octopus. Of these, the pair near the front, on

the middle and near the end, are nearly as long as the body, while the terminal pair are about one-third as long. There are also other shorter ones intermediate to these. These appendages* are strongly constricted at their base and so slightly attached to the body that they are easily broken off. They are always cast off, together with a number of other subtriangular smaller ones, before the construction of the cocoon, and ordinarily several of them will be found woven fast to the outside of the cocoon.

It is strange that while the peculiar and interesting larval form is not a rarity in some portions of the United States, no detailed description has been given of it from which the number, form and location of these appendages may be learned. The figures that we have do not supply the want; they disagree in structural features, and in one we are presented with thirteen distinct segments, exclusive of the head, with a probable fourteenth. Dr. Fitch states that "the sides of its body are prolonged in eleven, tooth-like processes." In the absence of specimens of the larva to compare with this representation, I will quote from notes made by me on two examples received by mail which were in the larval stage when sent. "The box contained two cocoons (the caterpillars having spun up en route) and fifteen of the velvety arms (some are frequently lost during growth). Besides these, there were also fifteen subtriangular velvety pieces which had been borne upon the more prominent lateral tubercles, of which there are probably four on each side."

Its Stinging Power.

The caterpillar is named by Riley in a list of thirteen, mostly *Cochlidie*, whose spines have an urticating power.† A few others possessing this power have since been added to the list, as exceptions to the rule that caterpillars may be handled with impunity and without fear of their stinging, biting, poisoning or inflicting any other harm, notwithstanding the strong jaws, liquid secretions, bristling spines, and formidable horns with which they are provided as if for both defense and offense. The almost universal fear or dislike of caterpillars is unreasonable—is not natural and would not prevail but for erroneous and culpable teaching in childhood. Careless habit, or undeveloped powers, of observation fail to note the jointed legs with which most caterpillars are provided, and they are therefore relegated to the class of creeping or crawling things—so closely

*No suitable name has been found for them. Fitch designates them as "tooth-like processes;" Harris as "flattened teeth;" Hubbard as "fleshy hooks."

† *Fifth Report of the Insects of Missouri*, 1873, p. 126.

associated in many minds with snakes; hence, children in infancy are taught that everything that creeps must be avoided, and every snake, however beautiful, innocent, and in movement the embodiment of grace, must be killed. Such ignorance is to be deplored. It results in the overlooking of much that is worthy of admiration and study, tends to the development of cruelty towards the lower forms in nature, and is often the occasion of much unnecessary fear and alarm. For example: A newspaper account that obtained wide circulation not long ago, and was doubtless believed by many, made of one of our harmless caterpillars, the common tomato-worm (of which hundreds have been handled by me, without having experienced even the slightest nip from their jaws), a creature more venomous and more to be dreaded than the rattlesnake. If disturbed, it would inflict a mortal sting with the horn on its tail, and it was capable of ejecting a venom to a distance of several feet, which was certain death to whomever it struck.

I have no personal knowledge of the stinging power of the hag-moth caterpillar. It certainly can not exist to any great extent, for it is unprovided with such urticating spines as are found in *Lagoa crispata*, and are so conspicuous in *Hyperchiria Io* and *Hemileuca Maia*. I do not recall any spines or hairs that would serve the purpose, but Mr. Hubbard, who is more familiar with it, states that they occur among the feathery brown hairs with which the "fleshy hooks" (arms) are clothed, as longer, black, stinging hairs.

Miss Emily L. Morton, of New Windsor, N. Y., who probably has had more experience with the caterpillar than anyone else, has written in reply to inquiry made: "Although I have handled dozens of them every year, for some time past, in all stages and of all ages, I have never yet discovered any indications of a power to sting — such as is possessed by *Lagoa crispata* (in my experience the very worst of all stinging insects), *Empretia stimulea*, or even the somewhat painful though only momentary sting of *Euclea querceti* or *Parasa Chloris*." The testimony of Mr. Herman Strecker is to the same effect; he has written of it: "This little worm has a Victor-Hugo devil-fish sort of look, but can not sting, and is perfectly harmless."

Its Degree of Abundance.

The caterpillar does not often come under notice of the field collector, and from the comparatively few examples of the moths that are to be found in our collections, it may properly be regarded as a rare insect in the northern States. Dr. Harris records an instance in which, on the testimony of an agricultural friend, "a swarm of these caterpillars appeared on a cherry tree and nearly stripped it of its

leaves," but as it is not stated that the caterpillar was identified by Dr. Harris, it is not at all improbable that some other larva may have been mistaken for it, although its remarkable appearance should prevent its being confounded with any other. Mr. Hubbard seems to have met with it in abundance in the orange groves of Florida and to have had favorable opportunities for observing its habits, for he informs us that he found it to display "the extreme of instinctive sagacity in a device to which it frequently resorts when unable to find a suitable place in which to weave its cocoon, in making itself more satisfactory surroundings by killing the leaves, upon which, after they have become dry, it places its cocoon." Mr. Hubbard states: "Several of these caterpillars unite together, and, selecting a long and vigorous immature shoot or leader of the orange tree, they kill it by cutting into its base until it wilts and bends over. The leaves, in drying, turn a light tau-color, which harmonize most perfectly with the hairy locks of the caterpillar covering the cocoon." The above notes of habit are apparently based on observations made upon numbers of the caterpillar, and would almost indicate a social disposition never observed in the northern States.

Food-plants of the Larva.

I have had the larva, on different occasions, feeding on the apple, crab-apple, and pear. One example was found by me, at Bath, near Albany, feeding on hazel, *Corylus Americana*. Dr. Harris states that it occurs on forest trees, cherry trees, and apple trees in New England, from July to September. According to Mrs. Dimmock, it is often found on the white birch, *Betula alba*. Abbott gives persimmon [*Diospyros Virginiana*] and the various kinds of oaks as its food. Other food-plants given for it are plum, wild cherry, white and red oak, and orange. To these, MS. notes of Miss Morton, kindly submitted to me, add, sugar-maple (*Acer saccharinum*), ash, witch-hazel (*Hamelis Virginica*), and chestnut (*Castanea*). Larvæ had been reared by her from eggs found on chestnut and sugar-maple. Those from the former grew more rapidly and attained larger size.

The Cocoon.

This caterpillar shows a disposition to spin itself up in its cocoon at any time after its last molting, under the provocation of a temporary withdrawal from, or an imperfect condition of, its food, or possibly from confinement and exclusion from light. In almost every instance in which it has been sent to me by mail, it had either inclosed itself in its cocoon when received, or proceeded to do so the day

thereafter. This peculiarity has been noticed in *Actias Luna* and others of our Bombycids, and in *Aglia tau* of Europe.* If shared by many of the *Cochlidieæ*, it may be the explanation of the failure that so generally attends the efforts to rear their larvæ to the imago stage.

The cocoon is oval and parchment-like, as are those of *Euclea*, *Empretia*, and *Limacodes*, which are more frequently met with. In nature, it is said to be formed usually between leaves. Confined in a box, it is quite as often attached to the sides as to the leaves that may be therein. The one fed by me on hazel spun its cocoon on the surface of some damp sand, fastened to the twig standing therein. The outside of the cocoon was covered with grains of sand, and in its upper portion were interwoven some of the long arms which have been described as characteristic of the larva. It was broadly oval, slightly flattened on the sides, measuring three-tenths of an inch by four-tenths, being about the form and size shown in the accompanying figure, although described by Mr. Hubbard as "almost spherical—bullet-shaped." Compared with *Empretia stimulea* Clemens, it is less elongated, for in that we have the proportion of 0.32 to 0.50 in.



FIG. 12.—CO-
COON of the
hag-moth
caterpillar,
PHOBETRON
PITHECIUM.

The attachment of several of the hairy arms of the caterpillar to its cocoon, which is usually a feature of it, is probably the result of the chance projection of the arms through the meshes of the frame-work of the cocoon, the difficulty of withdrawing them with the threads clasping their contracted base, and the ease with which they would be torn off in the contortions of the caterpillar in its close quarters, seemingly so disproportionate to its size. This dismemberment of its ornamental appendages, so often remarked upon by writers, would, therefore, appear to be involuntary and a necessity, rather than intentional, and for any purpose that it might serve in the economy of the insect.

The cocoon, in giving out its moth, opens by a circular lid in one end, made for the purpose by the larva during the construction of the cocoon. With no example at hand for examination, I am not able to state whether the lid displays even an approach to the remarkable ingenuity shown by the *Lagoa crispata* larva in the building up of the lid of its cocoon with hinge and an inner guard to protect from outward pressure.†

* *Entomological Contributions*, No. III—*Twenty-sixth Rept. N. Y. St. Mus. Nat. Hist.*, 1874, p. 153.

† *Entomological Contributions*, No. II, 1872, p. 38—*Twenty-fourth Rept. N. Y. St. Mus. Nat. Hist.*, 1872, p. 142.

Description of the Moth.

Female.—The front wings are narrower than in most of the *Cochli-
dia*, prolonged apically, and with rounded angles. They are yellowish-
brown medially (nearly reaching to the costal
margin), and outwardly forming a wavy band
of five flexures which is bordered within by a
similar band of a darker shade, and without
by a narrow dark brown lunulated band which
begins on the costa near its outer third, and
following the curve of the wing approaches nearer
the outer margin as it proceeds, is bent sharply inward beneath the
cell, and thence descends in a perpendicular line to the inner margin.
A similar toothed line crosses the wing just within its middle. (These
lines have not been very well shown in the figure; they are not
uniformly developed in all examples of the moth.) A large rounded,
pale, yellowish-brown spot, which is darker within, rests on the inner
margin beyond its middle. A dark brown shade-band runs near
the outer margin. At the outer end of the cell is a small black
spot. The basal portion of the wing is dark brown with some fuscous
lines.



FIG. 13.—The female
hag-moth, PHOBETRON
PITHECIUM.

The hind wings are somewhat broader than the front pair, pointed
at the apex, and so short as not to reach the end of the abdomen.
The fringes of both pairs of wings are spotted with dark brown. The
legs are hairy and tufted; the tibiae (shanks) of the middle pair bear
a conspicuous tuft of long pale yellow hairs. Antennae simple.
Expanse of wings, about one inch.

Male.—The front wings are narrower than in the other sex and less
rounded at the angles. The colors are similar but darker, limited
almost to the inner margin, the rest being thinly-scaled
or transparent. The hind wings with their acute
angles are almost rhomboidal in shape; their anterior
half is transparent. The antennae are broadly bipecti-
nated. The abdomen bears a terminal tuft of
ochreous hairs. Expanse of wings about three-fourths
of an inch.



FIG. 14.—The male
hag-moth PHOBE-
TRON PITHECIUM.

The abdomen of my only example is apparently brown, but it is
greased, and the entire moth is in too poor condition, from injuries
incurred in its breeding-cage, for accurate description. Miss Morton,
who has been favored with the privilege of seeing many of the males
flying around the cage of confined females, describes the abdomen of
the male as steel-blue, like that of the blue-bottle fly.

But Little Published of the Insect.

As almost nothing has been published on the history and habits of this interesting insect and knowing that Miss Morton had given particular attention to the *Cochlidix* and had been very successful in rearing them, I requested, if not desired for publication by herself, that she would permit me to introduce in the present notice, such notes as she might be able to give upon this insect. In response, she has very kindly communicated the following interesting and valuable contribution :

Life-history and Habits, as Observed by Miss Morton.

The egg.—“The eggs of the *Limacodes* bear no resemblance to any other species of *Heterocera* with which I am acquainted. Most of them would be invisible on a leaf as they are perfectly transparent. Even on white paper, the ova of *Parasa fraterna* are most difficult to find, and only by holding them against the light, a slight, shiny appearance is to be observed like a minute drop of dew.

“The eggs of *P. pithecium* are very flat, nearly an ellipse though slightly truncate at one end. When newly laid they are like tiny drops of transparent gelatine, of a pale brownish color, becoming darker with age and the development of the embryo larva. In ten days the eggs usually produce their larvæ, but if the nights are cool they develop more slowly, requiring twelve and sometimes fourteen days to reach maturity.

The larvæ.—“Of the young larvæ I know but little, as the only year in which I was successful in rearing them, I took no notes, and for the past three years, although the eggs developed, all of the larvæ died without emerging. From memory, those that I reared looked, on hatching, exactly like the mature larva in miniature, having the same brown cimeter-shaped processes covered with a soft fur-like clothing, but with the processes shorter in proportion to their size and less curved. They are of very slow growth, eggs hatching in the middle of July taking until the last of September and even into October before the larvæ made their cocoons. They did not fully mature until the nights became cold and the leaves changed on the chestnuts, which seemed to be their favorite food-plant.

The cocoon.—“The cocoon is of a dark chocolate-brown, with the usual ‘lid’ of all the *Limacodes*. The furry appendages of the larva are fastened to the outside of the cocoon, but adhere to it so slightly that they soon drop off unless handled very carefully.

The moth.—“In emerging, the moth leaves its transparent pupal-case projecting half-way from the cocoon. It seems to be very regular

in the season of its making its appearance from the pupa, for in three consecutive years it occurred on the third and fifth of July. The moths escape from the cocoons quite early in the morning. The males take wing and seek their mates from about 9.30 to 10.30 A. M. The mating ordinarily continues for three hours, although sometimes prolonged until the evening. The female begins to fly and deposit her eggs between 8.30 and 9 in the evening, placing them singly (in confinement), or more rarely in groups of four to eight. Abroad, seldom more than two eggs are placed on a leaf.

Habits of flight.—" *Pithecium* is the only Limacodes known to me which seeks its mate in broad daylight and bright sunshine. If the day is rainy the male will not fly. I do not know whether the great difference between the sexes has been noticed by observers, or the very strong resemblance that the male presents to a blue-bottle fly. When on the wing seeking its mate, its steel-blue abdomen and semi-transparent wings, together with the buzzing noise that it makes, would almost lead anyone to take it for a 'blue-bottle' unless acquainted with its habits. On warm and bright days the males will at times be seen swarming, to the number of fifteen or twenty, about the cage of a newly emerged female placed out of doors, coming suddenly, circling and buzzing around it, and as suddenly darting away with a swiftness that the eye can not follow."

To the above notes of Miss Morton, I would add: The eggs of *P. pithecium* (some of last year that failed to develop their larvæ were kindly sent to me) are the most remarkable looking objects of all the insect eggs that I have ever seen. Certainly no one unacquainted with them and meeting with them abroad, and not seeing them deposited by the moth (perhaps not even then) would suspect their nature. They are simply minute, flattened discs, showing no elevation as viewed from above, but only a slight circular depression within. When examined obliquely or against the light, the depressed line is seen to define the outline of the young larva curved so that the head and tail nearly touch, and occupying about one-half of the diameter of the egg. The greatest thickness of the egg is about one-half that of the thin sheet of paper to which they are attached. In size they hardly exceed an ordinary "fly-speck," measuring in the longest diameter 0.075 of an inch. Their color is a pale yellow-brown. Certainly, the egg is as peculiar, extraordinary, and as ludicrous as is the larva.

The statement of Miss Morton that the cocoons of *pithecium* are made the last of September or even in October is confirmatory of the

remarks made on page 188 on an apparent habit of the larva of inclosing itself in its cocoon prematurely, under certain conditions. Examples sent to me by mail, and, of course, subjected to unnatural treatment in their boxing, etc., have made their cocoons as early as in August. My notes — all the dates bearing on this point that I have — show the following, which will be seen to be quite in contrast with Miss Morton's experience with her carefully matured larvæ :

Larva, August 4, on pear; cocoon made August 6.

Larva, August 22, on apple; cocoon made August 24.

Larva, September 2, on hazel; cocoon made September 16.

Larva, September 3, on pear (fruit); cocoon made September 5.

Larva, September 4, on crab-apple; cocoon made September 7.

Larva, September 9, on pear; cocoon made September 12.

Parasites.

Miss Morton has sent me a *Tachina* fly which she has bred from *pithecium* which I can not separate from unnamed examples in my collection, marked "bred from *Limacodes* sp?" The slug caterpillars are apparently very liable to *Tachina* attack. Miss Morton feelingly remarks, in writing of the example sent: "It looks to me like all the grey Dipteræ infesting the *Limacodes* which so often render a summer's hard work abortive by their emergence from the empty skin of the mature larva just as it is about to form its cocoon."

Anisota senatoria (Sm.-Abb.).

The Yellow-striped Oak Caterpillar: The Senatorial Oak Moth.

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

- SMITH-ABBOT: *Lepidop. Ins. Geo.*, ii, 1797, p. 113, pl. 57 (larva, pupa, ♂ & ♀ imago). As *Phalœna*.
- HÜBNER: *Verz. Schmett.*, 1816, p. 193, No. 1979 (as *Anisota*).
- HARRIS: *An.-Pl. Mass.*, 1835, p. 72; *Rept. Ins. Mass.*, 1841, p. 292; *Ins. New Eng.*, 1852, p. 312; *Ins. Inj. Veg.*, 1862, p. 405-6, f. 198 (larva), 199 (pupa), 200 (♀ imago); *Entomolog. Corr.*, 1869, p. 298, pl. 2, f. 9 (larva), pl. 4, f. 12 (pupa). As *Dryocampa*.
- WALKER: *Cat. Lep. Brit. Mus.*, 1855, Pt. VI.
- FITCH: *5th Rept. Ins. N. Y. (3d.-5th Repts.)*, 1859, p. 43.
- MORRIS: *Synop. Lep. N. Amer.*, 1862, p. 231.
- PACKARD: in *Proc. Ent. Soc. Phila.*, iii, 1864, p. 385; in *Bull. No. 7, U. S. Ent. Comm.*, 1881, p. 45 (habits, etc.).
- GROTE: in *Proc. Ent. Soc. Phila.*, iii, 1864, p. 93 (restores *Anisota* Hübner); in *Proc. Amer. Philosoph. Soc.*, xiv, 1874, p. 260 (place in classif.).
- WALSH: in *Pract. Entomol.*, ii, 1866, p. 7 (in Wisconsin).
- GLOVER: in *Rept. Comm. Agricul. for 1870*, p. 83, f. 43 (larva).

BOISDUVAL: in Ann. Soc. Ent. Belg., xv, 1871-2, p. 87, pl. 3, f. 5 of larva (*Adolecephala*).

LINTNER: Ent. Contrib., No. II, 1872, p. 51-2; and in 24th Rept. N. Y. St. Mus. N. H., 1872, p. 155-6 (larval notes).

TREAT: in Amer. Agricult., xxxiii, 1874, p. 344 (habits).

FRENCH: in 7th Rept. Ins. Ill., 1878, p. 196 (brief description); in 10th Rept. do., 1881, p. 120 (larva described).

COQUILLET: in 10th Rept. Ins. Ill., 1881, p. 161 (larva described).

CLARKSON: in Papilio, ii, 1882, p. 188 (abundance in Columbia Co.).

CLAYPOLE: in Canad. Entomol., xv, 1883, p. 36 (abundance in Penn.).

DIMMOCK, A. K.: in Psyche, iv, 1885, p. 275 (bibliography and food-plants).

The caterpillar of this species, although it may not claim high rank in a list of our insect enemies as the cause of serious harm and pecuniary loss, yet, it at times presents itself to our notice in such vast numbers, and its defoliation of the trees that it infests is so marked and startling, that it is not strange that fears are oftentimes entertained lest its ravages should extend to other vegetation which would at once transform it into a formidable pest. To meet the inquiries that are from time to time made of its habits, and the information that is desired of it, the following somewhat extended account has been prepared, from notes made several years ago and from published notices in scattered works, many of which are named in the bibliography above given.

The Egg-laying.

The large and conspicuous moth, which will be noticed hereafter, was observed by me at Center, N. Y. (now Karner), July 7, 1869, depositing its eggs on the under surface of oak leaves, distributing them over the surface in large patches, in a single layer, in close contact with one another. A leaf of *Quercus prinoides* of ordinary size was plucked, which had one-half of its surface covered with the eggs. From a count of a portion of the deposit, and an estimate of the remainder, the number of eggs was 500. This may be accepted as the ordinary number from a single moth — usually placed in separate patches on a leaf, or on two or more leaves.

The female, doubtless, oviposits soon after emerging from the pupa. Her abdomen is so greatly distended with her burden of eggs that she is unfitted for flight and almost helpless. On one occasion my attention was drawn to some commotion in the sand of a roadway at Center, not recognized at the distance, when, on approaching nearer, it was seen to be a female *senatoria*, which was being knocked and rolled helplessly and ludicrously about in the ardor with which a half-dozen males flying above and around her were striving for her possession.

Larval Stages.*

First stage.—Larvæ from eggs collected on July seventh hatched on the eleventh. The head of the newly-hatched larva, after assuming its proper color, is glossy black and of an oval form. The body is pale yellow-green, with a few short hairs; on the second segment are two smooth, straight, subcylindrical, black horns, arising from a green base, and with a slight enlargement at their apex, where they give out two black diverging setæ of the length of two-thirds that of the horn.

The young larvæ feed in company, and occupy both surfaces of the leaf, the entire substance of which they consume, except the veins and veinlets, leaving frequently a very good skeleton of the leaf.

The *first molting* occurred on the eighteenth and nineteenth of July. At this stage the body is obscure green with seven fuscous lines, of which the dorsal and stigmatal ones are narrow; the subdorsal and lateral ones broader, having in them a row of short spines. The collar (on first segment) centrally and the anal segment shining black. Legs black; prolegs with a black spot outwardly.

Second molt.—July twenty-eighth and twenty-ninth. Length of larva, 0.37 of an inch. Head and collar glossy black. Horns slightly spinose, enlarged at the tip, and usually with apical spines. The abdominal stripes are black, with yellow-brown intermediately, showing a broad stigmatal stripe. The terminal segment is spinose and glossy black.

Third Molt.—August fourth and fifth. Length, 0.60 of an inch. The larva is glossy black, with eight yellow stripes, of which the lower one is geminated by a crescent on the central portion of each segment inclosing a spinule; ventrally, from the fifth segment, is a yellow-green interrupted stripe. The horns are slightly tapering, clubbed at their tips, and 0.20 of an inch long. The legs and prolegs are black.

Fourth Molt.—Extending from August fourteenth to sixteenth. Immediately following the molting, the head, collar, horns, anal shield and plates, and legs, are flavescent; in a few hours they became shining black. The horns are but slightly enlarged at their tip, being less so than previous to this molt. The body is covered with numerous shining, minute, elevated points of the color of the ground on which they are placed.

* From my *Entomological Contributions*, No. II (*loc. cit.*), of which a few copies only were published.

The Mature Caterpillar.

The larva when full-grown is two inches long and about the thickness of a lead pencil, cylindric, and of a coal-black color in stripes alternating with orange-yellow, as follows : Along the middle of the back is a black stripe, with a yellow one of the same width on each side of it. Outside of these is a



FIG. 15.—The yellow-striped oak caterpillar, ANISOTA SENATORIA.

broader black stripe followed by a yellow one on each side of the back, slightly broader than the two middle ones. Below these is another black stripe still wider than the one above, and below this along the sides are two yellow stripes with a black one between them in which the breathing-pores are placed. The upper of these last two yellow stripes is somewhat wavy and less smooth than those on the back, and the lower one is often widened on the fore part of each segment, or sends off a branch downward and backward [not shown in the figure]. Below this is an oblong yellow spot on each segment, which is sometimes lengthened to unite its anterior end to the yellow stripe. The under side is black with a yellow stripe along the middle, which is more or less interrupted. The legs and prolegs are black. The yellow stripes are not prolonged on the posterior and two anterior rings, but are here often replaced by small yellow spots. The head is black. The skin is tough and leathery, with numerous small, elevated, smooth grains, of which two on the fore part of each segment, placed in the yellow stripes, are larger and are sometimes elevated into small prickle-like points, and two others, similar to these, also occur posteriorly on each segment, but placed further apart. In addition to these, there are six larger, black, shining, conical prickles in a transverse row around the middle of each ring, some of which are occasionally forked at their tips into two sharp points. On the second ring in place of the two upper prickles, are two black curved cylindrical horns, equaling two of the rings in length and usually standing obliquely upwards and forwards, their tips blunt and shining. The last segment is rough from several prickle-like points of different sizes. (Fitch, in *Fifth Report Insects of New York*, [third to fifth reports] p. 43-44.)

Abundance of the Caterpillar in New York.

Dr. Fitch, writing of it, states : "The latter part of August, 1858, I observed them in greater numbers than I had ever before seen, in the cemetery at Saratoga Springs, where they had stripped most of the oaks of their leaves, and were then descended from the trees, probably in search of food elsewhere, as few of them appeared to be grown to their full size. They were everywhere crawling sluggishly about upon the surface of the dry, sandy soil, and up the sides of the monuments. In the paths, the dresses of the ladies sweeping over them, these worms frequently adhered to and crawled up them, to the great annoyance of everyone and the alarm of the more timorous."

In former years, they were found annually in great abundance at Center, N. Y. This locality was their metropolis until within a few years past, since which time the fires that have repeatedly swept over it have banished the superabundance of insect life that for so long a time made it perhaps the most noted insect hunting-ground of the northern United States. In the more favorable years for its multiplication, it abounded so excessively that all of the smaller oaks which were so numerous there, occurring in extended areas to the exclusion of other shrubs or trees, were, during the month of August, as effectually defoliated as if they had been swept by fire.

Dr. James Eights, a distinguished naturalist, for many years a resident of Albany, has informed me that on one occasion he observed on the line of the railroad between Albany and Schenectady, a species of caterpillar so exceedingly abundant on and about the railroad track, that the numbers crushed by the passage of the trains caused the slipping of the wheels of the engines to such an extent as to necessitate the sanding of the rails before the train could proceed. A notice of the interesting incident was communicated by him to one of the journals of the day, in which some account of the caterpillar was given. Although, from the number of years that had elapsed since the event he was not able to indicate positively the species, he believed it to have been *A. senatoria*, and the locality of its occurrence, in the vicinity of Center.

Mr. F. Clarkson has recorded (*loc. cit.*) a remarkable prevalence of the caterpillar at Livingston, Columbia county, N. Y., in the year 1882. It appeared in the latter part of June, and before the middle of August the larvæ had consumed all the leaves of the young oaks, and had visited many of the older trees standing in lawns and on the borders of forests.

Elsewhere than in New York, it has been reported as fearfully numerous along the Michigan Central railroad. "For three years the oaks near Kalamazoo have been entirely denuded of their leaves, and nearly all the trees first attacked have died." (*Report of the Commissioner of Agriculture for 1869*, p. 536.)

At New Bloomfield, Pennsylvania, in 1882, according to Prof. Claypole (*loc. cit.*), great ravages were wrought by it in the forests. He states: "I have seen hillsides that looked as if fire had passed over them, in consequence of the destruction of the foliage by millions of the species. In the woods they could be found crawling over almost every square foot of ground, and lying dead by dozens in every pool of water. The sound of their falling frass was like a slight shower of rain. Farmers tell me that they had never known them so abundant before within their recollection."

Its Food-plants.

The caterpillar was believed to feed exclusively on the different species of oak, until recently, when Mrs. A. K. Dimmock, of Cambridge, Mass., has added white birch (*Betula alba*) to its short list of food-plants. To what extent it was observed to feed thereon is not stated (see *loc. cit.*). Messrs. Walsh-Riley have recorded an instance in which the eggs of the moth were laid on raspberry leaves (*Amer. Entomol.*, ii, 1869, p. 26), but it was probably under the constraint of inability to reach an oak for oviposition, and it is doubtful if the larvæ when hatched would have fed on the raspberry.

Dr. Harris states that in Massachusetts they live on the white and red oaks [*Quercus alba* and *Q. rubra*]. Professor Claypole observed the white oak to be untouched by them at New Bloomfield, Pa., and their food to be almost exclusively the foliage of the black-oak (*Quercus tinctoria*), the scarlet-oak (*Q. coccinea*), and the bear or scrub-oak (*Q. ilicifolia*). In my own observations at Center, they have usually occurred on the dwarf chestnut-oak (*Q. prinoides*) and on the black scrub-oak (*Q. ilicifolia*).

Its Distribution.

Although originally described from specimens collected in Georgia, it is far less abundant in the southern States than in the northern.* Its eastern range is apparently from Canada to Georgia. To the westward it is reported in published lists from Wisconsin (Walsh), Missouri (Riley), Kansas (rare, Snow), and California.

It seems to be rather a local insect. Dr. Fitch mentions the fact that he had never met with it at Salem, Washington county, where he resided, while it was very abundant only twenty-five miles distant. In my collections, extending over many years, it has never been seen by me in abundance in any other locality than at Center.

Stinging Powers.

This caterpillar is another of the few that are capable of inflicting a sting when handled. It is not as severe, however, as those of the *Cochlidie*. According to Dr. Fitch, its prickles, if they happen to penetrate the skin, produce a stinging sensation like that of nettles and a slight redness of the spot; both these symptoms, however, lasting but a short time, as in the case of nettle stings.

It is not included in the list of stinging larva by Prof. Riley, referred to on page 185, although mention is there made of the sting of *Anisota stigma*, on the authority of Dr. Fitch.

* Prof. Geo. F. Atkinson, entomologist of the South Carolina Agricultural Experiment Station, at Columbia, represents this species as by far the most common *Anisota* in middle North Carolina. *A. rubinunda* is there frequently met with in broods on the maple, and twice he had found broods of *A. stigma* (Bull. No. 4, Jan., 1889, *So. Car. Agr. Exper. St.*, pp. 87-8.)

I have no recollection of having felt the sting of either this species or *Dryocampa rubicunda*. With the other Anisotas I am not familiar, they being rare in the State of New York.

Natural Enemies.

As would seem to be indicated by the remarkable number in which this insect often occurs, its known enemies are but few. Its formidable spines doubtless serve to protect it from destruction by insectivorous birds, although Professor A. J. Cook names two species that are known to eat it, viz., the robin and the blue jay [*Merula migratoria* and *Cyanocitta cristata*]. (*American Naturalist*, viii., 1874, p. 368.)

Of insect parasites, I only find recorded, *Limneria fugitiva* Say — a common parasite of the *Bombycidae*. In its parasitism of the young larva of *senatoria*, in making its cocoon it uses the body-wall of its host, which it eats through and fastens to a twig of the tree on which the larvæ are feeding (Atkinson). From some of the parasitized larvæ, Professor Atkinson had obtained examples of a species of *Hemiteles*, but he could not determine whether it was a primary parasite on *A. senatoria* or a secondary one on *Limneria fugitiva*.

Another ichneumon parasite, reared from the caterpillar, is in my collection, undetermined, but unfortunately can not be found at the present for identification.

Description of the Moth.

The female has the thorax, abdomen, and wings of a bright ochreous-yellow color. Its front wings are freckled with blackish dots; a large white spot rests on the lower part of the cross-vein of the cell near the upper middle of the wing; and a faint purplish stripe runs, slightly waved, from just before the apex to the outer third of the inner margin. The hind wings are much smaller, angulated apically, a brighter ochreous toward their hind margin, and a straight purplish band traversing them behind their middle. Its antennæ are short and simple. Expanse of wings about two and one-half inches.

The male is much smaller in size, being about one inch and a half in spread. It is of a darker color; its front wings are triangular, feebly dotted with black, the white spot quite distinct, the purple traversing line inconspicuous especially toward its middle, where the wing is somewhat translucent. The hind wings are rhomboidal, with the purple line only indicated. The antennæ are broadly pectinated for more than one-half their length.

Summary of Life-history.

The moth may appear abroad in the State of New York for oviposition as early as the second week in June. On June sixteenth I have seen examples *in coitu* and females depositing their eggs.

The eggs hatch in from a week to ten days. The young caterpillars feed together in swarms, and, according to Harris, "have their regular times for eating and for rest, and when they have finished their meals they cluster closely together along the twigs and branches; if disturbed they raise the forepart of their body and shake the head to signify their displeasure." They undergo four moltings, and their five stages seem to average about nine days each.

During the latter part of July and in August the defoliation of the oaks that they cause is noticed. An oviposition extending over three or four weeks will naturally give varied degrees of growth of the larvæ met with abroad. Thus, notes made by me in 1869 show on August twentieth, larvæ quite small, some passing through their fourth molt, and others in their last stage; August twenty-seventh, full-grown larvæ; September eighth, matured larvæ on their travels prior to pupation; September fourteenth, still abundant; thirtieth, a few seen; the locality was not visited in October.

The larger number probably enter the ground for pupation during the second and third weeks of September. They bury to a depth of three or four inches, where they shape a small and simple cell in which to undergo their change to pupæ.*

When the time for the last stage in the series of transformations has arrived, the pupa, aided by the circlet of spines or teeth with which the front of each of its free-moving segments is provided, and by a strong bifid anal spine, forces itself to the surface and partly out of the ground, where it is held while the moth bursts its case and emerges. The females are at once attended by the males that have preceded and are awaiting them, and the pairing usually occurs in the grass beneath the oaks, according to Mr. Clarkson, before there is time to ascend the trunks. Soon thereafter the eggs are laid, as before described, on the lower surface of the leaves of the terminal twigs of the branches nearest the ground, seldom exceeding an elevation of ten or twelve feet.

Associated Species.

The two other species of *Anisota*, viz., *stigma* Fabr. and *pellucida* Sm.-Abb.,† also feed on the oaks, but they never occur in injurious num-

* It is of interest in this connection to mention that *Anisota Heiligbrodti* Harvey (*Canad. Entomol.*, ix, 1877, p. 110), since referred, by Grote, with *bicolor* Harris, *bisecta* Lintn., etc., to the genus *Sphingicampa*, has a pupation above ground in a double cocoon like that of *Cecropia* and *Promethea*, but net-like instead of solid, and attached to the mesquite (*Entomologica Americana*, i, 1885, p. 60).

† Mr. Grote, in his last Check List, and in a list of *Ceratocampæ*, etc., published in 1874, has cited *pellucida* as a synonym of *Virginicensis* of Drury. I do not know why this reference was made, and believe that it has not been accepted by those entomologists, at least, who are unwilling to abandon a name, particularly when expressive and characteristic, as in this instance, which has been in general use for more than a century, unless the necessity for so doing is clear and unquestionable, and not simply resting on probabilities.

bers. *Dryocampa rubicunda* (Fabr.), often cited as *Anisota*, although having some other food-plants, is usually found on the maples (*Acer dasycarpum* and *A. saccharinum*), which it occasionally despoils of nearly all their foliage, particularly in some of the western States. It will, however, in confinement feed on oak leaves.

Remedies.

It will not often be necessary to resort to means for protection from the injuries of this insect, as the oaks that they feed upon in preference, and on which they occur in the largest numbers, are those that ordinarily occupy sandy tracts (as at Karner, N. Y.) or other unproductive places. When, however, their attack is made upon oaks that are valued for ornament or shade, it may be arrested by spraying the foliage with London purple in water.

Mr. Clarkson believes that its multiplication may be restrained by destroying the moths on their first appearance while among the grass beneath the oaks where their larvæ abounded the preceding year, and by trimming off the lower branches of the trees so that the foliage can not be easily reached by the heavy-bodied females, for oviposition.

Another remedy that has been recommended, for a similar larval attack, is to dig a trench, around an infested tree, of about a foot in depth, with its outer wall sloping inward, into which the caterpillars as they leave the tree for pupation will collect, and where they can be conveniently destroyed by crushing or by sprinkling with kerosene. A trench with the two walls sloping upward toward one another would be a still more effectual trap.

Agrotis saucia (Hübner).

Larva: *The Variegated Cut-worm.* Moth: *The Unarmed Rustic.*

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

HÜBNER: Samml. Europ. Schmett., 1796, 378 (*Noctua*); Verzeich. Bek. Schmett., 1816, 227 (*Peridroma*).

TREITSCHKE: Schmett. Eur., v., 1825, p. 149 (*Agrotis*).

HARRIS: Ins. New Engl., 1852, p. 344 (moth described); Ins. Inj. Vog., 1862, p. 444 (*A. inermis*).

GUENÉE: Spec. Gen. Lep.—Noct., i, 1852, p. 271 (remarks on larva).

STANTON: Man. Brit. Moths, i, 1857, p. 224 (brief descriptions of moth and larva).

BOISDUVAL: in Ann. Soc. Ent. France, ser. 3, vii, 1859, Bull., p. 102 (ravages in tobacco plantations in Algiers).

RILEY: 1st Ann. Rept. Ins. Mo., 1869, pp. 72-74, pl. 1, figs. 1-4 (descriptions and life-history, as *A. inermis*); 3d id., 1871, p. 129 (parasite from); in Rept. Comm. Agricul. for 1884, p. 297-8, pl. 3, figs. 1, 2 (notes on eggs and larva).

- SPEYER: Europ.-amer. Verwandtschaften, in Stett. Ent. Zeit., 1870, p. 107; id., 1875, p. 134.
- GROTE: List. Noct. N. A., in Bull. Buff. Soc. Nat. Hist., i, 1873, p. 135 (identical with *A. inermis* Harris); id., ii, 1874, p. 11; id., 1875, pp. 308, 314; in 6th Rept. Peab. Acad. Sci., 1874, p. 22 (Eur. and Amer.); in Bull. G.-G. Surv. Terr., vi, No. 1, 1881, p. 163.
- MORRISON: in Proc. Bost. Soc. Nat. Hist., xvii, 1875 (in Texas, and identical with *A. Ortonii* Pack.).
- FRENCH: in Trans. Ill. Hort. Soc., xi, 1877, pp. 192-194 (habits, etc.); in 7th Rept. Ins. Ill., 1878, pp. 94-5, 211-213 (description, habits, food-plants, etc.).
- LINTNER: Ent. Contrib., IV (in 30th Rept. N. Y. St. Mus. Nat. Hist.), 1878, p. 45 (dates of collection), p. 53 (in Patagonia); in 44th Rept. N. Y. St. Agr. Soc. for 1884, pp. 62, 63, 64 (food-plants), 68; in 39th Ann. Rept. [N. Y.] St. Mus. Nat. Hist., 1886, pp. 94, 95; in Trans. N. Y. St. Agricul. Soc. for 1888, pp. 71, 74, 75, 79, 85; Bull. N. Y. St. Mus. Nat. Hist., No. 6, 1888, pp. 8, 11, 12, 16, 22, figs. 11, 21.
- MARTEN: in 10th Rept. Ins. Ill., 1881, p. 131 (description and habits of larva).

From Mr. P. Barry, of the Mount Hope Nurseries at Rochester, N. Y., some apple twigs, containing an egg-deposit from which the larvæ were emerging, were received on May seventh. The eggs had been sent to him for name, from Centralia, Kansas.

The Eggs.

The twigs were quite small, not exceeding one-sixth of an inch in diameter. The eggs were closely and symmetrically arranged, in a single layer, in regular rows joined to one another, forming an unbroken patch. In one example there were seven rows of about sixty eggs in each, extending over about an inch and a half of the twig. The eggs, upon the point of hatching, were of a lavender color. They were round, with about forty sharp and prominent longitudinal ribs, which were connected somewhat irregularly with numerous transverse lines. In Figure 16, at *a*, one is shown in enlargement, and at *b*, a twig with one of the egg-deposits is represented.

Desiring to learn more of the occurrence of the eggs, I addressed a request for the information to Mr. A. Oberndorf, Jr., of Centralia, Kansas, from whom the eggs had been sent to Mr. Barry. The following communication was sent in reply, under date of May twentieth:

Up to the seventeenth inst. I have found the eggs on the twigs and bodies and branches of young apple, pear, and peach trees, but

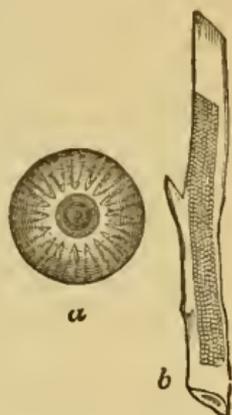


FIG. 16.— *a*, an egg of *AGROTIS SAUCIA* greatly enlarged; *b*, eggs of the same deposited upon a twig, natural size.

have found none on old or bearing trees. I found the eggs in batches, on twigs, in narrow strips from one inch to three inches long, and about three-sixteenths of an inch broad; on branches, in broader strips from one inch to two and one-half inches long and from one-fourth to three-eighths of an inch broad; on the bodies of trees, usually about in this shape and size,* and the eggs as close together as possible. I destroyed every nest that I could find, but concluded last Sunday to leave two nests in a little tree to see what they would do after being hatched. On Monday one-half of the cluster had changed from a light tan to a slate color, and yesterday evening that portion had hatched, and a number of little caterpillars, about one-eighth of an inch long, were wriggling about, but were gradually being carried away by the wind.

Larval Transformations and Habits.

First stage.—Some of the eggs had hatched when received from Mr. Barry, and the caterpillars presented the following appearance:

The head was black, the body green with indistinct lines, and a few scattered hairs. They had but three pairs of prolegs, and consequently looped in walking, after the manner of the *Geometridæ*. In dropping from the twig, they hung suspended by a thread that they gave forth. When disturbed they would often twist the head and several segments over the back, holding to the surface upon which they rested by the last two pairs of prolegs.

Grass was offered them of which they readily ate and with apparent relish. Some tips of apple twigs being given them, a few fed sparingly thereon, eating small holes into one surface of the unfolding leaves, but much the larger portion continued their feeding upon the grass.

Second stage.—Upon the fourteenth of May some of the caterpillars were observed to have undergone their first molting, and to have acquired in the operation an additional pair of prolegs. They were cylindrical, of a length of 0.2 inch, the head somewhat cordate with black setiferous spots; body with a pale dorsal line, two similar lateral ones, and a broad stigmatal stripe; the anterior pair of trapezoidal spots are black, elevated, and bear, as do the other setiferous spots, a stout black hair. The hinder part of the body slopes downward to the anal prolegs. There are now four pairs of prolegs.

Third stage.—Several of the larvæ had undergone their second molting on the morning of May eighteenth. They had now five pairs of prolegs (the normal number belonging to the *Nocturde*), and presented the following features:

Head dull yellowish, pale on the side, mottled, with two broad fuscous lines in front running from the summit of the head to the

* Referring to a rectangular figure given of about one inch by three-fourths, not continuously straight-lined on one of its longer sides.

palpi, curving toward one another and connecting mesially like an X (see this feature represented in the adult head at *b*, in Figure 17); last joint of the palpi black. Body cylindrical, bearing short black hairs on the setiferous spots, brown, shading darker toward the broad substigmatal yellow-brown stripe, a subdorsal black line shaded with yellow beneath, and a yellowish dorsal line accentuated into yellow spots on the summit of each segment, especially upon the third, fourth, fifth, and sixth (not counting the head as one); on top of the eleventh segment, a v-shaped black patch; beneath pale brown with delicate mottlings. Prolegs pale, semitranslucent. The setiferous spots are elevated and shining black. The larval length at about the end of this stage, is 0.55 inch.

The distinctive markings of this stage, are the pale lateral stripe, the fuscous dorsum (paler in many examples) and the dorsal line of yellow markings—the anterior ones of which are either rounded or lozenge-shaped and the following ones becoming elongated into lines.

During this stage and onward to maturity, the brood was fed on plantain leaves (*Plantago major*), for which they manifested a great fondness. They were not easily disturbed in their feeding when brought under observation. When removed by hand to fresh leaves they simply curled up in the usual cut-worm manner, without showing any alarm.

Fourth stage.—The third molting commenced on May twenty-first, and was completed in about two days. Their length at the end of the stage was 0.8 inch. The lines of the head are shining black, broader comparatively than before, and yellowish on the sides. Body, general coloring as before; about six conspicuous yellow dorsal spots, a black subdorsal line somewhat broken, with yellow beneath; resting on the line of the spiracles, a broad black band broken into crescents having the spiracles in one tip. The stripe beneath this is greenish with yellowish dots and beneath this, over the legs, greenish with whitish dots; a triangular black spot on the top of the eleventh segment and a yellowish patch behind it.

Fifth stage.—The fourth and last larval molt commenced on the twenty-fifth of May and was completed by the brood, 150 in number, on the twenty-eighth. Of larvæ fully matured on the thirtieth, the following are the prominent features:

Maximum length, 1.6 inch; average length of six examples, 1.46 inch, breadth, 0.25 inch. Colors not so bright or so contrasting as in previous stages—the prevailing shade being a sordid brown. The conspicuous features are: The yellow dorsal spots on the hinder part of segments two to seven inclusive, consisting of three or four trans-

verse markings on the obscure annulets; the dorsal black patch on the eleventh segment; an interrupted subdorsal black line consisting of a black streak on the posterior half of each segment; the stigmatal line of black crescents and the substigmatal line of a yellowish, approaching orange, color. The spiracles are small and black. One of the paler colored larvæ is represented at *a* in Figure 17.

At maturity.—By the thirtieth of May, many of the larvæ had ceased feeding and had evidently matured. The following day they were transferred to a box of earth upon which a layer of plantain leaves had been placed. When examination was next made on the third of June, a little feeding had been done. Four-fifths of the larvæ were found above ground, and the rest had buried themselves at different depths — some just beneath the surface, showing a slight contraction in length, indicating progress toward pupation. A few that had been transferred to a separate box with food, were still feeding on June fourth.

The Pupa.—On the fifth of June, three newly-disclosed pupæ were found beneath leaves on the surface of the ground — at first of a dull pale yellowish color, but later becoming mahogany-brown. The anterior segments following the rounded head-parts are cylindrical for the extent of the wing-covers, while the remaining six free segments rapidly diminish in size to the anal tip, which is armed with a single short, black, curved spine. The anterior margin of the segments is brown and closely punctated. Length, 0.7 inch; greatest breadth, 0.2 inch.

The Moth.—The first moths — eight in number — emerged from their pupæ on the twenty-fourth of June, and on the following day eighteen others made their appearance. The duration of their pupal

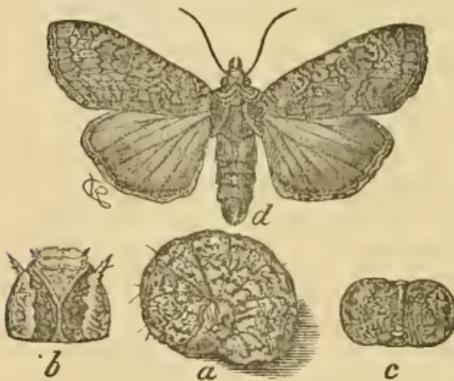


FIG. 17.—*AGROTIS SAUCIA* — *a*, larva; *b* and *c*, head and a middle joint of the same enlarged; *d*, the moth.

stage would thence have been twenty days, and their larval stage twenty-eight days. The last of the moths, 150 in all, were given out on June thirtieth. The species proved to be very easy to rear, unlike most of the cut-worms — hardly any fatality attending any of the several transformations. The moths displayed a remarkable absence

of timidity on being disturbed. With hardly any motion beyond the necessary readjustment of their legs, they could be lifted from the ground upon which they rested

or from the sides of the box to which they were attached, by slipping a piece of paper underneath them, from which they could be quietly dropped in the cyanide bottle. If alarmed, they attempted escape by running rather than flight.

The form, size and general appearance of the moth are shown in Figure 17. Its general ground color is a uniform brownish-gray, but individuals differ greatly in color, a large number being found having the costal region of the forewings nearly black while the rest of the wing is yellowish-brown. Others have the front of the wings blackish, gradually shading into the usual brownish-gray. A variety is mentioned by Riley in which the costal region is of a dull golden-buff color, but this does not appear in the large brood reared by me, nor have I met with it in ample collections of the species abroad.

An Injurious Species.

The variegated cut-worm is regarded as one of the most injurious of its class, from its numbers, its great voracity and the broad range of its food. It apparently will attack almost any field-crop that it may find convenient for its operations, and when these are not at hand, it as readily feeds on grasses and weeds. In cold-frames, it has been quite destructive to lettuce. In conservatories it has been very injurious to smilax, *Myrsiphyllum asparagoides*, eating off the softer parts and especially the tops of the plants. In its attack on cabbage, it has imitated the habits of some of the boring species, by penetrating directly into the head. In Kansas, in 1885, it was very injurious to clover and timothy in Johnson, Meade and Douglass counties — in the latter stripping off the leaves of the clover and cutting off the heads of timothy early in June (Professor Snow, in *Rept. Kansas St. Bd. of Agriculture* for June 1885, p. 6).

Its Food-plants.

In confinement it has been fed on knot grass, corn, leaves of peach, apple, strawberry, willow, eupatorium, tips of grapevine, plantain, etc. Kaltenbach states that in Europe it feeds on *Stellaria* [chickweed], *Litorella*, *Plantago* [plantain], and *Rumex* [dock, sorrel]. Rouast credits it with feeding on roots of grains, under the lucernes and trefoils, *Centranthus ruber*, *Plantago*, *Rumex*, *Daucus* [carrot], and *Carduus*. He quotes Milliere as saying that it does not eat roots but only leaves.

A Double-brooded Species.

Professor Riley remarks (p. 298 of *Rept. Comm. Agricul.* for 1884) that his St. Louis notes (given) of eggs of the species hatched from April ninth to May twenty-fourth, and moths emerged from June fifth to July fifth, "indicate at least two annual generations, with a possibility of three." In my collections at sugar, at Schenectady, N. Y., in

1875, the first brood had entirely disappeared at my commencement on July second. The first individual of the second brood was taken on September seventh, and others following on the ninth, eleventh, thirteenth, fifteenth, twentieth, twenty-ninth, thirtieth, October second, fourth, tenth, nineteenth, and twenty-second—on each evening except seven, when the collections were made (*Entomolog. Contrib.*, IV, p. 45). The following year, 1876, the first brood was evidently delayed in the time of its appearance, as it was taken only between July eighteenth and August third. No collections at sugar were made during the autumn, and I have, therefore, no record of the appearance of the second brood of that year.

Its Geographical Distribution.

It is a species of very broad distribution, being found throughout most of Europe; in Canada and British Columbia; in the United States from the Atlantic to the Pacific; in South America, in Colombia, Brazil and Patagonia; and in the Madeira and Teneriffe islands.

Remedies.

The remedies for attack of this species of cut-worm, as indicated by what has been above given of its life-history and habits, should be, in general, such as give best promise of killing the larvæ when concealed during the day under leaves, or just beneath the surface of the ground when no better shelter is offered. Large numbers may be easily destroyed by poisoning them with prepared baits of their favorite foods when they come abroad to feed at night during the month of May, and crushing the pupæ by thorough plowing while buried at a moderate depth in the ground during late May or early June, or, as more practicable, toward the latter part of August. For remarks upon these methods, and for other remedies and preventives available against cut-worms as a class, see *Bulletin No. 6 of the N. Y. State Museum of Natural History*, on "Cut-worms," lately published; and the same in the *Transactions of the N. Y. State Agricultural Society*, vol. xxxiv, for the years 1883-1886.

Mamestra picta Harris.

The Zebra Cabbage Caterpillar.

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

HARRIS: *Ins. N. Engl.*, 1852, p. 350-1; *Ins. Inj. Veg.*, 1862, p. 451-2, f. 223 (larva), f. 224 (pupa); *Entomolog. Corr.*, 1869, p. 317-18 (larval description and dates).

GUENÉE: *Sp. Gen. Lep.*, v.—Noct. i, 1852, p. 344, pl. 5, f. 8 (as *Ceramica exusta*—moth described).

- WALSH: in Pract. Entomol., ii, 1866, p. 21 (immunity to frosts, etc.)
- RILEY: 2d Rept. Ins. Mo., 1870, p. 112, f. 82 *a* (larva), *b* (imago); in Rept. Comm. Agricul. for 1883, p. 124-5, pl. 1, figs. 3, 3a, pl. 12, figs. 2a, 2b (*Ceramica*—description, habits and transformations).
- LINTNER: in 26th Rept. N. Y. St. Mus. N. H. for 1872—Ent. Contrib., III, 1874, p. 137-8 (*Ceramica*—larval description and habits); 2d Rept. Ins. N. Y., 1885, p. 1-2 (on beets); 4th Rept. do., 1888, p. 16 (on currant); Bull. N. Y. St. Mus. N. H., No. 6, 1888, p. 21, f. 24.
- GROTE: in Bull. Buff. Soc. Nat. Sci.—List Noct., 1874, pp. 22, 123 (*Ceramica*); Check List N. A. Moths, 1882, p. 26, No. 343 (*Mamestra*).
- THOMAS: 6th Rept. Ins. Ill. [1877], p. 60; 9th Rept. do., 1880, p. 51-2 (*Ceramica*).
- FRENCH: in 7th Rept. Ins. Ill., 1878, p. 226 (*Ceramica*).
- COQUILLET: in 10th Rept. Ins. Ill., 1881, p. 185, figs. *a*, *b* (*Ceramica*).
- PACKARD: in Amer. Nat., xviii, 1884, p. 1266-7 (larval stages described).
- CAULFIELD: in Canad. Entomol., xvi, 1884, p. 122-3 (Ophion parasite).
- WEED: in Bull. Ill. St. Lab. N. H., iii, 1887, p. 2 (Microplitis parasite).

This conspicuously marked caterpillar, shown, together with the moth produced by it in Figure 18, which is so injurious to many kinds of vegetation, has often been described and figured in its mature form, but only a few brief notes of its earlier stages have been given. Examples sent by Mr. George T. Powell, from Ghent, N. Y., June 8, 1887, found feeding in company on a currant bush, enable me to supply the deficiency.

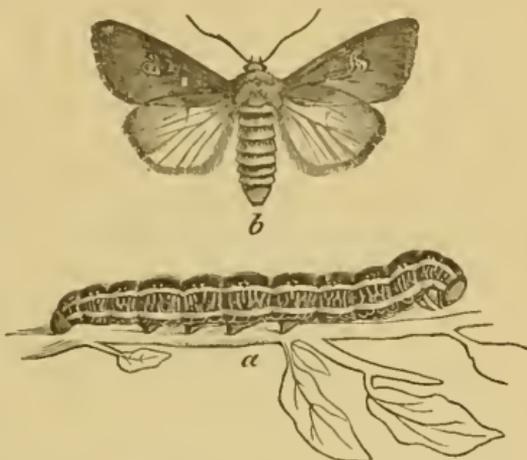


FIG. 18.—*MAMESTRA PICTA*, showing the moth and its caterpillar.

The Young Larva.

The larvæ were 0.35 inch in length, and cylindrical in form. The head is pale red, and nearly as broad as the body. The body is traversed dorsally by a bluish-white mesial stripe, except as it is interrupted at the incisures on the posterior segments by the coalescing of the two well-defined black stripes that, commencing on the white collar of the first segment, elsewhere border it. Below this is a distinct bright yellow subdorsal stripe, broader than the black one above it, in which, on the hinderpart of each segment, is a small, black setiferous tubercle—its seta a little longer than the breadth of the stripe; these tubercles, on the posterior segments, are merged

into the black stripes above. Next below is a broad, black, lateral stripe, traversed by an irregular white one, which is contracted on each segment so as to leave thereon a large rounded black spot united with the lower margin of the black stripe. The stigmatal stripe, next in order, is yellow, somewhat narrower than the subdorsal yellow one, bearing a row of black setiferous tubercles, similar to those in the superior yellow stripe, of which the anterior ones are merged in the black above. Below this, and centrally, the body is blackish, paler mesially. The legs and prolegs are reddish, the latter with a black patch outwardly.

The larvæ, at this time, have molted twice — possibly three times.

From the above details, it will be seen that the caterpillar is marked with seven distinct stripes, viz., three black ones (a dorsal and two lateral) and four yellow ones (two subdorsal and two stigmatal).

The Nearly Mature Larva.

In the stage previous to the last molt, the broad, dorsal black stripe is traversed medially by a narrow white line, and is marked on the hinderpart of segments three to nine with two small white dots. The broad, black lateral band consists of the black runic markings, with white interspaces, characteristic of the last stages of this larva.

A Peculiar Parasitic Attack.

In this stage six of the caterpillars disclosed a parasitic attack. In each instance, underneath the last segment of the larva, and usually placed transversely to it, an elongated brown cocoon, about twice as long as broad, was found attached.* Its formation was not observed. The diameter of the cocoon about equals that of the caterpillar. The parasitic larva may have emerged through the anus, as no rupture in the skin was observed. The cocoons were formed June twenty-second to June twenty-sixth. The cocoon and the insects emerging therefrom (date not known) are identical with those subsequently described by Mr. Clarence M. Weed (*loc. cit.*), of the Ohio Agricultural Experiment Station, as *Microplitis mamestræ*.

Transformations.

On the twenty-seventh of June the larvæ had matured and entered the ground for pupation. The moths emerged August eleventh to eighteenth, and deposited eggs, the earliest of which hatched August twentieth.

It will be observed, from the above, that there are two broods of this insect each year—the first of which appears abroad in the winged state about the latter part of May, and deposits the eggs for

* Mr. Weed found the cocoons "fastened transversely between the anal prolegs."

the summer brood. The caterpillars from these, feeding through June, produce their moths in August. From these, again, we have the caterpillars which are so destructive to autumnal crops in September and October, which pupate in the latter month, and pass the winter in that stage.

The larvæ obtained from the eggs on August twentieth enable me to give their features at an earlier stage than that previously given.

When just from the egg, they measure one-twelfth of an inch in length. The head is black, and the flesh-colored body bears rows of rounded, black, setiferous spots—the superior four of which on each segment form the “trapezoidal spots.” The hairs are black. The larva loops in walking, as only six of the prolegs are employed in locomotion.

Food-plants.

In addition to the list of food-plants of this caterpillar (apparently rather a general feeder on garden crops) given by Professor Riley, viz., cabbage, turnip, beet, spinach, strawberry, asparagus, honeysuckle, mignonette, asters, lamb's quarters (*Chenopodium album*), may be added from my own observations, sweet pea, field pea, currant, and buckwheat.

On July 3, 1884, Mr. Goff sent from the Agricultural Experiment Station at Geneva, larvæ of from three-eighths to one-half inch long, which may have undergone two molts, that were infesting, to a serious extent, peas and cabbage on the station grounds. For mention of a severe attack by the caterpillars on a mangold crop, in St. Lawrence Co., N. Y., in 1883, see my 2d report.

Remedies.

It is comparatively easy to deal with this insect while in its early stages when it is of social nature and feeds in companies. At this time the leaves containing them may be plucked and crushed by the foot.

Later, they may perhaps be best destroyed by pyrethrum powder, to which they are quite susceptible, as shown by the following experiments made:

Undiluted pyrethrum was scattered over five larvæ, less than half-grown. They were very soon in violent convulsions, squirming and twisting as if in great agony and discharging a green liquid from the mouth. In a half hour's time they were unable to turn from one side to the other, and only gave contractile movements. In three-fourths of an hour motion had nearly ceased. In one hour and a half they were motionless and seemingly dead.

Pyrethrum of the dilution of one part to five of flour was slightly dusted through a sieve over five larvæ. In three minutes time, they had ceased traveling and were violently squirming. In fifteen minutes time, they were barely able to turn themselves over. In one-half hour they showed no more motion than did those which had been treated with unmixed pyrethrum after the lapse of an hour. The experiment clearly showed that the diluted powder was not only quite as efficient as the undiluted, but even more rapid in its effect.

Mamestra grandis (Boisd.).

A Poplar-feeding Cut-worm.

(Ord. LEPIDOPTERA: Fam. NOCTUIDÆ.)

Hadena grandis BOISDUVAL: Gen. Ind. Eur. Lepidop., 1840, p. 950.

Hadena grandis GUENÉE: in Ann. Soc. Ent. France—Noct. Eur. Ind. method., 1841, p. 244; Spec. Gen. Lep., vi.—Noct., ii, 1852, p. 105, pl. 8, f. 10.

Mamestra grandis GROTE: List Noct. N. A., in Bull. Buff. Soc. N. S., ii, 1874, p. 12.

An irregularly rounded cluster of the eggs of this cut-worm was taken at Center, N. Y. (Karner), on the 14th of June, 1887, on the leaf of a poplar, *Populus tremuloides*. They were not identified at the time, nor even later when the larvæ had been reared from them, nor until the moths were obtained the following winter.

Eggs of other of the cut-worm moths have been taken from various trees. As there is no record of the larvæ of such species feeding upon the leaves where the eggs occur, we may presume that immediately upon hatching, the young larvæ drop to the ground and commence to feed upon the tender blades of grass. It is possible, however, that some of the species may creep at night from their hiding places—in crevices in the bark of the tree in their younger stages, and in the ground when more advanced—to feed upon the leaves unobserved, as *Agrotis Cochranii* and others of the “climbing cut-worms” are known to do. That this may be their habit seems plausible from the food upon which this family of *M. grandis* was reared. Their cut-worm nature not being suspected from their egg or larval features, poplar was supposed to be their natural food-plant and it was accordingly given them immediately upon their hatching. It was readily accepted, and continued thereafter to be eaten with apparent relish. They even consented to a transfer to other species than *P. tremuloides*, when, hav-

ing been carried with me in the Adirondack mountains, that particular specie of poplar, at times, could not conveniently be obtained.

The following is the account of the successive stages of *Mamestra grandis* as observed by me:

The egg.—The egg is round, ribbed with about twenty-four lines and punctured in the intermediate depressions. Color, a pale purple, an elongate deep purple dash at the apex, and a purple band near the summit not entire. The colors were probably the result of the larva partly showing through the translucent shell, as the hatching was near at hand, and the empty egg-shells were left nearly colorless.

Larva in first stage.—The larvæ were hatched on the fifteenth of June. They were quite small, slender, elongated, with long legs and numerous black spots from which long hairs proceeded. They are very active in their movements. When ready for their molting, they are of a pale, watery-green color, with three pale (whitish) stripes on each side; between the two lower is a dusky stigmatal stripe. The black, setiferous, trapezoidal spots are quite distinguishable, and of these the two anterior ones of the central segments, are about one-half as far apart as the hinder pair. Length when fixed for molting, 0.3 inch. Four pairs of prolegs are used in walking in this stage.

Second larval stage.—The first molting was on June twenty-second. The head is flat, pale brown, with a few dark spots. The body, bluish-green; a narrow, whitish, dorsal line; two lateral lines, then a dark stigmatal one, having a white stripe below. Ventral region pale green. The fifth pair of prolegs are partly developed, but not employed in locomotion, as the larva still loops.

Third stage.—Commencement of second molting not noticed, but was on or about the twenty-seventh of June. General color, darker green; a whitish dorsal stripe, a similar lateral one, a broad dark green stigmatal one, below which is a pale green stripe, bordered on each side with white. Head, brown, flat, bilobed, with numerous hairs. Body tapering anteriorly from the eleventh segment; the setiferous spots with comparatively shorter hairs. Of the five pairs of prolegs, the anterior pair is used in walking, but as they are shorter than the others, the larva still has a looping gait. It feeds principally at night; when disturbed, it coils up and bends its head on one side. At this stage, it eats holes in the body of the leaf and not from the edge as before. Length when in readiness for its next molt, 0.7 inch.

Fourth stage.—Molted on or about July second. Color, pale brown, a whitish dorsal line, two obscure lateral ones, and a stigmatal and

substigmatal whitish one. Head nearly as large as the first segment, pale brown with two darker lines down its front and paler reticulations on the sides. Body cylindrical. All of the prolegs are fully developed and there is no looping in walking.

Fifth stage.—On July ninth the larvæ were observed in their fourth and last molting. At maturity, they measure when at rest 1.5 inch, and are nearly cylindrical in form; when extended in motion they are two inches long with the body tapering quite regularly from the eleventh segment to the head. The head is bilobed above, flattened in front, brown, with darker brown reticulations. The body is an obscure pale brown, with indistinct dark brown mottlings, smooth, except the usual setiform spots, each with a short white hair; trapezoidal spots dark brown and inconspicuous—the anterior pair contiguous. Beneath, paler; legs unicolorated.

The larvæ were fed on poplar leaves to maturity.

Pupation.—First change to the pupa on July twenty-first—the last on July thirtieth—about thirty in all. Most of the larvæ declined to enter the ground that was given them, but pupated on the surface. After their pupation they were covered lightly with earth. A few buried two or three inches in the ground, where they made rude cocoons of earth by spinning together the surrounding soil in walls of about one-fourth of an inch in thickness.

Disclosure of the Imago.—The pupæ were kept during the winter in a warm room, having a temperature of 70° Fahr. and above. Although the breeding-case in which they were placed was supplied underneath its wire floor with an evaporating pan to furnish needed moisture, very few moths were disclosed. The first emerged in January, 1888—three examples prior to January twenty-first. A second and third example followed during the month, and four others in February; and although the pupæ seemed in good condition for months

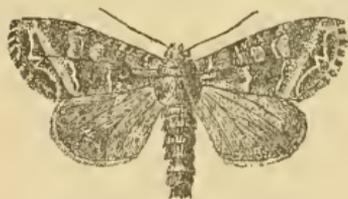


FIG. 19.—*MAMESTRA GRANDIS*.

thereafter, and some occasionally worked their way to the surface when covered only with a thin layer of earth, no other examples of the moth were obtained. The moth bears such a general resemblance to *Hadena Arctica* (Boisd.), that it was at first mistaken for it. It is represented in Fig. 19.

Distribution.

Mamestra grandis has rarely occurred among the large collections of *Noctuidæ* made in the vicinity of Albany during the years 1877 and 1878 by Messrs. Meske, Hill, Bailey, Chatfield, and others. It is

recorded as having been taken rarely in Ohio and Illinois. Beyond this, but little is known of its distribution in the United States. It is said to occur in the circumpolar regions of Europe. Boisduval received examples of it from Greenland and Lapland.

—

***Penthina nimbatana* (Clemens).**

The Rose-leaf Tyer.

(Ord. LEPIDOPTERA: Fam. TORTRICIDÆ.)

CLEMENS: in Proc. Acad. Nat. Sci. Phila., 1860, p. 364 (*Antithesia*).

WALKER: in Cat. Lep. Heteroc. Br. Mus., xxviii, 1863, p. 374 (*Penthina contrariana*).

ZELLER: Beitr. Kennt. nordamer. Nachtf., iii, 1875, p. 57, pl. 8, f. 13.

FERNALD: Cat. Tortric. N. Amer., 1882, p. 31, No. 187.

COQUILLETT: in 11th Rept. Ins. Ill., 1882, p. 12 (reference to); in Papilio, iii, 1883, p. 101 (larval features and habits).

LINTNER: in Count. Gent., xlviii, 1883, p. 169 (in a green-house).

Caterpillars of this moth were received from Scarsdale, Westchester Co., N. Y., on February seventh, with a statement that they had just made their appearance in a green-house and were injuring the foliage. Some method of destroying them was desired.

They are of small size, as are most of the family of *Tortricidæ* to which they belong, not much exceeding one-half inch in length, slender, and nearly cylindrical. They are of an apple-green color, of a transparency that permits the pulsation of the dorsal vessel (corresponding to a heart) to be seen through the skin, and are traversed by a dark dorsal line. The twelve segments of the body are well defined, each bearing several small tubercles or papillæ which give out a small white hair—the four on the back (the trapezoidal spots) being the most conspicuous. The head is flat and shining black, with some whitish hairs, and the collar (upper part of the first segment) is also shining black. The three pairs of legs are black; the prolegs green.

This species was named and described by Dr. Clemens as *Antithesia nimbatana*, in 1860, and was later referred to the genus *Penthina*. It is a common species in the vicinity of Albany.

Mr. D. W. Coquillett states (*loc. cit.*) that he has found the caterpillar of this species to be "utterly indistinguishable from a black-headed variety of *Cacœcia rosaceana* (Harris)." I have not compared the two, but the moths are so exceedingly unlike that their larvæ certainly should show differential features. From my recollection of the larva of *P. nimbatana*, its green is more yellowish and clearer than

is ever seen in examples of *P. rosaceana*. A number of the pupae-cases of both species are contained in the State collection, awaiting study which will undoubtedly show marked difference in them.

Food-habits.

With me the insect has shown a decided preference for some clumps of one of the commoner roses, not very double, which grow in clusters on the same stem, and entirely avoiding some of the choicer kinds. This same preference has been observed and mentioned to me by others. The explanation may, perhaps, be that this particular rose is apparently not very far removed from the wild rose, *Rosa blanda*, which, according to Mr. Coquillett, it infests, and from which he has bred it.

This is the first time that the insect has been reported in green-houses.

Life-history and Habits.

The parent moth, shown in its natural size in Fig. 20, comes from its pupa about the middle of April in ordinary seasons, in the State of New York, for the deposit of its eggs. They are laid at night, and presumably on the terminal leaves of rose bushes, just as they are pushing out from the buds. The eggs



FIG. 20.—Moth of the rose-leaf tyer.
PENTHINA NIMBATANA.

have not been observed, nor the moth in its oviposition, at this season of the year. The caterpillar soon hatches, and at once commences to bind together the margins and surfaces of the folded leaf. I have found it thus located on the last day of April, measuring one-eighth of an inch in length. With its increasing size, the single leaf, partly eaten and opened out in its rapid growth, is abandoned by the caterpillar, which then selects another habitation, and a more commodious one, between the surfaces of two leaves fastened together. This, in turn, at a more advanced stage of growth, is deserted for still more ample quarters among several of the terminal leaves of a tip. Within the shelter thus provided for itself, it feeds upon its immediate surroundings and is never seen abroad. Its growth is rapid, and at its successive moltings the papillæ and the hairs proceeding from them become more conspicuous. Immediately after its molting, and for a while thereafter, its head and collar are green, assuming slowly their normal black and shining color.

By the last week of May the larvæ have matured, ceased feeding, and, it would seem, have dropped to the ground, to undergo their transformations among the dead leaves, as I have not been able to find their pupæ among the folded or fastened leaves of the bush. When reared in confinement they have transformed within a folded

leaf which the caterpillar had first lined with a coating of silk. The period of pupation is about nine or ten days. The moth of the second brood has been observed abroad by me as early as June second. Eggs are laid for the next brood, and the renewed operations of the caterpillar upon the bushes are soon to be seen, extending into July. It is possible that there may be a third brood, as the transformations among the *Tortricidæ* may be quite rapid — the pupal stage in some being limited to five days. I have seen the moths flying in my garden as late as July



FIG. 21.—Front wing of the rose-leaf tyer, enlarged. (After Zeller.)

twenty-fifth — the latest period at which I have been able to pursue my observations upon it. From June second to the last days of July, and probably into August, would be too long a time for moths of the second brood to be seen abroad. It would be more in accordance with what is known of other *Tortricids* if a third brood made its appearance about the middle of July.

Remedies.

The presence of this caterpillar on a rose bush may be detected at a glance by the tied leaves at the tip of a stem, when it is only necessary to give the little bunch a slight pinch, and its occupant is at once destroyed. As it is seldom so numerous as to call for insecticidal applications to the entire bush, which would require to be very thoroughly applied in order to reach its food, this will be found the most convenient and efficient method of destroying the pest. It is the method that I have adopted in my own garden, where it is an annual visitant, and where its pretty, broad-winged and conspicuously marked moth is often to be seen by day during the months of June and July, resting upon the leaves, or if disturbed, flying quickly for a yard or two to a fence-board or other convenient resting place, and presenting much, in the pose of its wings, the appearance of some of the smaller *Noctuidæ*.

Incurvaria acerifoliella (Fitch).

The Maple-leaf Cutter.

(Ord. LEPIDOPTERA : Fam. TINEIDÆ.)

Ornix acerifoliella FITCH: in Trans. N. Y. St. Agricul. Soc. for 1855, xv, 1856, pp. 501-505; 1st and 2nd Repts. Ins. N. Y., 1856, pp. 269-273, pl. 4, figs. 5-7; in Count. Gent., xiv, 1859, p. 225.

Incurvaria acerifoliella CLEMENS: in Proc. Acad. Nat. Sci. Phila., January, 1860, p. 4; in Tineina of N. Amer., 1872, p. 90 (fig. of wings and brief description).

- Ornix acerifoliella*. REED: in Rept. Ent. Soc. Ont. for 1872, p. 42-3.—
LINTNER: in Count. Gent., xxxix, 1874, p. 631.
- Tinea iridella* CHAMBERS: in Canad. Ent., v, 1873, p. 86.
- Incurvaria iridella* CHAMBERS: in Canad. Ent., xi, 1879, p. 146; in Bull. U. S. G.-G. Surv. Terr., iv, 1878, p. 151.
- Incurvaria acerifoliella*. CHAMBERS: in Bull. U. S. G.-G. Surv. Terr., iv, 1878, p. 151 (references).—PACKARD: in Bull. No. 7, U. S. Ent. Commis., 1881, p. 114 (habits and description).—WALSINGHAM: in Trans. Amer. Ent. Soc., x, 1882, p. 172; in Insect Life, i, 1888, p. 147.—LINTNER: 1st Rept. Ins. N. Y., 1882, p. 308 (mention).—FLETCHER: Rept. Entomol. for 1885, p. 31-2 (severe injuries); id. for 1887, p. 38 (mention); in Trans. Ottawa Field Nat. Club, ii, 1887, p. 353-4 (injuries).

This little Tineid, for some unknown reason, is remarkably local having been reported from only a few localities in the United States and Canada; yet when it makes its appearance, it is usually so destructive to the foliage of the trees that it attacks, and its operations are of such a peculiar character as to impart much interest to them.

The following communication, received from a correspondent residing at Pittsford, Vt., tells the story of a demonstration made by it at that place:

Inclosed I send you some leaves from the sugar maple, upon which you will find a small worm covered with portions of the leaf which he has cut out and appropriated for a house; he carries it about and feeds upon the leaf until it is all consumed but the fiber. Nearly all the hard maple trees in our forests are as brown and look as dead as though fire had been through them. We have never seen anything of the kind here before, and I would like to know where they came from and what their future will be. They touch no other tree but the hard maple; not even the soft maple. Any light in regard to the insect will be thankfully received.

The Leaf-case of the Caterpillar.

The leaves sent with the above present a curious appearance and would naturally arrest attention and provoke inquiry. In one of them are no less than twenty-two round (or more correctly, subelliptical) holes, of from one-tenth to four-tenths of an inch in diameter, while several of the pieces, neatly cut out from the holes, are fastened to the upper surface of the leaf. A large portion of the surface has been eaten away in such a manner as to leave frequently circular patches of green untouched surface, corresponding in size and form to the excised pieces of leaf.

Upon inserting the point of a needle under the edge of one of these pieces, it is found to be attached to the leaf by silken threads at different parts of its circumference. On raising it, underneath is seen a

smaller round piece, and within these two, when separated, two other pieces of smaller size, containing within them the remains of a minute caterpillar which had been killed, probably by pressure in transit through the mail.



FIG. 22.—The maple-leaf cutter, *INCURVARIA ACERIFOLIELLA*, and its operations. (After Fitch.)

When the leaves were received, a few of the leaf-cases which had escaped crushing were observed in motion, as the caterpillars, with head and front legs protruded, were dragging them over the surface in search of fresh pasturage, as stated in the above communication.

In Fig. 22 the operations of this insect on a maple leaf, as above described, are shown, as also two of the moths upon the leaf in their natural size. Three of the larval cases, in different sizes, are represented on the leaf. At its left is the case of a full-grown larva, in natural size, and to the right the same enlarged.

The Insect, and its Appearance in New York in 1850.

The insect which constructs for itself this singular shelter, and inflicts the serious injury on the forest maples mentioned above, is known as the Maple-leaf cutter. The perfect insect proceeding from it, after its hibernation among the dead leaves on the ground in the pupa state, is a little moth of only a third of an inch in expanse of

wings, belonging to the family of *Tineidæ*, which comprises the smallest forms of the *Lepidoptera*. It was described thirty-five years ago by Dr. Fitch, in his *First Report on the Noxious Insects of New York*, under the name of *Ornix acerifoliella*, where it is recorded as having caused so serious an affection of the maples in the eastern section of New York, in the year 1850, as to make it a common subject of remark. The forest maples were alone affected by it; those isolated in fields and about dwellings entirely escaped. It had been observed for several years (perhaps ten) annually, with the return of the month of May, in numbers in the forests, but at the time of writing (1854) it had nearly disappeared; for two years past not one had been seen, and even its pupæ could not be found on searching among the fallen trees.

Its Subsequent History.

No record is found of later injuries from it in the State of New York. In 1859 Dr. Fitch received examples of the insect with inquiries of its habits, from North Clarendon, Vt., as appears from a communication made by him to the *Country Gentleman* of October sixth of that year. Its ravages at and in the vicinity of Pittsford, Vt., given on page 216, were in the year 1874. Dr. Packard's only acquaintance with the insect seems to be (*loc. cit.*) in maple leaves, and cases illustrating its work received from Vermont — at what time is not stated. Its occurrence in the State of Illinois was observed by Miss Emily A. Smith, on forest maples, during the month of August and thereafter increasingly until the fall of the leaves in autumn.

Its Destructiveness in Canada.

Mr. James Fletcher, Entomologist of the Department of Agriculture of Canada, has given an account of an extraordinary occurrence of this insect in a maple wood adjoining the grounds of the Government House at Ottawa, in September of 1885. The maple trees, for a space of perhaps four acres, had the foliage almost entirely consumed, and the flat, disc-like cases of the larvæ were carpeting the ground, and were also in great numbers on the trunks of the trees. Some beech trees growing among the maples had also been attacked after the leaves of the maple had been devoured. The attack was so severe in the skeletonizing of the leaves that the woods presented a cream-colored hue instead of their usual green.

A similar visitation had been observed by the Rev. T. W. Fyles, of South Quebec, in Missisquoi county, in the year 1881, particularly in maple groves in the village of Sweetsburgh, Quebec. The foliage was so skeletonized that it presented a brown and scorched appearance, as if a hot blast had passed over the woodland. Myriads of the larvæ

in their disc-like covering were to be seen on the leaves and branches of the trees and on the undergrowth. The following season clouds of the perfect insect would rise from the foliage when disturbed by the passers-by.

Elsewhere in Canada—which, from the above accounts, would seem to be the home of this insect, from which it, at times, extends southward into Vermont and New York—it has been observed in the London district by Mr. E. Baynes Reed, who records it (*loc. cit.*) as more or less common every year in that locality, and notably in the year 1872.

Caterpillar and Moth Described.

The larva is described by Dr. Fitch as nearly one-fourth of an inch long at maturity; slender, and of a flattened cylindrical form, soft and contractile, its segments marked by slight, intervening constrictions. It is of a dull white; the head, which is strongly depressed, and the three thoracic segments are pale rusty-brown; an interrupted broad, blackish stripe, more or less distinct, traverses the middle of the back.

The moth measures 0.35 inch across its forewings, which are of a brilliant steel-blue color, or sometimes bluish-green, with



FIG. 23.—The maple-leaf cutter, *INCURVARIA ACERIFOLIELLA* (after Fitch).

a purple reflection, and without spots. The hind wings are pale smoky-brown and translucent, with pale blue and purple reflections and a pale brown fringe. On the crown of the head, between the antennæ is a tuft of erect bright orange hairs. The thorax is brilliant steel-blue, and the abdomen of a dark satiny-brown.



FIG. 24.—Neuration of wing of the maple-leaf cutter.

Figure 23 (after Fitch) represents the moth in enlargement, and Figure 24 (after Clemens) the neuration of its wings.

Remedies.

As the insect pupates within the leaves, and remains in them after their fall during the winter, its numbers may be greatly reduced in maple groves by permitting cattle or sheep to range therein, and attracting them to the more particularly infested trees, if such there are, by feeding salt beneath them, as suggested by Dr. Fitch.

When isolated shade trees are attacked, as they sometimes are (on the authority of Mr. Reed), the depredations may be arrested by spraying with London purple—one pound to 200 gallons of water.

Hæmatobia (Lyperosia) serrata Rob. Desv.*The Cow-horn Fly.*

(Ord. DIPTERA: Fam. STOMOXYDÆ.)

Hæmatobia serrata ROB. DESVOIDY: Essai sur les Myodaires, 1830, p. 389, 3.*Hæmatobia serrata*. MACQUART: Suites à Buffon, ii, 1835, p. 244.*Lyperosia serrata* RONDANI: Dipterologiæ Italicæ Prodomus, v, 1862, p. 231.*Priophora serrata* ROB DESV.: Hist. Nat. Dipt., 1863.*Stomoxys cornicola* WILLISTON MS.: LINTNER: in Count. Gent. for Oct. 18, 1888, liii, p. 779.*Hæmatobia serrata*. LINTNER: in Count. Gent. for Nov. 29, 1888, liii, p. 893.*Hæmatobia cornicola* WILLISTON. SMITH: in Count. Gent. for Aug. 8, 1889, liv, p. 591-2 (description, figures, habits, etc.): Bull. F. N. Jer. Agricultural. Col. Exp. St., 1889 (habits and remedies).*Hæmatobia cornicola* WILLISTON: in Entomolog. Amer. for Sept., 1889, v, p. 180-1 (figure, description and notes).—HOWARD: in Insect Life, ii, 1889, p. 60.

"The Texas fly." LINTNER: in Count. Gent. for Sept. 20, 1888, p. 705; id. for Oct. 11, 1888, p. 759.

"The Buffalo or Texas fly." Pacific Rural Press for Aug. 3, 1889, p. 89 (in Iowa).

Hæmatobia serrata occurs in Europe, in Southern France and in Italy, where it is reported as tormenting cattle. Beyond this, very little, so far as we know, has been written of it and we may therefore infer that it has not been regarded in its native home as a particular pest.

Its introduction into this country must have been of recent date. It seems to have been first noticed in Chester county, Penn., in the year 1886. In the autumn of 1887, the attention of Professor Cope, of Philadelphia, was drawn to the fly, as greatly annoying cattle and congregating in large numbers on and around their horns. My attention was called to it in the summer of 1888, through a communication submitted to me and published in the *Country Gentleman* of September twentieth, as follows:

Farmers in this neighborhood are making quite a time about a small fly that gets on their cows' horns. They say that they bore into the horn and deposit an egg that hatches, and the grub burrows into the head of the cow and produces death. They are putting tar over the cows' heads and horns, which I do not wish to do. They call it the Texas fly. Please answer in your valuable paper if there is any danger, or whether it is all moonshine. H. F. A., *Hamilton Square, N. J.*

Reply was made to the above of ignorance of any insect having the habits above described and a doubt of the existence of such. That an injury of this nature might be inflicted was within the range of possibility, but if the fly existed in Texas, or elsewhere in the United

States, or in other countries, it would have been known long ago to scientists. The story as told, therefore, of the Texas fly, need not be credited, and it does not seem advisable to make the application of tar to protect from injuries which probably do not occur.

The publication of the above called forth the following communication, contained in the *Country Gentleman* of October 11, 1888, which gave us the first definite information regarding the habits of the new insect, and was also accompanied with specimens of the same:

EDS. COUNTRY GENTLEMAN.—The small cow-fly referred to by your correspondent, on page 705, first attracted general attention in Chester county, Penn., in 1886. How long they may have been present in lesser numbers we do not know, but in that year they caused general comment by their habit of congregating on the horns of cattle, seeming at the first glance like a mass of tar, extending some three or four inches on the upper surface of the horn. Examination would soon show that they were not confined to the horns or head, but attacking the animal generally—neglecting, however, the legs and feet; where the ordinary fly is particularly troublesome. They especially feed on the shoulders and at the root of the tail—our cattle generally having a sore spot on the hairless skin on each side of the tail. They are, as will be seen by the sample mailed, about one-half as large as the ordinary fly, and quite like them in appearance. They avoid horses entirely, and appear to have largely reduced the number of their predecessors. They do not bite the milkers as the others did, and their several bites do not appear to annoy the cattle nearly as much as the old ones; but they are much more persistent, and come early in spring, long before “fly-time.” For want of a better name, our farmers are calling them Texan flies.

It is generally affirmed that they cling to the cow and bite all night. From my own observations, I doubt their feeding then.

It would be of considerable interest to learn how much of our country the fly has appeared in, and when it was first observed. Your readers can give us the information, no doubt.*

J. L. B.

KENNETT SQUARE, CHESTER CO., PA.

The fly was unknown to me. It was evidently closely allied to our well-known and common biting fly, *Stomoxys calcitrans* (Linn.), which appears in autumn and attacks animals and men, often entering our houses, and from its marked resemblance to the common house fly, not recognized as different until it inflicts a sudden, sharp, stinging bite through the stocking or elsewhere on the leg—seldom on any other part of the body. If captured and examined, the long, slender and projecting proboscis with which the bite is inflicted may be readily seen.

*No one, as yet, has given an earlier date than the above for the first appearance of the fly, nor has its distribution been ascertained.

Upon making inquiry of Dr. S. W. Williston, who is conceded to be the best authority among us on American Diptera, of his knowledge of the insect, reply was made that he had received specimens of it from several sources during the past year, and that it was a new species of *Stomoxys* which he would soon describe under the name of *cornicola*.*

Previous to this, it seems to have excited considerable attention throughout the State of New Jersey during the year 1887, and was accordingly made the subject of inquiry and remark at the Annual Meeting of the State Board of Agriculture held at Trenton on the 3d of February, 1888. The principal statements of interest made, were, that it appeared at different localities about the same time, viz., in the early morning before daylight. It was particularly fond of fastening itself on the udders of the cows, or where the skin of the animal is the thinnest. When the animal is lying down it settles on the thin skin behind the shoulder-blades. It often collected about the horns, and this spot would be covered with its excreta. It followed the cattle into the stall where it annoyed them both in the morning and evening. It had not been seen on horses or mules — only on cattle. Specimens of it had been sent to the Department at Washington, and it was learned from the Entomologist that it had not been seen by him before, and could not at present be named.†

Identical with an European Species.

Although new to all of our entomologists, it did not seem wise to accept it as a species that had long been with us and chanced to have remained undetected until it suddenly developed a new and peculiar habit of annoyance. So many of our more noted insect pests have, through the daily intercommunications of commerce been transferred from Europe to our shores, that it was quite probable that this also had a similar origin — the more so since the Diptera could be so easily carried on shipboard. A number of examples of the fly were therefore obtained and sent to Baron Osten Sacken of Heidelberg, Germany, whose special study of the Diptera during the past forty years, both in this country and in Europe have given him the highest rank among the Dipterologists of the world. He kindly returned answer that the insect, although a true Stomoxyd, and allied to *Stomoxys calcitrans*, was easily distinguishable from it in the following characters: 1. Its smaller size and more uniformly grayish-brown color. 2. Its long palpi, nearly as long as the horny, porrect proboscis. 3. The structure of the hind tarsi in the male, the two long basal joints of which show a

* See *Country Gentleman* of October 18, 1888, p. 779, where the proposed specific name is erroneously given as *cervicola*.

† *Fifteenth Ann. Rept. N. J. State Board of Agriculture*, 1888, p. 163.

triangular projection which makes the edge of the tarsus appear serrate; hence its specific name. It was the *Hæmatobia* (*Lyperosia* Rond.) *serrata* of Rob. Desvoidy.

The determination of the specific name had been made by his friend, Mr. F. Kowarz, to whom some of the specimens were sent, in consideration of his superior knowledge of European Diptera. He had written that "the most careful comparison has not disclosed any differences between the American and the European specimens of this fly."

European Bibliography of the Fly.

Baron Osten Sacken, with his accustomed kindness, also communicated the European bibliography of the insect herewith given, together with the following remarks upon the generic terms employed therein, which will be appreciated by the scientific student:

As there are several other species of *Hæmatobia* in existence, Rondani formed the genus *Lyperosia* (Prodr., etc., i. p. 92, 1856) for those of them which have the arista beset with hairs on the upper side only, and the end of the first longitudinal vein *opposite* the small cross-vein. In the remaining *Hæmatobias* the arista shows some few hairs on the under side also, and the first longitudinal vein reaches *beyond* the small cross-vein.

The genus *Priophora* was proposed by R. Desvoidy (in his posthumous work, Hist. Nat. Dipt., etc., 1863) for *H. serrata*, on account of the structure of the hind tarsi in the male. Robineau [Desvoidy] did not know of Rondani's publication; nevertheless *Priophora* and *Lyperosia* are *not* synonyms, and are based on different characters, viz., *Priophora* on the male hind tarsi, *Lyperosia* on the mode of hairiness of the arista and on the venation; *Priophora*, in Robineau, contains the single species *serrata*; while Rondani's *Lyperosia* contains *serrata* and *irritans*.

Doubt Expressed of its Introduction.

Prof. J. B. Smith, of the New Jersey Agricultural Experiment Station, in a recent publication on the fly (*loc. cit.*), expresses his belief that it is not an introduced species, and that there is no real reason for supposing it to be other than an American form which abnormal circumstances have raised to the rank of a temporary pest. It is but just to Prof. Smith to state that the opinion was expressed, and the MS. name of *H. cornicola* given it by Dr. Williston, accepted without the knowledge of the positive identification of the fly with the *H. serrata* of Europe, from the examples sent by me for comparison, as above stated. It is also learned from Dr. Williston, that his quite recent publication of *Hæmatobia cornicola* new sp., was also made in ignorance of the above determination — since unhesitatingly accepted by him,

The Fly Illustrated.

Those who desire a description of the fly may find it in the *Country Gentleman* or in *Entomologica Americana*, as cited. As preferable to a detailed description for the use of the agriculturist or stock grower, the illustration by Prof. Smith, given in the above places, is herewith presented.

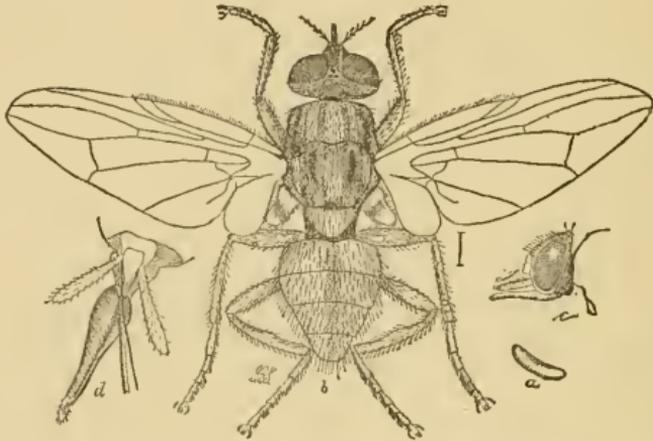


FIG. 25.—The Cow-horn fly, *HEMATOBIA SERBATA*: *a*, the egg; *b*, the imago or perfect insect; *c*, head of the same seen from its side, showing the proboscis at rest; *d*, mouth-parts, showing the long palpi and the proboscis with its lancets thrown out.

Life-history and Habits.

The interest excited by the sudden advent in great abundance of a new pest, together with the greatly exaggerated reports of the character and amount of injury it would inflict upon the cattle interests of the country, have drawn the earnest attention of some of our entomologists and others to it, but as yet we are without a published life-history of it. It is now generally known, however, that the fly does not deposit its eggs on the animal, the grubs from which bore into the horns and penetrate the brain, as at first believed, but that it oviposits largely, if not altogether, in fresh cow-droppings.

The egg, of a deep brown color and larger than that of the common house-fly, has been described by Prof. Smith, and Mr. L. A. Howard has given the entire period of development of the insect from the egg through the larval and pupal stages to the perfect fly, as only twelve days. A knowledge of this fact satisfactorily accounts for the rapidity of multiplication of the insect seen after its first appearance in the month of May.

Mr. E. Boder, of Freehold, N. J., who has apparently given close attention to the fly, has kindly furnished me some of his observations, from which I extract:

“In my observation in a pasture-field this morning I found a lot of horn-fly eggs on manure dropped last night and this A. M.—only on droppings that were in the shade. The eggs were scattered over the top and not buried in the manure as those of other cow-flies, and which, I think, prefer the sun.”

A number of the eggs thus found were sent me on different occasions, upon their bedding, but they could not be recognized when received, nor were larvæ from them found within. Two other species of *Muscide* were obtained from the masses, about fifteen days after reception, but no examples of the horn-fly. Others have experienced the same difficulty in attempts to rear the species.

Some other statements of habits, etc., contained in Mr. Boder's letters, are these :

Not one in fifty of the flies appear to be blood-suckers, judging from their actions by daytime, and, also, by crushing them fresh from the cow. Those that are blood-suckers also bite at night the cattle that are left out all night. For the past month (August), a portion of the flies have come to stall with the cows that are stalled all night.

It may be prejudice, but from my view, our common cow-fly [*Stomoxys calcitrans*], for biting, beats this new pest twenty to one in worrying the cows.

The fly subsists on the loose, soft part of the horn, near the head, and also, apparently, on the hair or dandruff, or both. [We can not imagine what operation of the fly has been mistaken for this feeding, for it is known that its mouth-parts—even of the male, which probably does not subsist on blood—are entirely unfitted for taking other than liquid food].

Heavy rains seem to be unfavorable to the production of the fly—perhaps through destroying its eggs. Ants and beetles of several kinds explore every piece of the droppings favorable, and apparently destroy millions of the maggots.

As these pages are about being handed to the printer, the gratifying information is received from Mr. Howard, of the Entomological Division at Washington, that they have secured full notes of the insect, have traced every stage of its life-history and have had a number of illustrations made, which will be published either in the Annual Report of the Entomologist, or earlier in Insect Life.

The Injury to Cattle.

The nature of the injury caused to cattle, from the attack of this fly, and its extent, has been so ably summarized by Prof. Smith that we copy the following from his paper cited, as best covering our present knowledge on the subject:

When many of these flies are at the cattle, of course the pain caused by the poisoned punctures is almost incessant; the cattle throw their heads about, lash their tails, and in every way try to get rid of their

tormentors. These, on the other hand, congregate at those points where they can not be easily reached, and the cattle are kept in a state of constant excitement. Judge Forsyth writes: "They live on them day and night and never leave them. My cows have shrunk in cream full one-half; the milk will not make but little more than half it did before the flies came." This is the primary injury caused. The cows kept in a constant state of annoyance, become poor and fall off in milk; secondarily, the cow, to get rid of the pests on her horns, and to allay the itching of the punctures at the base, will rub her head and horns against anything convenient to scratch, and inflammation of even a severe character may result—possibly even to the loss of one or both horns. There is no such thing as burrowing into the skin either by the larva or the imago, but the facts, as I have detailed them, are bad enough, since the result is the same, even if common observation has mistaken the actual cause.

Its Distribution.

Thus far the fly has been observed infesting cattle in northern Virginia, Maryland, Delaware, Pennsylvania, and New Jersey. I have not heard of its presence in New York, but in all probability it is to be found in some of the southeastern counties of the State.

The statement of its presence in Iowa, made in the *Pacific Rural Press* of August 3, 1889, and of the injuries inflicted by it, needs verification—the latter, to the extent stated, of course, can not be accepted.

The Buffalo fly, or Texan fly, an insect but half as large as the common house-fly, has been killing off the cattle in southeastern Iowa for some weeks past. A dispatch from Burlington states that the pests have caused the loss of several herds in that vicinity. They attack the cows at the base of the horns, and after a few days the horns come off. In another day the cow dies. Many beasts are suffering in a similar manner, and there has not been any remedy discovered that will effectually destroy the fly.

Preventives and Remedies.

It is believed that this new pest will not prove to be a difficult insect to control. There are several applications much less objectionable than tar that can be used for keeping the flies from alighting on the animal, or at least from remaining long enough to puncture the skin or be an annoyance otherwise. Crude kerosene oil, it is claimed, will accomplish this, without harm to the animal. The Division of Entomology at Washington has recommended the following: (1) Fish-oil and fine tar with a little sulphur added; (2) tobacco dust when the skin is not broken; (3) tallow and a small amount of carbolic acid.

Some oil mixed with "soluble phenyle" or almost any one of the popular "sheep-dips," properly applied, should prove efficient.

Professor Smith recommends very highly a tobacco-dust preparation known as X. O. Dust and manufactured by the Insecticide Manufacturing Co., at 10 East Camden street, Baltimore, as safe in use and prompt and efficient in action. He asserts: "If thoroughly applied so as to get the hair well dusted, no *Stomoxys* or *Hematobia* can stand it long enough to puncture the skin of the cattle. It would mean death to them. The powder does not lose strength by exposure."

But the best way to meet the insect, would, in all probability, be to destroy it in its earlier stages by applying lime to the droppings. If this be done on successive mornings, the eggs would be killed before their hatching and entering the manure as maggots. The suggestion of Mr. Howard is therefore valuable — to prevent the insect surviving the winter by liming the dung in the autumn where the cattle frequently stand at night. It being here that the eggs are deposited and where by far the larger number of the insects will probably hibernate, if the liming be done so thoroughly as to be carried or trodden into the droppings, it certainly should destroy all the horn-flies in its early stages that might otherwise survive the winter.

Dynastes Tityus (Linn.).

The Spotted Horn-bug.

(Ord. COLEOPTERA: Fam. SCARABÆIDÆ.)

LINNEUS: Syst. Nat., ii, 1767, p. 542, No. 5 (*Scarabæus Tityus*).

FABRICIUS: Syst. Ent., viii, 1775, p. 18; Sp. Ins., i, 1781, p. 8, No. 23 (*Scarabæus*); Ent. Syst., Pt. i, 1792, p. 10, No. 25; Syst. Eleuth., i, 1801, p. 10, No. 28 (*Geotrypes*).

SAY: Amer. Entomol., i, 1824, p. 8; Compl. Writ., i, 1883, p. 8, pl. 4 (*Scarabæus*).

FITCH: 3d Rept. Ins. N. Y. (3d-5th Repts.), 1859, p. 49, No. 72.

GLOVER: in Rept. Commis. Agricul. for 1868, p. 89, f. 80.

RILEY: in Amer. Entomol., ii, 1870, p. 374, f. 224.

HORN: in Trans. Amer. Ent. Soc., iii, 1870, p. 78 (var. *Grantii*).

LEBARON: 4th Rept. Ins. Ill., 1874, p. 84, f. 38.

THOMAS: 6th Rept. Ins. Ill. [1877], p. 96, f. 7 (description).

LINTNER: in Count. Gent., xlvii, 1882, p. 645; in id., I, 1885, p. 623.

DIMMOCK: in Cassino's Stand. Nat. Hist., ii, 1884, p. 368, f. 427.

JOHNSON: in Bull. No. 4, Divis. Entomol., U. S. Dept. Agricul., 1884, p. 78.

HENSHAW: List Coleop. N. Amer., 1885, p. 93, No. 5886.

SMITH: in Proc. Ent. Soc. Wash., i, 1888, p. 54 (its odor).

ATKINSON: Bull. No. 4, Agricul. Exp. St. Univ. S. Car., 1889, p. 87 (its odor).

WEBSTER: in Insect Life, ii, 1889, p. 89 (in Indiana).

The following communication, under date of August second, from a gentleman at Perrowville, Va., accompanied specimens of the above-named beetle. The reply made thereto in the *Country Gentleman* of

August 17, 1882, has been rewritten and extended in the present notice, in consideration of the particular interest attending the insect.

I send by mail to-day a box containing several specimens of a hideous and most offensive beetle which has recently begun its ravages in the ash trees on my lawn. Will you please tell me its name and character, and how to free our trees from its presence. The odor from these beetles is so offensive at night that it is disagreeable to sit in the open air. I learn that they also occur on the forest trees in our vicinity.

The beetle is the *Dynastes Tityus* of Linnæus, known under the popular names of "the spotted-horn-bug" and the "rhinoceros beetle"—each having reference to the large horns with which the male is armed—these horns being, as in many other species of Coleoptera, as notably in "the stag-beetle," a sexual feature.

An Odorous Insect.

The family of *Scarabæidæ*, to which this beetle belongs, contains many species which are noted for the disagreeable odor that they emit, but none have the penetration and pungency of this. Where a large number are congregated, the atmosphere in their vicinity would readily become quite unpleasant to the nostrils, for even the dead bodies of the half-dozen sent me, although occupying a place, as I am writing, upon an open piazza at a distance of several yards from me, and after having been exposed to the air throughout the night, have rendered their vicinity quite intolerable to some of the unscientific members of my family who have been sitting with me.

The remarkable offensiveness of this insect has often been commented on. Among other notices of it are the following:

Mr. J. B. Smith, in a paper read before the Entomological Society of Washington, September 2, 1886, on the peculiar odor emitted by these beetles, stated that they had during the season developed into a veritable pest. In two States, Virginia and Tennessee, they had been locally so abundant as to saturate the air with the penetrating stench. The local boards of health, especially that at Memphis, Tenn., disinfecting all sorts of foul and suspected localities without success, and only by accident was the true source of the smell at last discovered.

Prof. G. F. Atkinson, Entomologist of the Agricultural Experiment Station of South Carolina, states in Bulletin No. 4 of the station for January 4, 1889: "In the summer of 1886 the beetle was so plentiful, feeding on the leaves of the ash in Raleigh, N. C., as to cause a disagreeable odor, which pervaded nearly the whole city. For some time it was thought to be due to uncleanness in certain parts of the city, but was eventually traced to these beetles."

Description.

The beetle, although "horrid" in the eyes of the gentleman communicating it, is, to the entomologist, from its size, form, and ornamentation, a beautiful and attractive specimen of the Coleoptera. It is, perhaps, the largest of our United States beetles. The maximum size of the males before me (not the largest that occurs) is two and one-half inches in length (three and one-half inches with legs extended), one and one-tenth inch across the abdomen, and eight-tenths of an inch in thickness of body. The female has the general form of the much smaller grapevine beetle, *Pelidnota punctata*. The male has quite a different aspect, being armed anteriorly with two stout black horns of a half-inch or more in length, of which the



FIG. 26.—The Rhinoceros beetle, *DYNASTES TITIVUS*, male.

upper is a straight projection of the anterior part of the thorax, curving slightly toward its notched tip, and bearing stiff yellow hairs beneath; the lower one on the crown of the head curves upward to meet the other. On each side of, and near to, the thoracic horn is a black, short, sharp-pointed horn or spine. The thorax and wing-covers are of a pale olive-brown, the latter dotted irregularly with black spots of various sizes and shapes, of which some may be ocellated. Beneath, the abdomen is black. The legs are shining black, strong, and armed with stout spines and bristles. Fig. 26 represents the male as seen from above, and Fig. 27 as seen from the side.

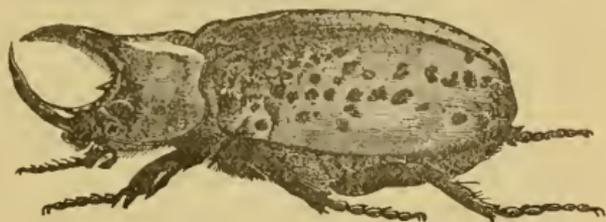


FIG. 27.—Side view of the Rhinoceros beetle.

Variation.—Much variation is presented in the colors and markings of these beetles, and particularly in the females. One example in my collection has the thorax black, while in another both the thorax and the wing-covers are very dark brown. A male before me has the

thorax of the normal color, while the elytra are dark brown, slightly mottled with paler brown. The females have the thorax delicately punctured (smooth in the other sex), with the wing-covers strongly punctured.

Distribution.

This beetle is quite abundant locally, at times, in most of the Southern States. To the west of the Mississippi, it occurs in Arizona, Kansas, Missouri, etc. It is found in Pennsylvania, but rarely. Dr. Fitch, in his *Third Report on the Insects of New York*, notices it as infesting the cherry (presumably in New York), but if taken within the State, it must have been in its southern portions.

Food of the Insect.

This insect has not been numbered among our insect pests, since its food has generally been supposed to be confined to decaying vegetable matter. The larva, probably, subsists only on material of this nature, which is a fortunate circumstance, for from its large size, attaining, it is said, four inches in length and a large diameter, it would be capable of inflicting most serious injury if it burrowed within the roots or trunks of living trees.

It has frequently been found (either as larva or imago) in cavities of dead or dying trees, as the cherry, willow, oak, etc., buried within the black vegetable material there accumulated.

The beetle, however, seems capable of injuries of considerable importance. Mr. J. W. Murrell, of Perrowville, Va., has informed me that, on the thirtieth of June, numbers of the beetle were feeding on the tender shoots of the spring growth of ash trees, causing the leaves to fall and cover the ground as if a frost had passed over them.

Request made of Mr. Murrell for additional observations on the feeding and other habits of the beetle was promptly complied with, in the following interesting communication received from his son, Mr. G. E. Murrell, of Coffe, Va.

Among the trees on my father's lawn are twenty of ash, to six of which my observations have been mostly directed, as they have been infested yearly for some time past. These are in different parts of the lawn, between other ash trees, and are the same in health and otherwise as those not attacked. I have first seen the beetles coming out of the ground at the roots of the trees; with one exception, which was four years ago, when I dug them out of a decayed fork of a mulberry, on which no trace of them has since been seen.

When feeding on the ash, they place themselves longitudinally on a smooth limb, and, rising to the full extent of their legs, move their entire body backward and forward like a plane, using several chisel-like projections on the under-side of the head for cutting, stopping the

motion as soon as the alburnum is reached, and never using their horns, so far as I can see, except for fighting. They breed below ground, to the best of my observation.

A neighbor says that he has been troubled with them on his tobacco, to which they are extremely fatal—no plant once attacked ever surviving.

The method of feeding on the bark of the ash, as above given, is an interesting item in the habits of the beetle, but it leaves us desirous of further information as to whether it prefers the bark to the leaves, and if it consumes, harmlessly, only the outer bark, or injuriously, also, the alburnum beneath. Does the larva, in its growth within the ground, subsist only on decaying vegetable matter, or in part on the rootlets of the trees?

The nature of the attack on tobacco—in what manner and to what extent it feeds upon it—would also be of much interest toward a fuller knowledge of this large insect.

Remedies.

When attacking, to a harmful extent, shade or ornamental trees, or when the offensive odor becomes intolerable, the beetles may be destroyed by the application of an arsenite to the foliage, or by jarring or beating them from the branches and dropping them in hot water.

Oberea bimaculata (Oliv.).

The Raspberry-cane Girdler.

(Ord. COLEOPTERA: Fam. CERAMBYCIDÆ.)

Saperda tripunctata FABRICIUS: Ent. Syst., i, pt. ii, 1792, p. 310, No. 15; Syst. Eleuth., ii, 1801, p. 321.

Saperda bimaeculata OLIVIER: Entomologie, iv, 1795, 68, p. 21, pl. 4, f. 43.

Saperda affinis HARRIS: Rept. Ins. Mass., 1841, p. 91.

Oberea tripunctata HALDEMAN: in Trans. Amer. Philosoph. Soc., x, 1847, p. 57.

Oberea perspicillata HALDEMAN: in loc. cit. sup., p. 57.

Oberea tripunctata. LECONTE: in Journ. Acad. Nat. Sci. Phila., 1852, p. 153.

Oberea basalis LECONTE: in loc. cit. sup., p. 153.

Saperda (*Oberea*) *tripunctata* HARRIS: Ins. New Engl., 1852, p. 100; Ins. Inj. Veg., 1862, p. 114, f. 51.

Saperda tripunctata. EXMONS: in Nat. Hist. N.Y.—Agricul., v, 1854, p. 122, pl. 16, f. 7.

Oberea tripunctata. GLOVER: in Rept. Comm. Agricul. for 1863, p. 576.

Oberea tripunctata. SAUNDERS: in Rept. Ent. Soc. Ont. for 1873, p. 8-9; Ins. Inj. Fruits, 1883, p. 305-6, f. 315 (*O. bimaculata*).

Oberea tripunctata. LINTNER: in Count. Gent., xxxix, 1874, p. 487.

Oberea perspicillata. RILEY: 6th Rept. Ins. Mo., 1874, p. 111 (quotes Provancher).

Oberea tripunctata. PROVANCHER: Pet. Faun. Entomolog. Can., 1877, p. 636.

Oberea bimaculata. HORN: in Trans. Amer. Ent. Soc., vii, 1878, pp. 46, 48.

Oberea bimaculata. HENSHAW: List Coleop. N. Amer., 1885, p. 104, No. 6496.

An insect attack on the new shoots of the raspberry which is often the occasion of inquiry, is that which attends the oviposition of the raspberry-cane borer. The following is received from Potsdam, N. Y.:

You will find herewith a small vial containing an insect and three pieces of canes of Brinckle's Orange raspberry. You will see the two rings that are made in the canes between which an egg is deposited — usually in the center, but not always. Can you give me the name of the creature which is causing so much mischief; and what shall we do to prevent the destruction of our raspberries?

Synonymy of the Insect.

The author of the mischief above described is a longicorn beetle having the scientific name of *Oberea bimaculata*. As may be seen above, it was given the name of *Saperda bimaculata* by Olivier in 1795. It had been previously named by Fabricius as *tripunctata*, from the three black spots that its thorax frequently bears, and it was for a long time, and until quite recently, known under the Fabrician name. When it was found, however, that the name had been preoccupied in the same genus by a species by Swederus occurring also in the United States, it was necessarily abandoned for that given it somewhat later by Olivier. Of the other specific names, that bestowed on it by Dr. LeConte, *basilis*, was based on examples in which the entire basal margin of the thorax is black; and *perspicillata* of Haldeman, on smaller forms showing some other features not of specific importance.

Description of the Beetle.

The beetle is of a slender cylindrical form, about a half-inch in length, with delicate antennæ nearly as long as the body and tapering slightly toward the tip. It is of a deep black color except the forepart of the breast and top of the thorax which are rusty-yellow. There are two black elevated dots on the middle of the thorax (sometimes absent) and a third dot (usually) on its hinder border. The wing-covers are closely punctured in the rows, and irregularly on the sides and tips — each of the latter slightly notched and ending in two little points.



FIG. 28. — The raspberry-cane borer, *OBEEEA BIMACULATA*.

The Cane-girdling.

The two rings referred to in the communication consist of closely placed punctures which are made by the mandibles of the beetle around the stem not far from its tip; the distance between the rings ranges from half an inch to one inch. As soon as these punctures are made — usually in the month of June — the portion of the cane above the upper girdling commences to wither and droop, to shrivel and die, when it is easily broken off by the wind.

It is supposed that the purpose served by the girdling is the arrest of the circulation of the cane in the portion thus treated, to the extent that the tender egg deposited therein may not be crushed by the vigorous and rapid growth of the tips at just this season. A number of insects are apparently endued with an instinct that leads them to resort to some similar method for the preservation of their eggs in cases where a provision of the kind seems to be needed.

Summary of Life-history.

The egg, which is deposited by the beetle in the cane previous to the girdling, hatches in a few days and the grub therefrom burrows downward into the cane, feeding meanwhile upon the pith. It may be found full-grown a few inches down the stem about the first of September. It passes the winter within the stem (according to Riley, in the root beneath the surface of the ground), to emerge therefrom as the perfect beetle the following June.

The beetle unquestionably prefers the garden raspberry for oviposition, yet it is also to be found at times on the more tender canes of the blackberry. Professor Riley has observed its operations in cottonwood [*Populus monilifera*], and identified its oviposition in the twigs of persimmon [*Diospyros Virginiana*] from Saint Augustine, Florida.* A closely related species, *Oberea Schaumii*, oviposits in sassafras, according to Mr. Schwarz.

The *Oberea perspicillata* of Walsh and other writers is our raspberry-cane borer under a name given it by Haldeman in 1847, as cited.

Remedy.

It is seldom that this insect appears in sufficient number to be the occasion of serious injury. Its multiplication may be prevented by going over the bushes at intervals of a few days, during the period of its oviposition when the bent and wilted tips at once disclose the attack, and breaking off the egg-bearing tips at the lower ring. If these tips are destroyed, the unhatched eggs or the newly hatched larvæ will be destroyed with them, the larva not having at this time passed downward into the cane.

* Bulletin No. 12, Div. of Entomology, U. S. Dept. Agricul., 1886, p. 34.

Galeruca xanthomelæna (Schrank).*The Elm-leaf Beetle.*

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

- LINNEUS: Syst. Nat., ii, 1767, p. 600, No. 101 (*Chrysomela Calmariensis*.)
- FABRICIUS: Syst. Ent., 1775, p. 119, No. 4 (*Crioceris Calmariensis*); Spec. Ins., i, 1781, p. 150, No. 6; Mant. Ins., i, 1787, p. 87, No. 7; Ent. Syst., i, pt. ii, 1792, p. 23, No. 46 (*Galeruca Calmariensis*).
- SCHRANK: Enumeratio Insectorum Austriæ indigenorum, 1781, p. 78.
- OLIVIER: Encyc. Method.—Hist. Nat. Ins., vi, 1791, p. 589 (as *Galeruca cal-mariensis*).
- WESTWOOD: Introduc. Classif. Ins., 1839, p. 382 (destructiveness in Sevres).
- HARRIS: Treat. Ins. N. Eng., 1852, p. 109; Ins. Inj. Veg., 1862, p. 124 (*Gale-ruca Cal.*).
- EMMONS: in Nat. Hist. N. Y.—Agricul., iv, 1854, p. 134, pl. 12, f. 12.
- FITCH: in Trans. N. Y. St. Agr. Soc. for 1858, xviii, 1859, p. 842-3; 3d-5th Repts. Ins. N. Y. (5th Rept.), 1859, p. 62-3.
- LECONTE: in Proc. Acad. Nat. Sci. Phil. for 1865, p. 218 (features and references).
- GLOVER: in Rept. Commis. Agr. for 1867, p. 62 (br. ref. and fig.); id. for 1870, p. 73.
- RATHVON: in Field and Forest, ii, 1876, pp. 96-98 (at Lancaster, Pa.).
- RILEY: in Rept. Comm. Agricul. for 1878, p. 245 (br. ref.); in Amer. Entomol., iii, 1880, p. 291 (natural history, enemies, etc.); in Ann. Rept. Comm. Agricul. for 1883, pp. 159-170, pl. 12, f. 3 (full account); same, repub. as Bull. No. 6, U. S. Dept. Agricul., Divis. of Ent., 1885; same, in Bull. No. 10 id., 1887, pp. 8-22, figs. 1-6.
- FULLER: in Amer. Entomol., iii, 1880, p. 3 (at Newburgh, N. Y.).
- LOCKWOOD: in Amer. Nat., xv, 1881, pp. 242-244 (hibernation); in Bull. No. 4, U. S. Dept. Agr., Div. Entomol., 1884, p. 90 (ravages at Freehold, N. J.).
- PACKARD: Ins. Inj. For.-Sh. Trees, in Bull. No. 7, U. S. Ent. Commis., 1881, p. 64 (brief description).
- LINTNER: in Count. Gent., xlvii, 1882, p. 805; id., l, 1885, p. 841 (remedies, etc.); in Canad. Entomol., xvi, 1884, p. 183 (reference); in Count. Gent., li, 1886, p. 409 (bibliography, etc.): lii, 1887, pp. 421, 565, 695 (spraying for); 4th Rept. Ins. N. Y., 1888, pp. 15, 143, 161, fig. 59 (extension of range).
- VAN WAGENEN: in Canad. Entomol., xv, 1883, p. 160 (abundance at Cold Spring, N. Y.).
- CLARKSON: in Canad. Entomol., xvi, 1884, p. 124 (at Flatbush, L. I.).
- HENSHAW: in Cassino's Stand. Nat. Hist., ii, 1884, p. 316 (its enemies, etc.); List Coleop. N. Amer., 1885, p. 111, No. 6912.
- COOK: in Rur. N. Yorker, xlv, 1886, p. 577 (general notice).
- DYAR: in Insect Life, i, 1889, p. 285 (at Poughkeepsie).

This destructive insect pest, which within the last few years has extended its ravages into the State of New York, entering it from the south and spreading northward with a steady progress that threatens to carry it to the northern borders of the State, and even beyond, is one of the many injurious species which Europe has contributed to

us. Its great destructiveness wherever it has established itself among us, is one of the many attestations to the often-made statement, that by far the larger number of our more injurious insect pests have been introduced from Europe.

Belongs to the Chrysomelidæ.

It belongs to the *Chrysomelide*, that large family of very bad reputation on account of their leaf-eating habits. The beetle is a small, yellow-legged, brown insect, having a broad dull-black stripe

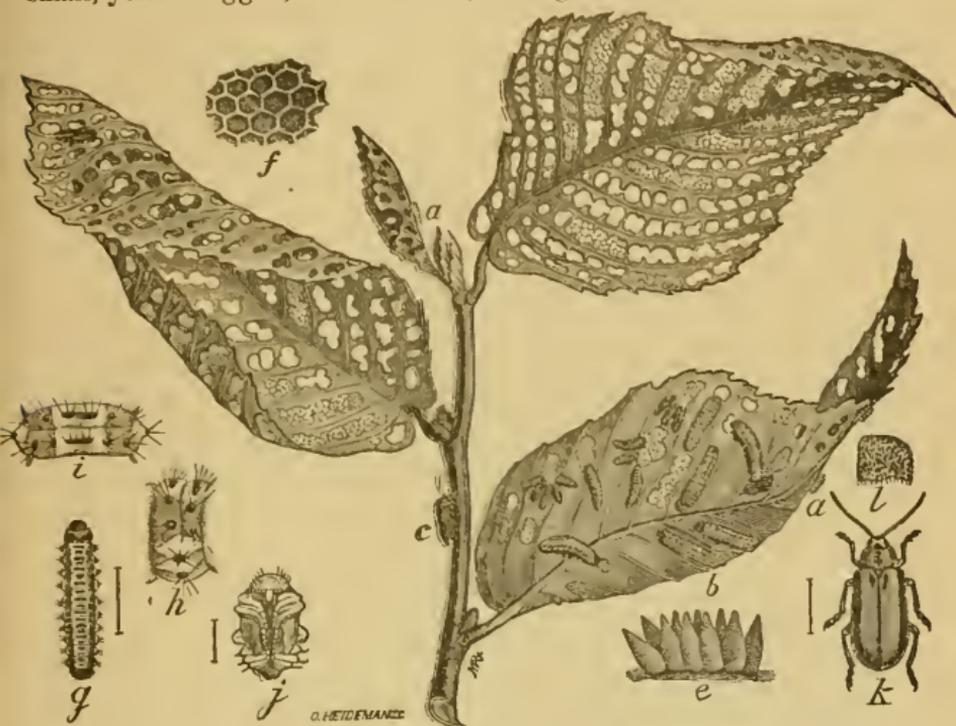


FIG. 29.—The Elm-leaf Beetle, *GALERUCA XANTHOMELENA*, in its different stages.

on each wing-cover toward its outer margin, and three black spots upon the ochreous thorax. In size and general appearance it resembles another well-known member of the family—the striped cucumber beetle, *Diabrotica vittata* (Fabr.). The insect has been so often described in its egg, larval and perfect stages in the Reports and Bulletins of the Entomological Division of the Department of Agriculture, that it does not seem desirable to repeat the details here. Those who may desire detailed descriptions for the purpose of identification or for scientific use, are referred to these publications or to some other of those included in the bibliographical list accompanying this notice.

The figure above given, illustrative of the insect in its several stages, which was presented in our fourth report and is herewith

repeated, should suffice for its recognition when met with upon the elm. In it, *a*, shows the eggs as they are deposited in clusters on the leaf; *b*, the larvæ; *c*, the beetle in natural size; *e*, the eggs enlarged; *f*, their sculpture under a high magnifying power; *g*, the larva in about twice its natural size; *h*, a side view of the segment of the larva; *i*, dorsal view of the same; *j* and *k*, the pupa and the beetle enlarged; *l*, a portion of the wing-cover of the beetle enlarged.

Its European Reputation.

This species has long been known as, at times, quite injurious to the foliage of elms in Europe, but it nowhere appears to have occasioned even an approach to the amount of harm that it has in this country. Linnæus wrote of it over a century ago, in 1767, and named it *Chrysomela Calmariensis*, from its occurrence in Calmaria, a small sea-port town in Sweden.

Introduction in the United States.

It was introduced in this country, according to Glover, as early as the year 1837, but probably several years earlier than this, for it is recorded that in 1838 and 1839, elms in Baltimore and the vicinity were entirely stripped of their leaves in midsummer, and when new leaves had again put forth, these were also destroyed by a second brood of the grubs. Such a degree of multiplication could not have taken place in less time than six or eight years.

Its Ravages.

It has proved very destructive in the District of Columbia, in various portions of New Jersey, and in Pennsylvania. Later, it made its appearance upon the elms in the State of New York, and has wrought great havoc among them.

In 1879, it appeared in immense numbers at Newburgh, N. Y., and almost entirely stripped the foliage from the elms that it attacked. (*American Entomologist*, iii, 1880, p. 3.)

The *New York Daily Tribune*, of July 8, 1884, contained the following picture of the destructions caused by this insect on Long Island:

WORK OF ELM-TREE BEETLES.—Flushing, L. I., is suffering from an insect plague which bids fair to mar the renowned arborial beauties of the village. A few days ago it was noticed that the leaves on several stately trees in Main street were withering. A more careful examination resulted in the discovery that the trees were covered from trunk to topmost branch with little worms about half an inch long. On the ground under the trees were thousands of dead insects which had been blown off and trodden upon by pedestrians, making a most disgusting sight. All the trees in every part of the village are being

slowly ruined by these insects. They are what are known as elm-tree beetles, but they do not confine their presence to elm trees. A number of attempts have been made to destroy them, but without success. It is said that in a communication sent to the Commissioner of Agriculture in Washington last year by a distinguished naturalist, he gave it as the result of his experiments that there was no means of exterminating the beetles. All sorts of insect powders have been used by the residents, but in vain. The village streets present such a plague-stricken appearance that the trustees will probably order some of the trees to be cut down to prevent the pestilence from spreading.

Mr. James Angus has written me of the ravages of the insect as observed by him near Throggs Neck, Westchester county, N. Y., on the 24th of August, 1883. A row of elm trees bordering the road had been entirely defoliated by it. "Incredible as it may seem, there was not a green leaf on any of the trees, except that upon some limbs a second growth had commenced. The leaves had been attacked rose-slug fashion, and every tree looked as badly as the worst slug-eaten rose-bush that I had ever seen." Writing the following year, under date of May thirty-first, he stated: "I visited to-day the place where the insect was so destructive last year, and found that the elms were eaten far worse than ever before. A gardener informed me that the leaves had been stripped three times during the preceding year. He showed me two trees that had been killed, and others of which most of the outer limbs were dead."

Life-history, as Given by Glover.

The habits and transformations of this insect were concisely and correctly given, and with such a degree of fullness as to leave but little to be added, by Mr. Glover, Entomologist of the U. S. Department of Agriculture, in the *Report of the Commissioner of Agriculture* for the year 1867 (pp. 62-63, with figures). We therefore quote the following from the report named:

The insect deposits its eggs in clusters upon the leaves, the worms or larvæ from which are hatched out in a few days, and immediately commence to feed upon the parenchyma or soft pulpy substance of the leaf, at first making merely small blotches, but eventually, as they increase in size, destroying the whole leaf, leaving only the harder part, such as the midribs and network of veins untouched, thus causing the leaves to turn brown and wither, until the whole tree assumes the appearance of having been scorched by fire. These worms, when fully grown and ready to change to pupæ, not being able to descend by means of a silken thread, like the real caterpillar, crawl down the trunk to the ground; and soon casting their larva skin, change into pupæ on or near the surface of the earth, at the foot of the tree they have despoiled. Some of the worms, however, conceal themselves in

fissures of the bark, where they undergo their transformations into the perfect beetle. These last, however, are few, and bear no comparison with the multitudes of the pupæ which will be found on the damp ground, motionless, helpless, and appearing like grains of wheat accidentally fallen near the tree. After becoming pupæ, in a few days the skin of the back splits open, and the perfect insect crawls forth, furnished with wings, by means of which it is enabled to fly to other trees to deposit its eggs, thus spreading the nuisance to every elm in the neighborhood, or it may ascend the same tree and lay the eggs for the second generation, which destroys the second crop of leaves, frequently so enfeebling the already exhausted tree that it is unable to recover, and eventually dies.

Hibernation of the Beetle.

To the above comprehensive account of Mr. Glover may be added a few additional observations on the life-history of the insect for the benefit of those who may desire as full a history as may be given, in order that they may be the better prepared to meet it in its several stages of transformation.

The insect hibernates in the beetle stage. Members of the last brood (in the State of New York we have two broods a year*) — those that have survived the dangers to which they are exposed — quite early in the season (time not definitely known) seek such sheltered places as may offer them fitting quarters for their winter's sleep. Many enter out-buildings and dwellings for their hibernation, for each spring examples of the beetle, found within doors, and usually in unoccupied apartments, are sent for name and other information, their numbers having drawn attention to them as unknown guests. Mr. Angus, of West Farms, New York, has informed me that a neighbor, whose house was overtopped with two large elms, and had been closed for some time during the summer, upon his return, found the beetle in large numbers lying about everywhere. They had entered the house through the crevices in the shingled roof, and through the chimneys.

The time of the emergence of the beetle from its winter's retreat will vary, of course, with the degree of forwardness of vegetation, but it will be as early as the leaves of the elms are in condition to receive the eggs. On the 24th of April, 1884, Mr. Angus wrote me that it was then first making its appearance in the garret of his house.

* Although this has been generally accepted, Rev. Mr. Hulst and Prof. J. B. Smith, from careful observations made on the insect, as entomologists of the New Jersey Agricultural College Experiment Station, have reached the positive conclusion that for the last two years, at least, there has been but a single annual brood in that State. There may be, they think, a second brood in Washington, but not in New Jersey and to the northward.

A week later, he could send me any number for examination if desired. Writing again on the twenty-eighth inst., he stated, "the garrets of all the houses in the neighborhood where there are elms are full of them."

Oviposition.

It appears that both sexes hibernate, and that their union takes place in the spring, after they have flown to the elms and fed to a noticeable degree on the new foliage. Leaves quite badly eaten by the hibernating beetles have been sent to me from Mr. Angus on the twenty-third of May, and on the thirty-first the beetles were reported as copulating and the females rapidly laying their eggs.

Pupation.

The pupation occurs in July. On the ninth of that month Mr. Angus wrote that the larvæ were then pupating in "handfuls" in the crevices of the bark at West Farms. A moderate amount of shelter satisfies the larva, and it accordingly assumes its pupal state under any convenient crevice offered it as between the base of the tree and the ground surrounding it, in crevices between the bricks of a sidewalk, beneath stones or any other object lying on the ground. The beetles make their reappearance after a very brief pupation, rarely exceeding ten days.* Riley has recorded pupation at Washington on July twenty-ninth, which may have been of the third brood.

Remedies.

The most effectual remedy for the ravages of this insect is believed to be spraying the foliage of the infested elms with Paris green or London purple in water. Of these, London purple has been found, through careful experiments made, to answer the purpose the better. Its efficiency will of course depend upon its method of application—the apparatus used, the liquid and the time applied. A suitable force-pump is essential to success. It should have sufficient power to carry the liquid to a good distance and distribute it over a broad area. The nozzle for its distribution should be an atomizer, or the finest of the "Nixon nozzles," made at Dayton, O., or one of the several "graduating spray nozzles" which are in market. The nearer the spray can be made to approach a mist the more effectually will it be spread over the foliage, with the least expenditure of material and with the least injury to the leaves.

If the spray is to be applied to tall and large trees, from the ground or from a wagon, a long rubber hose will be needed having the

* See foot-note on preceding page for qualification of this statement.

nozzle at its end, and tied, for convenience of elevation, to a long bamboo or other light rod. If the highest portion of the tree may not be reached in this manner, a portable spraying apparatus holding four or five gallons, such as is advertised and illustrated in some of the agricultural journals, may be strapped upon the back, and, ascending the tree with a ladder, the spray distributed from its principal limbs.

The proportion of London purple to be used would be one pound to 200 gallons of water. To the above eight quarts of flour might be advantageously added, the effect of which would be to cause the arsenite to adhere better to the leaves and prolong its usefulness.

It is quite important that the spraying should be done early—even before the first traces of injury to the foliage are discovered—as soon as examination shows that the eggs of the beetle are being deposited on the leaves, usually on the under side. They can readily be seen, as they are of a yellow color, oblong-oval in form, and placed on end—sometimes but two or three together, but more often in clusters of from ten to twenty. By early spraying, a less strength of the arsenite is needed to poison the young larva as soon as it hatches from the egg, and the foliage is less liable to sustain injury, as there will be at the time no eaten and raw edges of the leaves to absorb the poison rapidly, and thereby causing greater harm.

If the spraying be properly done at the right time, it should not be necessary to repeat it, unless a heavy rain occurs very soon thereafter. If the foliage shows continued depredations, a second spraying should follow in ten days or a fortnight.

Sulphur for the Elm Beetle.*

W. H. Dodd, of Orange, N. J., says that he has demonstrated to his satisfaction that the annual attack of the elm beetle upon elm trees in this country can be thwarted by an extremely simple and inexpensive process. He addressed a meeting of interested citizens in Bloomfield on Tuesday night, and described the plan which he used last year, not only upon a large elm, but upon fruit trees which were infested with insect pests of various kinds. He says that in the early spring he bores one-inch auger holes, five inches apart and in a circle around the trunk of the tree, about eighteen inches from the ground, taking care that the holes do not penetrate beyond the sap-wood of the tree. Then he fills the holes with flowers of sulphur or powdered brimstone, and loosely plugs them up. He says that the plan worked to perfection last year. His idea seemed to be that the sap took up the sulphur and carried it into the leaves, making them distasteful to the worms which hatch out on the under side of the leaves from the eggs deposited there by the beetles. The plan involved little trouble or expense.—*New York Sun.*

* Communicated, by request, to the *Country Gentleman* of March 15, 1888.

Repeated experiments have failed to show any benefit from the use of the above reputed remedy for insect attack on the foliage of fruit or other trees. It seems to have been first announced sixty-six years ago in the *Memoirs of the [old] New York Board of Agriculture* (vol. ii, page 250, by George Webster, of Albany, who, after having bored holes six inches deep in his infested trees, which he filled with sulphur and tightly plugged, found that all the caterpillars disappeared within a day or two thereafter. Others who tried the experiment had the same result. This was, perhaps naturally, ascribed to the sulphur, when, in fact, the larvæ had matured and left the trees to find suitable places for pupation.

Mr. Dodd, the latest propagator of the old remedy, claims that the sap takes up the sulphur, carries it into the leaves and makes them distasteful for food. This can not be true. Sulphur can not enter into circulation, unless it be first dissolved, and we know that it is not dissolvable by the sap of plants or trees. Mr. Isaac Wicks, of New York, having placed a quantity in some peach trees as a remedy for the yellows, on cutting up the trees five years thereafter, found it still remaining in the cavities in its original condition (*Practical Entomologist*, i, 1865, p. 125).

Nor is there any reason to believe that if the sulphur could be carried into the sap, the leaves would thereby become distasteful or injurious to the caterpillars. Among the various articles experimented with in France in search of some remedy against that terrible scourge of the vineyards, Phylloxera, sulphur was tested, but without any effect either upon the leaf or root insects, although these are almost microscopic and exceedingly delicate creatures.

Experiments made by Dr. Fitch prove conclusively that sulphur is not injurious to the apple-tree tent-caterpillar. A limb of a wild cherry tree having on it a nest of these caterpillars which were only one-fourth of an inch long, was cut off and placed in a cup of sulphur slightly moistened with water—a more severe test than if the material had been inserted in the branch. A limb containing another nest was placed beside it in a cup with water only. At the end of nine days the caterpillars of the last-named nest measured four-tenths of an inch long, while the others had grown to double the size, measuring from 0.8 to 0.85 inch. The experiment seemed to show that so far from the sulphur having been injurious to them, it had rendered them more healthy and robust, and accelerated their growth. (*First and Second Reports on the Insects of New York*, 1856, p. 203.)

It seems a great pity that something as simple as the "sulphur cure" can not be found available against the elm-leaf beetle, but until such a discovery shall be made, we shall have to hold fast to the well-tested and efficient method of spraying with Paris green or London purple, with a suitable force-pump, and a sufficient length of hose furnished with an atomizing nozzle; or, later, to cage the mature larvæ for destruction in a box, tarred within and on the bottom, placed around the tree trunk, when they descend the tree for pupation in the ground.

The Box Remedy.

The box, above mentioned, was suggested by Mr. Glover, in his Annual Report as Entomologist to the U. S. Department of Agriculture for the year 1867:

Place around each tree a low open box or frame about a foot or eighteen inches in height, at about the same distance from the main trunk, its lower part sunk four or five inches below the surface of the soil, the top capped with strips of bright tin sloping inwards and projecting on both sides like the eaves of a house, and the upper half of the inside boards painted every morning with coal tar or some other viscid substance. The earth within should be covered with cement. It being the habit of the larvæ when full grown to crawl down the trunk of the tree, they would, upon their descent, be imprisoned within the frames, being unable to escape either by entering the ground, or crawling outside over the tar and the projecting tin. They would therefore be compelled to change to pupæ within the frames, where they could at any time easily be killed by hot water or otherwise, by thousands. The frames should be made so as to be readily taken apart and laid aside at the close of the attack, until they are again needed.

Mr. Glover remarks that the same box might also be used for preventing the female canker worm, *Anisopteryx vernata* (Peck) from ascending the elms and fruit trees for the deposit of her eggs; but in that case, the tar should be applied to the outside of the box.

♀ *Clastoptera obtusa* (Say).

The Alder Spittle-Insect.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. CERCOPIDEÆ.)

Cercopis obtusa SAY: in Jour. Acad. Nat. Sci. Phila., iv, 1825, p. 339; Compl. Writ., Lec. Edit., ii, 1883, p. 256.

Clastoptera obtusa FITCH: in 4th Rept. N. Y. St. Cab. Nat. Hist., 1851, p. 53.—UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 244.—COMSTOCK: Introduc. Eutomol., 1888, p. 178.—PROVANCHER: Pet. Faun. Ent. Can.—Hemip., 1889, p. 259.

Its Spittle Observed.

The peculiar frothy masses of the secretion of a spittle-insect were observed on June twenty-seventh, in a large clump of alders, *Alnus serrulata*, at West Albany, N. Y. On every bush of even moderate size hundreds of the masses were clinging. They were believed to be the *Clastoptera obtusa* of Say, which Uhler represents as common on the black alder in July. The larvæ within the secretion may have been at this time half-grown.

Observations on the Insect.

On the seventh of July the locality was revisited for further observation. The perfect insect had made its appearance, and fifteen examples of it were secured. It proved to be, as was expected, *Clastoptera obtusa*. The species had developed unequally, for the spittle masses were still abundant—some containing the larvæ and others the pupæ. Twigs bearing the secretion were collected. When placed in a box for rearing, if possible, the immature insects all left their coverings and traveled over the box within, escaping from beneath a not very close-fitting lid. The larvæ were nearly white. Their legs were long in proportion to the size of the body and were moved rapidly in walking. The pupæ, which had but recently undergone their transformation, show but little coloring, especially on their wing-pads. With increased age they become more deeply colored, and are olive-green on their thorax, wing-cases and legs. The thin, transparent cases from which the larvæ had emerged were adhering to the stems and leaves of the alders.

The Spittle Mass.

C. obtusa belongs to a group of Hemipterous insects, known as "spittle-insects," from the frothy, liquid mass, resembling human spittle, in which the larvæ and the pupæ live concealed. These insects derive their sustenance from the stem or plant or grass upon which they are found, by sucking the juices through the proboscis with which all of the Hemiptera are provided in place of the cutting jaws or mandibles of most of the other orders. The excess of the sap beyond what is needed for their sustenance, is thrown out to form the "spittle" mass, which is often so abundant as to fall to the ground in drops of clear liquid when the imprisoned air has escaped from it.

How the Spittle-mass is Produced.

There seems to be a question as to the manner in which the frothy matter is produced. Mr. Uhler, our authority in the Hemiptera, in Cassino's *Standard Natural History* has stated: "The larvæ live covered by masses of white froth, which the insect produces by expelling from its beak the juices drawn out of the tree." DeGeer, the dis-

tinguished Swedish naturalist, has given an elaborate account of the observations made by him on the method of the spittle production. Wishing to obtain definite knowledge in relation to it, he removed one of the insects from its frothy coverings, wiped it dry with a camel's-hair pencil, and placed it on a freshly cut stalk of honeysuckle in a glass of water. The following is his account of what he saw:

It begins by fixing itself on a certain part of the stalk, in which it inserts the end of its trunk, and remains there for a long time in the same attitude, occupied in sucking and filling itself with the sap. Having then withdrawn its trunk, it remains there, or else places itself on a leaf, where after different reiterated movements of its abdomen, which it raises and lowers and turns on all sides, one may see coming out of the hinder part of its body a little ball of liquid, which it causes to slip along, bending it under its body. Beginning the same movements again, it is not long in producing a second globule of the liquid, filled with air like the first, which it places side by side with, and close to the preceding one, and continues the same operation so long as there is any sap left in its body. It is very soon covered with a number of small globules, which, coming out of its body one after the other, tend toward the front part, aided in this by the movement of its abdomen. It is all these globules collected together which form a white and extremely fine froth, the viscosity of which keeps the air shut up in the globules and prevents its froth from easily evaporating. If the sap which the larva has drawn from the plant is exhausted before it feels itself sufficiently covered with froth, it begins to suck afresh, until it has drawn a new and sufficient quantity of liquid, which it takes care to add to its first stock. (*Memoires pour servir a l'Histoire des Insectes*, Tome 3.)

In another place DeGeer makes this positive statement: "The globules have absolutely no other issue than from the anus."

Purpose of the Secretion.

As to the purpose served by this liquid covering, it has been conjectured that it has the effect of protecting the delicate-skinned insect from the burning heat of the sun, for it can not live long if withdrawn from it, for the insect soon shrinks and speedily dies. It is thought also that the covering protects it from carnivorous insects and other enemies, that but for this concealment would prey upon it. It does not, however, give it entire immunity, for some of the larvæ collected by me at West Albany had been visited with a parasitic attack, and several *Chrysopa* larvæ were found in such association with the spittle masses that they were undoubtedly preying upon the insects concealed within.

Description of the Insect.

Uhler has briefly characterized it as of a claret-brown color above, marked with two pale bands on the vertex, two on the prothorax, and a wavy, broader band on the wing-covers. The membrane is often

whitish, the waved band is extended exteriorly, and there is a pale v-shaped figure on the end of the scutellum. It is a little larger than *Clastoptera Proteus*, a very common species, living on cranberry and blueberry bushes in swampy places throughout the Eastern United States.

It inhabits Canada, many parts of the eastern side of the United States, and is distributed southwest into Texas, and Tamaulipas, Mexico (Uhler).

Say (*loc. cit.*) has given a more detailed description of the insect, but the above should serve for its identification.

Some of the Spittle Insects.

There are a number of species of the insect which produce and live in this peculiar secretion, constituting the Hemipterous family of *Cercopidæ*, and occurring on various kinds of vegetation, as grasses, several of the weeds, on the grapevine, on willows, pines, etc. One of them, *Ptyelus lineatus* (Linn.), was briefly noticed and illustrated in the *Fourth Report of the Insects of New York*. The species more commonly met with belong to the genera of *Aphrophora* (meaning in the Greek, I bear froth), *Lepyronia*, and *Ptyelus*, meaning saliva. Of the first-named genus, the frothy envelope of the larval *Aphrophora parallela*, is often quite common on the white pine, and I have had drops from it fall upon me with unpleasant frequency when sitting under the branches, while pinning insect collections, in the month of June. *Aphrophora quadrinota* Say, and *A. Signoreti* Fitch, occur on the grapevine, and *A. quadrangularis* Say, on grasses, weeds and blackberry twigs. *Philenus spumaria* (*Cicada spumaria* of Linnæus), originally described from Northern Europe, also occurs in New York and is quite common in portions of New England.

Popular Names for the Insects.

The more common name for these froth-bearing tree-hoppers in the United States is "spittle-insects." In England the secretion is known as "cuckoo-spittle." The peasants of France know it by the same name, viz., *crachat de coucou*, and also by another, *ecume printaniere*, meaning "spring-froth." Another name that we may sometimes hear applied to it is "frog-spittle," having reference, probably, to its supposed origin. The negroes in Maryland, according to Glover, have a belief that the small forest-flies, so numerous in the woods, are produced from these frothy accumulations. In the final stage of these insects, from their habit of seeking safety in leaping when alarmed rather than in using the wings with which they are provided, they are known in common parlance as "tree-hoppers" and "frog-hoppers."

Their Injuries.

Report has been made in Vermont of one or more of the grass infesting species causing considerable damage to the hay crop. It was estimated that, in consequence of the depredations, the quantity of hay grown on some fields was one-third less than the natural yield, not including the depreciation in the quality of the crop. It is but seldom, however, that these insects increase to such an unusual extent as to become of serious injury, and it is therefore unnecessary to indicate any means for their destruction. A gentleman, who asks for information regarding them, states that, in passing through his mowing fields, in Auburn, Mass., they are so numerous as to wet his shoes. An abundance such as this would, of course, be harmful to the crop, but, fortunately, it is of rare occurrence.

Siphonophora avenæ (Fabr.).

The Grain Aphid.

(Ord. HEMIPTERA : Subord. HOMOPTERA : Fam. APHIDIDÆ.)

- Aphis avenæ* FABRICIUS : Syst. Ent., 1775, p. 736, No. 13; Sp. Ins., ii, 1781, p. 386, No. 18; Mant. Ins., 11, 1787, p. 316, No. 22 (name only); Ent. Syst., iv, 1794, p. 214, No. 22 (description); Syst. Rhyng., 1803, p. 297, No. 22 (name).
- Aphis granaria* KIRBY : in Trans. Linn. Soc., iv, 1798, p. 238.
- Aphis hordei* KYBER : in Germar Mag. Ent., i, 1815, p. 11.
- Aphis cerealis* KALTENBACH : Mon. Fam. Pflanz., i, 1843, p. 16, No. 6.
- Aphis granaria*. CURTIS : Farm Ins., 1860, p. 293, f. 39, pl. J. figs. 10, 13.
- Aphis avenæ*. FITCH : in Count. Gent., xviii, 1861, pp. 96, 114; in Trans. N. Y. St. Agr. Soc. for 1860, xx, 1861, pp. 833-840; in id., xxii, 1863, pp. 32-38; 6th Rept. Ins. N. Y. (6th-9th Repts.), pp. 91-98, pl. 1, figs. 5, 6.—ASHTON : in Proc. Ent. Soc. Ph., i, 1862, p. 141.—WALSH : in id., p. 268.—THOMAS : in Prairie Farmer, Jan. 18, 1862; 8th Rept. Ins. Ill., 1879, pp. 51-55.—BETHUNE : in Rept. Ent. Soc. Ont. for 1871, p. 57-8, figs. 51-57.—GLOVER : in Rept. Commis. Agricul. for 1876, p. 36, f. 38.—PACKARD : in 9th Rept. Geolog.-Geograph. Surv. Terr., 1877, pp. 710-712.
- Siphonophora granaria* BUCKTON : Mon. Brit. Aphid., i, 1876, pp. 114-119, pl. 6 (descrip. habits, history, etc).—RILEY-MONELL : in Bull. U. S. Geolog.-Geograph. Surv. Terr., v, 1879, p. 19.
- Aphis granaria*. ORMEROD : Rept. Inj. Ins. for 1879, p. 22; id. for 1882, p. 14; id. for 1884, p. 25; Manual Inj. Ins. [1881], pp. 63-65.
- Siphonophora avenæ* LINTNER : in Count. Gent., xlvi, 1882, p. 493; in Rept. Reg. Univ. for 1886, pp. 112-114; in Trans. N. Y. St. Agricul. Soc., xxxiv, 1889, p. 105, f. 3 (as *granaria*).
- Siphonophora avenæ*. WEBSTER : in Rept. Commis. Agricul. for 1886, p. 576, (? migration).
- Nectarophora granaria* OESTLUND : in Bull. No. 4, Geolog.-Nat. Hist. Surv. Minn., 1887, p. 82.

The grain aphid owes its conceded claim to a place among the more injurious insect pests of the agriculturist, in consideration of the vegetation it attacks, its capability for harm, and its wide distribution. It is very generally distributed throughout the grain-producing regions of both continents. It infests all of the more valuable grain crops, as wheat, rye, barley, oats, and many of the other members of the grass family (*Gramineæ*). It is of common occurrence, being found in our fields nearly every year, but, like many other of the more destructive insects, it is only in certain years that, in particular localities, unknown conditions concur in causing its excessive multiplication, when its injuries are very great, even to the almost complete or the entire destruction of the crops attacked. Such an instance occurred in many of the Middle and Eastern States in the year 1861, when, as a new pest of the grain crops, it came under the observation of Dr. Fitch, who gave it careful study and contributed an excellent paper upon it, in his Sixth Report on the Insects of New York, first published in the Transactions of the New York State Agricultural Society for that year. In it are contained its European history, account of its first appearance in this country, description of its three forms, its propagation and habits, its parasitic and other enemies, etc. As this paper is accessible to most who may desire the information that it embodies, only a brief notice will be presented of the insect in this report.

Different forms of the Aphis.

Dr. Fitch observed four different forms of the insect through the season, viz.: 1st, the young louse or larva; 2d, the pupa; 3d, a wingless female; and 4th, the winged female. The last two of these are shown in the accompanying figures.

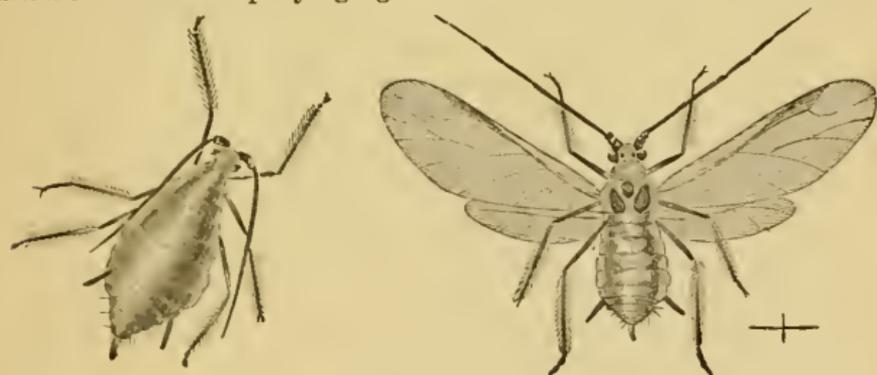


FIG. 30.—Wingless and winged females of the grain aphid, *SIPHONOPHORA AVENÆ*.
(After Fitch.)

The wingless female is described as varying remarkably in color, being either red, green, brown, or yellow. The front is convex in the

middle with a distinct lobe on each side; antennæ black, nearly as long or longer than the body; knees, tarsi (feet), and tips of the tibiæ (shanks), black. The honey-tubes are shining brown, long, and thickened at the base.* The tail large, yellow and recurvel. The winged females, according to Buckton, are generally pale brown or rust-yellow; thorax brown; abdomen ovate, broad and shining green; honey-tubes black; antennæ longer than the body; frontal tubercles not large; legs ochreous, with black knees and feet; tail yellow, ensiform, and hairy.

Dr. Fitch has presented a detailed description of the winged form, which should be consulted. It differs in some particulars from the above, as, for example: The thorax is pale yellow, shining, with a large egg-shaped black or brown spot on each side; abdomen broad oval, grass-green, with a row of three blackish dots on each side; antennæ about equaling the body in length; legs with pale-greenish thighs, becoming yellowish toward their middle, and with dull yellow and black-tipped shanks.

The winged female was observed by Dr. Fitch to be less prolific than the wingless. Inclosed in separate vials, the former uniformly gave birth to two young in a single night, while the latter produced four in the same time. The winged ones were also much slower in coming to maturity.

Method of Attack.

As in other Aphides, its injuries are inflicted by means of its beak or proboscis, which it inserts in the plant for sucking the juices. This beak, which is folded under the breast when not in use, is pale green, black-tipped, and is given out from between the base of the forelegs and reaches half-way to the middle legs. The insect may be first observed early in the season, during the month of May, feeding upon the stalks and leaves, usually on the under side of the blades. As soon as the heads of the grain make their appearance — ordinarily in the latter part of June in New York — deserting every other portion of the plant, all the individuals congregate thereon about the base of the forming kernels, each with its head downward, sometimes crowding together in clusters that nearly cover the head. A remarkable change, according to Dr. Fitch, now takes place in their color; while feeding on the coarser juices of the leaves and stalks they are all of a grass-green hue, but as soon as they change to the more delicate juices of the flowers they begin to assume an orange color. After awhile the orange in most of them inclines either to red or to yellow.

* Mr. Glover records a statement made to him, that although these honey-tubes are well developed, they emit no honey, and in consequence are not visited by ants.

This seasonal change of color, dependent upon the portion and condition of the plant that nourishes them, together with the particular food-plant on which they are observed, will fully explain the discrepancies in the colors assigned to them by different writers.

Abundance in the Year 1861.

Although a few individuals of this aphid had been observed sparsely distributed in grain fields in the State of New York and elsewhere, it had not been regarded as of any economic importance previous to the year 1861. Dr. Fitch knew of no recorded instance in which an aphid, although noted for rapid increase, had become thus suddenly and excessively multiplied over such a wide extent of territory. In the summer of 1861, throughout the greater portion of the New England States, the State of New York, except its western section, the north-eastern part of Pennsylvania, and in several localities in Canada, every grain field was invaded by it, and in most of them it abounded in incredible numbers. The yield of wheat was often reduced one-half, while the oat crop suffered still more severely, to the extent of hardly paying for the harvesting.

Not Usually very Injurious.

No demonstration of the insect has since occurred at all comparable with that above recorded. It continues, however, to make its appearance almost annually in considerable or in insignificant numbers. Examples of it are frequently sent to me with inquiries similar to the following, which came from Albemarle county in Virginia :

I send by this mail specimens of flies and aphides with which the wheat-heads all through this section are affected. You will confer a favor upon a large number of farmers in this county by giving the name and nature of these insects, and the information whether they will materially injure the crop.

To the above, after giving the name, habits, etc., of the insect, it was further stated :

“The injuries will be in proportion to their number and of the associated parasites. Heavy and long continued rains would be very serviceable in checking the attack. It is not probable that it will inflict severe injury to the wheat crop now attacked, for the kernels will soon have so far advanced and hardened as no longer to serve for food. Its numbers are, doubtless, being materially lessened by the parasites and other predaceous insects which are preying upon it, judging from the many dead aphids found in the package received. The specimen separately inclosed and marked ‘for examination and name,’ is the larva of a lady-bug, probably that of *Hippodamia con-*

vergens Guer., which has, doubtless, rendered excellent service in the destruction of the lice. A single one of these larvæ upon a head of wheat should, from its well-known voracity and remarkable appetite, entirely free it in a short time from aphid presence."

Different Names of the Insect.

Several names have been given to this insect, as may be seen in the partial bibliography given of it, since it was first brought to scientific notice, about a hundred years ago. It is the *Aphis avenæ* of Fabricius, Schrank, Walker and others of Europe; of Fitch, Thomas and most of our writers in the United States. Mr. Buckton, in his Monograph of British Aphides, vol. 1, 1876, designates it as *Aphis granaria*, adopting the name given it by Mr. Kirby in 1798, in a paper read before the Linnean Society, on the ground that Fabricius gave no description of his *Aphis avenæ*. In this he seems to have accepted without examination, the statement made by Curtis in his *Farm Insects*, viz., "as Fabricius has given no description of his *Aphis avenæ*, which is possibly the same species [with Kirby's], Mr. Kirby was constrained in describing it, to designate it by a new name." Both these gentlemen have very strangely, as was some time ago pointed out by Dr. Fitch, overlooked the description of Fabricius. In the earlier Fabrician writings—*Systema Entomologiæ* in 1775, *Species Insectorum* in 1781, and in *Mantissa Insectorum* in 1787, the species appears only by name, but in the *Entomologia Systematica* in 1794, it was sufficiently described to indicate beyond doubt the insect named; and that there need be no excuse for longer continuing the name of *granaria*, the description contained therein is herewith given :

Avenæ. 22, A. *Avenæ sativæ*.

Habitat in *Avena sativa*.

Caput obscure testaceum antennis nigris. Thorax testaceus, antice viridis. Abdomen viride lituris marginalibus, nigris. Corniculi cylindrici, nigri. Anus terminatur stylo parvo, albo. Pedes nigri femoribus basi albis.

That Kirby's name, published four years later, may be seen to have no claim to priority or adoption for any reason whatever, we quote from the Transactions of the Linnean Society, for 1798:

A. *granaria*, viridis, cauda biseta, setis geniculisque pedum nigris.

Aphis avenæ. Fab. Sp. Ins., ii, p. 386, N. 17.

Gmel., i, pt. iv, p. 2206.

Caput flavidum uti antennarum articulus primus. Oculi nigri. Abdomen obovatum cauda aculeata. Pedes livida, tarsis geniculisque nigris.

As may be seen from the synonymy presented, Kyber, a distinguished anatomist and microscopist, who early in the present century, made valuable researches and discoveries in the Aphides, gave the name of *Aphis hordei* to the insect, from the barley on which he found it feeding. Later, Kaltenbach, another German naturalist named it *Aphis cerealis*. More recently, it has been transferred to the genus *Siphonophora*, in the division that seemed demanded of the *Aphidinae* into separate tribes. Still later, another writer, Mr. Oestlund, in his *Synopsis of the Aphididae of Minnesota*, has transferred all of the Siphonophoras to the genus *Nectarophora*, assigning as a reason for proposing to replace the familiar name of *Siphonophora*, that "as a generic term it was already appropriated for the Myriopoda before Koch made use of it in the *Aphididae*; and it is also used to denote an order of the Oceanic Hydrozoa, and should, therefore, according to practice, be replaced by one not already occupied." This proposed change will not, we think, be accepted, until demanded by a code of laws regulating nomenclature that shall rule authoritatively.

Its Incomplete Life-history.

The life-history of the grain aphid is incomplete; the male sex, although a form was described by Curtis as such, is still unknown. The summer form is believed to have an autumnal migration to some other food-plant, as have many of the Aphides, yet it has never been observed. Mr. Walker has affirmed that this species migrates in autumn from the wheat to several kinds of grass.

Professor Webster has made some experiments toward ascertaining where the species passes the summer, or until the young wheat appears in the autumn. It was infesting the heads of barley in considerable numbers, and when the grain was fully ripe and the winged adults ready to forsake the barley heads, he transferred some of them to cages, in which growing timothy, blue grass, and red top had been transplanted. The grasses were kept alive, but the insects died, and no trace of a following generation was observed. (*Loc. cit.*)

Buckton had searched the roots of grain in September for its supposed underground habitat at that time, but fruitlessly; nor did he know what became of it during the winter. Since then, Dr. Thomas has been able to add somewhat to our previous sparse knowledge of its life. He found on wheat, in the winter of 1875, an aphid, which, although differing from the descriptions of Fitch and Curtis, he had no doubt was the same species, and he has written of it as follows:

"When the winter wheat appears above the ground in the fall, it passes from its hiding-place at this time, wherever that may be,

probably in the same way that it does from the winter wheat to the spring wheat and oats in the spring, that is, by the winged individuals. Here they work upon the leaves and stalks singly while the weather is not too cold, but when winter appears they move downward toward the ground, some of them, at least, entering the soil and feeding on the sap of the roots. At any rate, I find the apterous ones at this time working upon the roots, but at the same time I find a winged individual above ground.* I have observed them heretofore at the root of the wheat late in the winter, while snow was on the ground, and, what somewhat surprised me, I found them busy at work under the snow, and the apterous females bearing well-formed larvæ. I am, therefore, led to believe that in this latitude the species passes the winter in other than the egg state. This will probably be found true wherever winter wheat is grown."

The above will serve to show how much yet remains to be learned of the life-history of this species. A male unknown and no knowledge of an egg-laying female, should be a sufficient stimulus for its further study. Dr. Fitch has written of it: "I have watched the grain aphid this year [1862] round so closely that I am perfectly assured that no eggs were laid and no males were produced. When and under what circumstances males occur, if they ever do occur, is yet remaining to be discovered. At present it seems as if these insects might go on forever producing young without any intercourse of the sexes."

Is it possible that this species will be found to confirm a statement made by Kyber, a careful and skillful student of the *Aphididæ*, that certain species that feed on herbaceous plants which fruit early in the year and then wither, produce males and apterous oviparous females *in the middle of the summer?*

Its Food-plants.

The grain aphid is by no means confined to wheat, barley, and oats. Kaltenbach has enumerated as its food-plants *Secale cereale* (rye), *Triticum sativum*, *Avena fatua*, *Hordeum murinum*, *Bromus mollis* (soft chess), *Dactylis glomerata* (orchard-grass), *Holcus* and *Poa*. Walker has added *Glyceria fluitans* and *Polygonum persicaria*. Passerini records it on various species of sorghum in Europe, including *Sorghum saccharinum*. Mr. Oestlund has found it in Minnesota, on *Phalaris canariensis* (canary-grass) and on *Poa annua*.

*See, in this connection, a statement made to Mr. Glover, which would seem to indicate an unusual degree of endurance of cold (although doubtless not to the extent reported), viz., that "they freeze on the stalks in winter and revive in the spring."

Remedies and Parasites.

The use of salt, of soot, of gas-lime and of several other substances has been proposed as remedies for this insect, but we are compelled to admit that no method has been discovered by which its formidable attack upon a grain crop can be arrested. Fortunately, in nearly every instance when it has abounded, it has been promptly met by hosts of parasites which have done their work so effectually* that if the attack was not at once checked, it was not repeated the second year, or if continued, then ceasing to be serious and soon brought to a close. It is the particular province of a group of ichneumon flies to feed internally on plant-lice and restrain materially their rapid and prodigious increase. They belong to the family of *Braconidae* and to the subfamily of *Aphidiine*—its name indicating the close relationship to the Aphides that it bears. About fifty species of these have been described from the United States and Canada by the three authors who have given them particular study—Mr. Ashmead, Dr. Fitch, and l'Abbé Provancher. The two species that were bred by Dr. Fitch from the grain aphid were named by him *Praon avenaphis* and *Toxares triticaphis*—their hosts having occurred on oats and wheat. Curtis, in his *Farm Insects*, has described *Aphidius avenæ* and *Ephedrus plagiator* which he obtained from the grain aphid in England.† A single one of these parasites entirely fills the body of the aphid, causing it to swell into a globular form. The infested aphid, fastened to the plant, is indicated by this distended form, its sienna-brown color usually, and later by the round opening on the back through which the parasite has emerged.

Myzus cerasi (Fabr.).
The Cherry Aphid.

Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. APHIDIDÆ.

FABRICIUS: Syst. Ent., 1775, p. 734.4; Spec. Ins., 1781, ii, p. 384.4; Mant. Ins., 1787, ii, p. 315, No. 6; Ent. Syst., iv, 1794, p. 211, No. 6 (*Aphis*).FITCH: in Trans. N. Y. St. Agricul. Soc. for 1854, xiv, 1885, pp. 829-833, 836, 837; 1st Rept. Ins. N. Y., 1856, pp. 125-128, 132, 133 (*Aphis*).BUCKTON: Mon. Brit. Aphides, i, 1876, p. 174, pl. 33, figs. 1-5 (*Myzus*).THOMAS: 8th Rept. Ins. Ill., 1879, p. 75-6 (*Myzus*).

SAUNDERS: Ins. Inj. Fruits, 1883, p. 216-7.

* Mr. Curtis has written: On some wheat which we examined not a single aphid had escaped the searching vigilance of its enemies, and the husks were spotted with innumerable black globules [the bodies of Aphides which had been parasitized by *Ephedrus*]. *Farm Insects*, 1860, p. 291.

† For notices of other species of *Aphidiina*, their oviposition, etc., see 1st Report of Dr. Fitch on the Insects of New York, 1856, pp. 134-138, and Buckton's *Monograph of British Aphides*, 1879, ii, pp. 151-153 (Aphidivorous Ichneumonidæ). For recent descriptions of many new species, see Ashmead, in *Proceed. U. S. Nat. Mus.*, 1888, pp. 656-671.

Although with no new observations to present upon this insect, the inquiries recently made from some of the eastern fruit districts in the State of New York, of means for preventing its injuries, call for information in regard to it, and the following is, therefore, accordingly presented, compiled from the writings of Dr. Fitch and other careful observers:

Myzus cerasi, the *Aphis cerasi* of Fabricius, is the common black aphid of the garden cherry, *Cerasus vulgaris* — long known as quite destructive to cherry trees in Europe, whence it has doubtless been introduced in this country. It is rare to find a tree that is wholly exempt from it, and it often occurs in such incredible numbers upon the underside of the leaves, that, completely covering them, it overflows upon the leaf-stalks, the ends of the tender twigs, and even upon the young fruit. The larger infested leaves do not curl but turn backward or roll slightly. The more tender leaves upon the delicate twigs being drained of their juices, shrivel and dry and die, as do also the tips of the twigs. To such prodigious extent does this species sometimes multiply, that a single young tree that had attained a height of ten feet, harbored, according to a calculation made by Dr. Fitch — by taking the average number on a single leaf, counting the leaves on a branch, and the branches on a tree — at least 12,000,000 of individuals.

Life-history.

Its life-history, according to Dr. Fitch, who had not observed its underground operations, is the following: It makes its appearance as soon as the leaves put forth in the spring, hatching from eggs deposited the preceding autumn. During the spring and summer, winged and wingless forms are found; nearly all are without wings, and all are females. They continue to produce living young throughout the summer, which, when hatched, are smaller and of a brighter color than when mature. They multiply with exceeding rapidity, so that by the middle of June, in New York, the trees are literally overrun with them. Toward the latter part of the month, they are often attacked so vigorously by the larvæ of Syrphus flies and the lady-bugs (*Coccinellidæ*) that their ravages are temporarily checked and their numbers greatly diminished. If apparently exterminated, new broods shortly appear and resume their work, but they are incapable of inflicting as serious harm upon the now mature foliage, as at their first advent. On the approach of cold weather, male aphides make their appearance, and eggs are deposited at the base of the buds and in the crevices of the bark for the continuation of the species another year.

Mr. Buckton has given but few items relating to the life-history of this species. He states that two swarms occur in the year with a certain interval, one in June and the other in October. During the latter period the male makes its appearance, which he had taken under the leaves of the garden cherry in company with oviparous females. Mr. Walker had taken the latter on October thirty-first.

Description.

The careful description given of the insect in its several stages, leaves but little to desire. For those who have not convenient access to the first report of Dr. Fitch, we condense from it, as follows:

The LARVÆ when newly born are about 0.03 long, of a dull white or pale yellow color, with transparent and colorless legs and antennæ. They are oblong-oval in form, with the opposite sides of their bodies parallel, and their transparent or slightly dusky nectaries not reaching to the tip. Later, they become broader across the abdomen and deeper yellow, with the tips of the antennæ and the feet dusky and the nectaries black. After molting they change to dull reddish-brown or chestnut colored, with black heads. The legs, antennæ, and nectaries are whitish transparent.

The WINGLESS FEMALES are 0.05 long, broadly egg-shaped, black and shining, with a tail slightly projecting, nectaries black and reaching to or beyond the tip; the antennæ are shorter than the body and whitish, their two short basal joints and the apical half, black; the beak whitish, black-tipped; the legs white, with the feet, tips of the shanks, and commonly the thighs, at least of the hind legs, except at their base, black. [Cauda long and black — Buckton.]

The PUPÆ are 0.06 in length, resembling the wingless females in color and the larvæ in form, but may be known by the rudiments of wings like vesicular scales of a white or pale green color; the nectaries equal the tip which has no tail-like appendage.

The WINGED FEMALES are 0.05 long, and 0.20 across the wings; of a deep black and shining color; abdomen nearly twice as broad as the thorax, egg-shaped, with an acute apex having a short conical tail-like appendage, the nectaries reaching to its base; antennæ black, and about three-fourths the length of the body; beak black or dusty with a black tip; the legs black with the shanks, except at their tips and the basal half of the thighs, white. The wings are transparent, their bases, outer margins and rib-vein, white, the remaining veins blackish with their bases pale; the stigma opaque, dull white with black margins.

Food-plants.

Dr. Fitch was of the opinion that the cherry aphid lived only upon the garden cherry — not on any of our native or wild cherry trees, or upon any other tree. This opinion has not been sustained by our further acquaintance with the insect. Thus, in the year 1878, Dr. Thomas found it in Illinois, covering the twigs and axils of the small limbs of plum trees as well as the cherry, in confirmation of the statement of its occurrence on the plum that had been previously made by Mr. Walsh.

Mr. Buckton has observed viviparous specimens of it in limited number, on the black currant, showing the slight colorational difference of a duller body and paler cornicles.

It is possible that this species also extends its ravages to the peach tree, appearing there as a root-form infesting the roots. For many years past, the roots of peach trees along the Atlantic seaboard have been seriously infested with an aphid, to the extent of causing a great mortality, particularly in seedling trees. The attack was naturally referred to *Myzus persicæ*, but by some has been regarded as a distinct species. Examples of it sent to the Department of Agriculture at Washington, were pronounced by Professor Riley to be the *Myzus cerasi* of Fabricius, but in correspondence with him, the opinion is expressed that before its identity with that species can be positively asserted, additional study is necessary. For a notice of *M. ?cerasi*, on the roots of peach trees, the *Second Report on the Insects of New York*, pp. 19–22, may be referred to.

Remedies.

A kerosene and soap emulsion sprayed upon the insects would effectually kill all with which it came in contact. Clustered as they are on the under sides of the leaves, it would be necessary to apply the liquid from beneath the tree, changing position as might be necessary in order to reach every portion of the infested foliage. The statement of Dr. Fitch, that “these are creatures that *sprinkling* will not cleanse from the tree — *immersion* must be resorted to,” may have been warranted by the sprinklers then in use, but is not sustained by the progress subsequently made in the discovery of insecticides and improved instruments for their application.

Strong soap-suds alone, although not entirely effectual, will materially reduce the aphids upon a tree — only the more hardy ones surviving its use.

Tobacco water, if made of sufficient strength, is claimed to be an effectual remedy for the insect. It has been used with unfailling suc-

cess when prepared "by boiling four or five pounds of tobacco in water sufficient to nearly fill a tin pan"—an indefinite measure, but a pan such as used upon a farm for milk may be presumed.

Dr. Fitch, at the time of his writing, regarded, as the very best measure for subduing these pests, that of using their natural enemies for the work. This was to be done by collecting from the hedges and borders of the forest in the neighborhood, by the aid of a beating-net, such as is sometimes used by entomologists for gathering insects, or an open inverted umbrella, or some other convenient implement, a few scores of their natural enemies (lady-bugs and their larvæ) and, conveying them alive in small boxes and vials, to set them free upon the infested tree. Their increase would be so wonderfully rapid that but a short time would be required to put an end to the aphid attack.

The convergent lady-bird, *Hippodamia convergens* Guer. [its orange-red wing-covers dotted with black spots and its black thorax marked

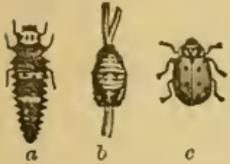


FIG. 31.—The convergent lady-bug, *HIPPODAMIA CONVERGENS*; a, the larva; b, pupa; c, the imago or beetle.

with two converging pale lines, as shown in the slightly enlarged Fig. 31 at c, and in Fig. 32 more enlarged] could be conveniently used for this purpose early in the season, as it may be gathered by thousands during the month of May on the common



Fig. 32.—*HIPPODAMIA CONVERGENS*, enlarged.

Mayweed (*Maruta cotula*), and no better investment could be made by those who wish to destroy plant-lice than in the employment of boys to collect these lady-birds, four or five of which will clear a two-year-old peach tree in as many days (Riley, in *New York Tribune* for June 17, 1874).

INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS.

A number of the following notices were contained in the Report of the State Entomologist to the Regents of the University, S. N. Y., for the year 1885, as published in the *Thirty-ninth Annual Report of the New York State Museum of Natural History*. No separates of the Entomologist's Report having been printed for general distribution, and the edition of the State Museum Report being quite small, portions of the former are herewith republished, that they may reach the agriculturists for whose benefit they were primarily prepared.

THE CANKER-WORM.

Anisopteryx vernata (Peck).

It really seems that the canker-worm is becoming an annual pest of the orchards of the State of New York. While the New England orchards have been for many years ravaged by it, and the noble elms, so long the boast of eastern villages, destroyed, and it has also been

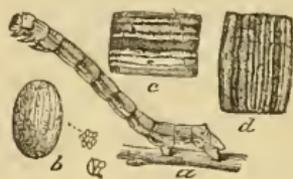


FIG. 33.—Larva and eggs of the spring canker-worm—ANISOPTERYX VERNATA. (After Riley.)



FIG. 34.—a, b, male and female moths of *ANISOPTERYX VERNATA*; c, enlarged joints of female antenna; d, joint of female abdomen; e, ovipositor.

very destructive in several of the Western States, our own State, for some reason, has been almost exempt from its depredations. Within the last few years, occasional instances of its occurrence have been reported. Last year [1884] they were received from Poundridge and Pleasantville, in Westchester county, where they inflicted damage to the apple crop to the amount of thousands of dollars (*Country Gentleman* of July 10, 1884, p. 577). The present year, report is received of serious injuries from them in Wayne county. A gentleman writes:

“The orchards are all being destroyed in this part of the State by the canker-worm. Thrifty orchards were cut down last winter, and there will be many more sacrificed if there can not be found some way to stop the havoc.”

Early in June their presence in the vicinity of Albany was reported, where I had not previously heard of their occurrence. Examples of the caterpillar were brought to me by Mr. David M. Knickerbocker, of Albany, that I might see if they were, as he believed, the veritable canker-worm. They were found upon his apple trees at Loudonville, in "millions," and were rapidly consuming the foliage. He had also heard of their presence in other orchards in his neighborhood. The examples of the larvæ brought were nearly full-grown (on June ninth), having almost attained their maximum length of one inch. As usual, they differed greatly in their markings and colors, some being almost without stripes and of a uniform black.

The folly and the criminality of permitting this destructive pest to obtain a permanent footing within our State can not be too strongly censured. It is an extremely local pest and, at the outset, can be easily controlled. Often one tree only in an orchard is infested, or a portion of an orchard, or a single orchard in a township, while others are wholly free from it. The female moth has no wings with which to distribute herself, and can only, upon coming out from her pupation in the ground underneath the tree in the early spring, climb up the trunk, meet her winged mate, and deposit her eggs upon the branches.

Preventives and Remedies.

The preventives and remedies that should be used against this insect are simple. First, the females should be prevented from ascending the tree, by cloth bands, coated with tar or printer's ink, around the trunk, or by some of the mechanical appliances which have been so frequently described in our agricultural journals and entomological reports. Second, when the larvæ are upon the tree and rapidly consuming the young leaves, they should be killed by spraying the tree with Paris green water, as in directions so often published. Third, if the caterpillars have been permitted to feed to maturity upon the trees, and thereafter to enter the ground immediately beneath for their transformation, the soil under the trees to the depth of from four to six inches should be thoroughly worked so as to crush the tender pupæ.

Either one of the above measures, if properly used, will be effectual in arresting the attack. If all are employed, immediate success would be insured.

ABUNDANCE OF GEOMETRID LARVÆ.

Mr. Verplanck Colvin, Superintendent of the New York State Land Survey, writes from his camp, on Salmon lake, head-waters of Beaver

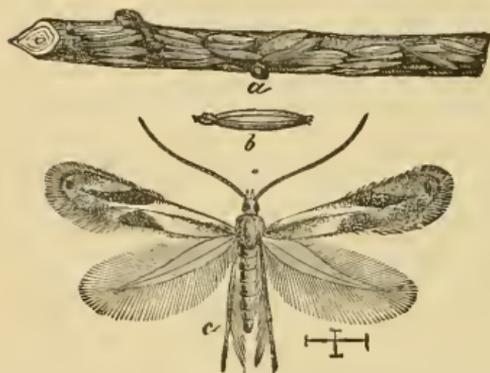
river, under date of August 5, 1888, as follows, of some insects that came under his observation :

I believe you would be interested were you with us, for we are constantly meeting what are, to us, such novel forms of insect life that I feel confident you would find some undescribed species. What seems to me most novel, from an entomological standpoint, is the abundance of larvæ of the kind known as "measuring-worms." I never saw so many of these insects in the woods. They attack the witch-hobble [*Viburnum lantanoides*], which is usually quite free from insect injury, and reduce the leaves to skeletons. But they do not, by any means, confine their attack to deciduous vegetation, but are also found on evergreens—on balsam and spruce—and their number is infinite. The common form is a bright green worm of about one inch in length: another is a dark gray or brown. Both of these attack the human being with a sharp and painful bite—a surprising thing, as I have never known such larvæ to attack animals before. They are certainly worthy of your observation and study.

THE APPLE-LEAF BUCCULATRIX.

Through Dr. Sturtevant, of the New York Agricultural Experiment Station, a communication was received from Mr. Malcolm Little, of Malcolm, Seneca county, N. Y., stating that the apple orchards in that vicinity were infested upon the branches and the fruit with objects such as sent upon some twigs. They had not been seen before, and it was asked what they were, and if they would probably prove injurious. Answer to the following effect was returned :

The twigs received were thickly covered on one side with the



cocoons of the apple-leaf Bucculatrix—*Bucculatrix pomifoliella* Clemens. A piece of twig an inch and a quarter in length, and one-eighth of an inch in diameter, had upon it thirty-three of these cocoons. From the small size and the general appearance of the cocoons they are often mistaken for insect eggs. They are white, about one-fourth of

FIG. 35.—Apple-leaf Bucculatrix, *BUCCULATRIX POMIFOLIELLA*: a, piece of twig covered with cocoons; b, cocoon enlarged; c, the moth, enlarged.

an inch long, as thick as an ordinary pin, and show upon

their exposed surface five or six prominent longitudinal ribs as represented at *a* in Fig. 35, and at *b* in enlargement. The insect is an injurious one. Where it abounds, the caterpillars consume such an amount of the foliage as seriously to interfere with the production of the fruit. It displays a remarkable facility for

increase, and every proper means should, therefore, immediately upon its discovery, be resorted to, that its spread may be arrested.

The parent is a small moth (shown at *c*, much enlarged) belonging to the *Tineidæ*—that division of the Lepidoptera that embraces the smallest species of the order. There are two annual broods of the insect. The cocoons sent to me are of each brood. Some of them were spun in July, and have given out the insect, leaving only the empty pupa-case within the cocoon. The moths that emerged from them laid eggs from which the caterpillars were hatched, which might have been observed feeding upon the leaves in September, if attention had been given at the time to the eaten foliage. The caterpillars make their cocoons during October, and upon opening those that are the freshest-looking and unbroken, the pupæ may be found which are destined, if not meanwhile destroyed through parasitic or atmospheric agency, to remain in that state throughout the winter, and to give out the moth in the month of May next.

A notice of this insect, containing further information upon it, may be found in my "First Annual Report on the Insects of New York, 1882, pages 157-162."

Distribution.

In the above publication, the presence of this insect had only been reported within the State of New York, in Monroe and Chemung counties. As would naturally be expected, it seems to be extending its range. It has since been received by me, from an orchard of Mr. J. S. Roy, Lyons, Wayne county. A piece of twig only two and one-half inches long contained twenty-two of the cocoons. It has also been sent to me by Mr. J. C. Wolf, of Waterloo, Seneca county. It is reported as present, in small numbers as yet, in Lagrange, Wyoming county. It also occurs in South Byron, Genesee county.

I had previously written of this insect, that as yet in its New York distribution, it was apparently confined to the western portion of the State, but the present year it has been brought to me from an orchard at Bethlehem Centre, five miles south of Albany, on the Hudson river. Mr. Isaac Bussing, with whom it occurred, reports that he has observed it upon his trees for the past few years, in limited numbers, but does not think that it inflicted serious harm.

In the *Second Report of the Department of Entomology of the Cornell University Experiment Station*, 1883, Mr. A. E. Brunn has published his studies upon the life-history of this insect (with illustrations of some of its stages) which adds materially to our previous knowledge of it (*l. c.*, pp. 157-161, pl. 6, figs. 2-2*e*). An abstract of the above observa-

tions has been given by Professor J. H. Comstock, in the *Proceedings of the Western New York Horticultural Society*, at its twenty-eighth annual meeting in January, 1883 (pp. 20-23).

Remedies.

This injurious pest is the most vulnerable in either its caterpillar stage or after the cocoons have been made. In large orchards the cocoons may be best attacked by means of a mixture of kerosene and soap sprayed upon them with a force-pump. This emulsion which is quite as effectual as, and easier to make than, the milk emulsion formerly recommended, may be made by dissolving two pounds of common bar soap in a gallon of water, with heat, and then mixing in a gallon of kerosene with the aid of a force-pump until emulsified. This, upon cooling, will form a thick, gelatinous mass, containing fifty per cent of kerosene, which will have to be reduced by the addition of water before it can be applied with a force-pump. If diluted with nine gallons of water, giving a mixture of about ten per cent of kerosene, it should give a strength sufficient to destroy the pupæ within the cocoons, but the proper strength had better be first ascertained by experiment upon a few of the cocoons.

If the infested trees are not very numerous the emulsion might be applied to the branches by means of a stiff bristle-brush, which would remove the cocoons, and serve to show thereafter if there is a continuance of the attack in the deposit of fresh cocoons.

When the caterpillars are found in abundance feeding on the trees in July or September, by suddenly jarring the branches, numbers will drop and hang suspended by their threads, when they may be swept down by brooms or branches and destroyed. Showering the trees with Paris green and water would kill all the larvæ eating the poisoned foliage.

THE CLOVER-SEED MIDGE.

Cecidomyia leguminicola Lintn.

A package of the larvæ of the clover-seed midge was received October twelfth, through Dr. E. L. Sturtevant, from Mr. D. M. Linsley, of Orleans county, N. Y., with the statement that they were from a second crop of clover, that had been cut for hay, and placed on a scaffolding above the barn floor. Four or five days thereafter the larvæ were observed in large numbers upon the floor beneath the clover. Mr. Linsley was desirous of knowing if they would attack any other grain or plants. Answer was made that the attack of the clover-seed midge, so far as known, was confined to clover seed. From the abundance of the larvæ reported by him, it was quite important, as a

means towards diminishing the attack of the coming year, that the larvæ falling upon the floor should be frequently swept up (if the floor was a tight one) and burned. If in the sweeping the larvæ were liable to fall through the floor-joinings, it would be advisable to kill them before attempting their removal by sprinkling them from time to time with kerosene.

The following extracts are from a letter received later from Mr. Linsley in reply to the request made for additional information of the occurrence of the larvæ:

They came wholly from the second cutting of the clover, cut about the twentieth of September. They began to make their appearance about four days after it was drawn into the barn. They came out in such numbers that they looked like red sand upon the floor. This continued for about two weeks, since which time I have not noticed any of them. I destroyed what I could collect from the floor, but the greater part of the hay being put into a mow, they were, of course, out of reach for the most part. * * * * *

It is said that these weevils do not work in the Alsike, or large pea-vine clover. This may be due to the fact that in these varieties the first growth of cutting is used for seed, so that the seed matures too early for the insect. But these varieties are far inferior to the Medium clover and can not well supply the place of it. The destruction of the crop of Medium clover seed is a very serious loss to the agricultural interest in this portion of the State, amounting to from twenty to forty dollars per year on every farm of 100 acres, according to the market price of the seed.

THE HESSIAN-FLY.

Cecidomyia destructor Say.

Wheat infested between the first and second joints with the Hessian-fly, was sent for examination, June twelfth, by Mr. A. F. Dowd, of North Huron, Wayne county, N. Y. On stripping the sheaths from the stalks, four or five of the puparia, or "flaxseeds" as they are popularly called, would be found in company, showing the attack to be a severe one. [See figure 45 on page 286.]

The perfect insects failed to develop. Under natural and favorable conditions they would probably have emerged in the month of July.

The fly had been more injurious in western New York the preceding year (1884) than usual. The following statement in relation to its operations, and containing some good suggestions for controlling the insect, is from a gentleman in Monroe county, which joins Wayne county on the west:

A considerable part of the wheat of 1884 was injured by the Hessian-fly, which crinkled the straw so that the heads of wheat were cut off too short to be gathered in harvest. On some fields this scatter-

ing wheat would make, if evenly distributed, a sufficient seeding. I am afraid this self-sown wheat will prove a detriment to the crop, as the Hessian-fly will lay her eggs on these early plants.

The fly works until frosts check it. Rolling the ground or dragging with the smoothing harrow, and then rolling, is probably as good a preventive of injury from the Hessian-fly as can now [late in September] be applied. These operations both cause the wheat to stack more, making a mass of small leaves rather than one or two tall ones from each plant. As the fly lays her eggs in the fold of the leaf [at the crown of the root], she finds less place than where the leaves are unchecked in growth. Besides, many of the eggs and newly-hatched worms are destroyed by crushing and contact with soil brushed against them.—W. J. F., Monroe county, N. Y. (*Country Gentleman* for October 9, 1884.)

Some plants of winter wheat in ground, containing the flaxseeds of the Hessian fly, were received from Prof. F. M. Webster, of La Fayette, Ind., on April fourteenth. On April nineteenth six of the flies emerged, males, and additional ones as follows: On the twentieth, four ♂; on twenty-first, seven ♂ and fourteen ♀; twenty-second, not observed; on twenty-third, about sixty ♂ and ♀ were taken from the box, some of which were dead.

SCIARA SP. ? OCCURRING ON WHEAT.

Examples of a small fly were received October second, from Dr. E. L. Sturtevant, which "had appeared upon wheat" at the Experiment Station.

In our present limited knowledge of the species of this genus, a generic determination only could be made of it.

From what is known of the larval habits of the few *Sciara* that have been studied, and of their associated *Mycetophilidæ*, it is not probable that the species sent was injurious to wheat. The larvæ, as a class, are not regarded as injurious, as many of them are known to occur beneath the bark of felled trees, in decayed wood and vegetables, in vegetable mold, in fungi, etc.

From their frequent occurrence in boleti and fungi, Latreille had arranged the *Mycetophilidæ* in his group of *Fungivores*—one of the five into which he divided the *Tipulidæ*. A noted fungivorous species is the *Sciara Thomæ* Linn., of Europe, known as the "army-worm" (Hierwurm) in Germany. The larvæ are remarkable for assembling in immense numbers and hanging together by means of a viscid moisture in a long mass resembling a snake or rope, sometimes several feet in length, two or three inches in breadth, and perhaps a half inch in thickness. Larger processions of these larvæ have been observed,

massed in a breadth of three inches and one or two inches in thickness, and extending thirty yards in length. Individually, they are but about five lines long and a third of a line in diameter. M. Guérin-Ménéville has given interesting details of some of these assemblies observed by him, some of which have been quoted in *Figuier's Insect World*, pp. 46, 47.

That some of the species of the genus may possess injurious habits appears from the mention by Prof. Westwood, that Olivier had reared three species of *Sciara* from wheat, of which account is given in *Prem. Mém. sur quelques Insectes qui attaquent les Céréales*, Paris, 1813.

Sciara pyri, of Europe, is said to injure the blossoms and fruit of the pear, causing them to fall; while of other European species, *S. fucata* lives in decaying potatoes, turnips and other vegetables; *S. quinquelineata* breeds in diseased potatoes and is supposed, by some, to cause the "scab;" *S. pulicaria*, *S. vittata*, *S. longipes*, and *S. hyalipennis*, have also been bred from decaying potatoes; *S. tilicola* produces a gall on the leaves of young linden trees; and *S. Giraudii* has been bred from stems of *Malva* and *Athwa*.

One of our American species, at least, is known to be injurious, viz., *Sciara mali* (Fitch), the larvæ of which destroy the interior of apples by burrowing through them, while the fair exterior shows no indication of the concealed attack. A species of *Sciara*, apparently near to *S. nervosa*, of Europe, has recently been brought to me (1889), as infesting mushroom beds in Albany, where it has been regarded as injurious to mushroom culture. Mr. Wm. Falconer has also sent me the same species from mushroom cellars in Glen Cove, Long Island, but does not consider it harmful. It will be given study, and reported upon hereafter.

The Osten Sacken catalogue of N. A. Diptera contains twenty-three species of *Sciara* described by Say, Walker, and others, but of these very few have been identified in present collections. For notice of the habits of some of the *Sciara*, see Osten Sacken, in *Proc. Ent. Soc. Phil.*, i, 1862, pp. 163-165; and for references to writings upon them, pp. 169-171.

THE CABBAGE-FLY.

Anthomyia brassicæ Bouché.

A severe attack of this insect upon young cauliflower plants was reported by Mr. D. W. Seeley, of Albany, and examples of the plants badly eaten and having the larvæ within and upon their roots, were brought to me on June eighth. Mr. Seeley had made several appli-

cations of popular remedies for the arrest of the attack, without avail, and had nearly determined upon taking up the entire crop and destroying it, although it would be at a loss of about a thousand dollars — the estimated value of the matured crop. The application of bisulphide of carbon was recommended to him before an abandonment of the crop; the result of the application, if made, was not learned.

Some of the above larvæ, apparently full-grown, were placed in a box with ground when received. Sixteen days thereafter, June twenty-fourth, they gave forth the perfect fly.

A LADY-BUG ATTACK ON SCALE-INSECTS.

A number of Austrian pines, *Pinus Austriaca*, in Washington park, Albany, were observed, on October ninth, as having been very nearly killed by an attack of the pine-leaf scale-insect, *Chionaspis pinifolii*

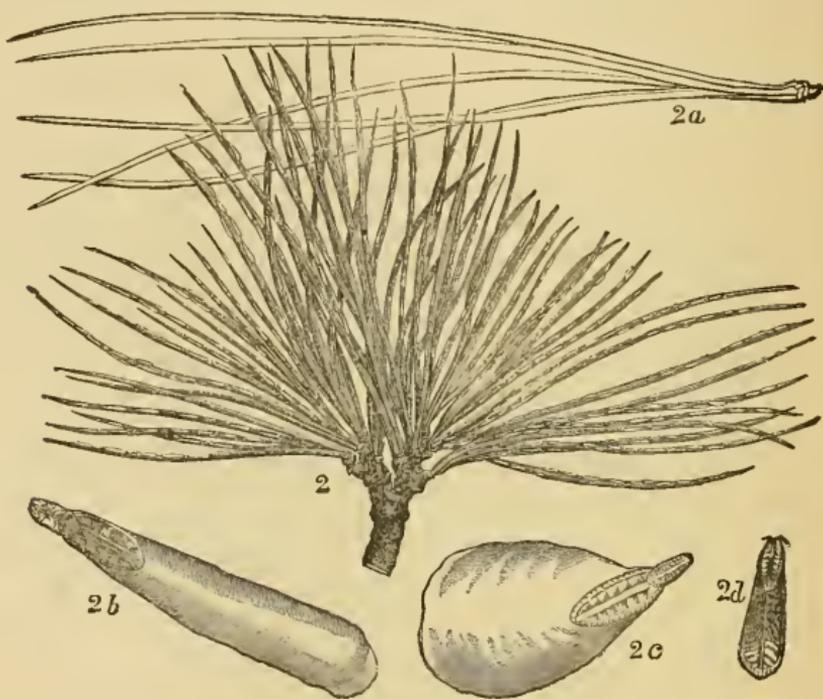


FIG. 36.— The pine-leaf scale-insect, *CHIONASPIS PINIFOLII*.

(Fitch). Millions of the peculiar white scales of this destructive species had attached themselves to the leaves almost as thickly as they could find place, to the extent of whitening the tree, and nearly hiding its

natural green. Hundreds of scales could be counted upon a single one of its slender leaves. The scales are represented in Fig. 36 in their natural size on the leaves of *Pinus strobus*, at 2. At 2a, are leaves of the same not stunted by the presence of the scales; 2b, a scale of female, of usual form, enlarged; 2c, wide form of the same, enlarged; 2d, a male scale enlarged. The figure is from Prof. J. H. Comstock's *Report to the U. S. Department of Agriculture* for the year 1880, while Entomologist of the Department.

The species of lady-bug, *Chilocorus bivulnerus* Muls., which seems to be specially commissioned to feed upon the eggs of this and other scale-insects, was present upon the trees in great abundance. Its larval stage had already passed, and it was now occurring in its pupal and perfect stages. The larval cases, split longitudinally upon their back, and disclosing the pupal case within, were quite numerous; as many as ten of these could be seen upon a single leaf.

The larger number of pupæ had given out the pretty beetle, with its shining black wing-covers, bearing centrally upon each a blood-red spot—the two spots suggesting the common name that it bears of “the twice-stabbed lady-bird.” A few of the beetles were still emerging, with pale ochraceous-colored elytra, and without the least indication of the two red spots which are gradually developed later with the darkening of the wing-covers. In a few minutes time, about one hundred and fifty of the beetles were collected from the leaves and branches of a pine—most of them from the branches, on which they were found quietly resting.

An examination of the scales upon the more badly infested trees showed that most of them had been eaten into and their contents destroyed.

From pupæ collected and taken to my office, the beetles continued to emerge for about ten days thereafter.



FIG. 37.—The Twice-stabbed lady bird, *CHILOCORUS BIVULNERUS*: The larva and imago.

THE CARPET BEETLE.

Anthrenus scrophularice (Linn.).

A very early date for the appearance of this beetle abroad is April twenty-seventh, at which time it was found feeding on the pollen of a *Crocus*, associated with *Anthrenus varius* Fabr., by Mrs. Hoagland, of Albany. It seemed to show a preference for the white-

flowered Crocus, in which sometimes a half-dozen of the carpet-beetles would be seen at the same time.

An early date for its flight within doors is March sixth, when an



FIG. 38.—The Carpet-beetle, ANTHRENUS SCROPHULARIE.

example of it was seen floating in the water of an aquarium in my office. It is probable, however, that the beetle may at any time during the winter months, be brought out from its quiet and often protracted repose within its ruptured pupal skin (alike contained within the split larval skin), as it has been observed under such conditions, disclosing segments of its brilliantly-scaled wing-covers, on November eighteenth. A number of our noted household pests, in their perfect domestication, are apparently no longer subject to stated times for the appearance of their successive broods.

As a Museum Pest.—From a box of unspread *Noctuidæ*, contained in a drawer of the entomological cabinet at the Capitol, two examples of *A. scrophularie* and three of *A. varius*, were taken on January 11, 1888; the note made at the time does not state how many of them were alive. The only other instance under my observation of the carpet-beetle as an insect pest, was in finding a living imago, early in January, in association with an *Eumenes fraterna*, upon which it had evidently been feeding and partially consumed.

THE OAK-PRUNER.

Elaphidion parallelum Newm.

Mr. George Theo. Lyman, of Bellport, Suffolk Co., N. Y., writes of an extraordinary increase this year (1887) of this oak-pruner. He had gathered, on his place alone, six large cart-loads of the severed twigs.

Most of the twigs, on examination, were found to contain the larva, but in quite a number it was absent, and in these cases there was a hole in the cut-off end. He was led, from this observation, to question the statement of Harris and others, that the insect transformed within the twig. Reply was made that in these cases, probably, the packing of the burrow in the excised section had been eaten into by some bird or predatory insect, and the larva devoured. That many of the larvæ and pupæ are thus destroyed has been recorded by different writers. Dr. Fitch records that insectivorous birds have frequently been seen industriously picking around the ends of the

twigs lying on the ground, and that doubtless the oak-pruner often falls a prey to these sagacious and diligent foragers.

Mr. Lyman had also observed this present season, at Waltham, Mass., where there are many oaks, the same ravages of this insect as at his home at Bellport, L. I. He had cut open the burrows of many, at Waltham, and had found the grub in most, but it seemed to differ from those at Bellport, in being larger, longer, having a less pointed tail, and a square, blunt head.

He also noticed that some of the twigs, unmistakably cut off by the grub, had no burrow in them, but only a shallow pit of the diameter of a burrow on the severed surface, raising the question, in his mind, whether the grub did not sometimes lose its direction and burrow downward toward the trunk instead of from it.

OVIPOSITION OF *SAPERDA CANDIDA* Fabr.

The following notes, condensed from a communication made by E. W. Junkins, of Carroll Co., N. H., to the *New England Homestead*, of January 3, 1885, are of value as an addition to our knowledge of the habits and life-history of the destructive round-headed apple-tree borer, *Saperda candida*:

A part of a trunk of an apple tree that had been killed by the borers and taken within doors in the early spring, showed, through a crack opened by drying, a pupa of the beetle, on May twentieth. On June eighth it had changed to the beetle (indicating a pupal period of at least nineteen days). Four other specimens that afterward emerged were inclosed in a large glass jar containing wet sand at the bottom, into which were thrust some shoots of an apple tree. The beetles fed upon the tender bark. On June fifteenth, one of the four females was seen depositing an egg. "She first made an incision in the bark close to the sand; then turning head upward, with her ovipositor she placed the egg under the bark nearly a quarter of an inch from the incision, the bark having been started from the wood. July seventh a young borer, three-sixteenths of an inch long, made its appearance. July eleventh, the sticks near the sand were full of eggs, and the beetles were depositing their eggs higher up on the sticks. July eighteenth, one of the borers, three-eighths of an inch long, had worked an inch and a half downward. August seventh, the last beetle died, but would doubtless have lived longer with better care."

On the twenty-sixth of August a beetle was captured among the branches of an apple tree, in the trunk of which eight young borers

were found. The beetle was kept alive for several days and deposited an egg.

This insect is probably known generally to the orchardists in localities where it occurs in injurious numbers, but for the benefit of those

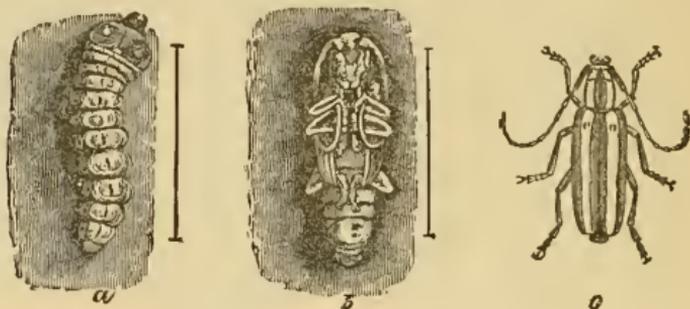


Fig. 39.—The round-headed apple-tree borer, *SAPERDA CANDIDA*; a, the grub or larva; b, the pupa; c, the imago or beetle.

who may not be familiar with its appearance, representation is given of it in Fig. 39 above.

The above observations of Mr. Junkins are of considerable importance, as they extend the period of oviposition of the beetle much beyond the period heretofore assigned to it, and consequently the time during which the application of soap to the trunk of the apple tree to protect it from the egg-deposit is to be made, will also require a corresponding extension.

Professor Riley has stated:

The female deposits her eggs during the month of June, and the young worms hatch and commence boring into the bark within a fortnight afterward. * * * Keep the base of every tree in the orchard free from weeds and trash, and apply soap to them during the month of May, and they will not likely be troubled with borers. (*First Report on the Insects of Missouri*, pp. 43, 45.)

Dr. Fitch states as follows in his account of this insect given in his *First Report on the Insects of New York*:

The beetle makes its appearance every year early in June. * * * In the course of this and the following month the female deposits her eggs (page 13).

Commonly, here in Washington county, they begin to be found upon trees about the twentieth of June, from which time until the close of the month they appear to be more numerous than they are afterward (page 17).

In all orchards where the borer is present, this measure [soap application] should invariably be resorted to the latter part of May, or in more northern localities, where the beetle will be somewhat later in appearance, early in June (page 22).

Referring to Mr. Junkins' observations of the first egg having been deposited after the middle of June, many after July eleventh, and oviposition continued even after the twenty-sixth of August (probably into September), it would seem advisable that the use of the soap application — perhaps our best preventive of the injuries of this pernicious borer — should, in northern New York, not be delayed longer than the first week of June, and should be continued *through the month of July* and into August.

Mr. Charles G. Atkins, of Bucksport, Maine, in a paper read before the Maine State Pomological Society at its last annual meeting, confirms the above observations on the late oviposition of *Saperda candida*. He has found the egg-laying to begin (at his farm in Kennebec county) soon after the middle of June, and to continue until late in August, and had not with unhatched eggs after the first of September.

Mr. Atkins offers the suggestion that relief from this apple-tree borer may be better sought through remedial than preventive measures. With young trees having a smooth bark he would prefer mounding the base to a height of six inches or more with sand, thus compelling the borer to place its eggs where they, or the young larvæ emerging from them and entering the bark, may easily be discovered by proper inspection and destroyed. (*Home Farm*, March 5, 1885.)

ORTEALTICA COPALINA (Fabr.).

Numbers of this beetle were observed at Schoharie, N. Y., on July sixth, feeding on the leaves of *Rhus typhina*. It was the first time that the species had been noticed by me upon this plant. Many of the beetles were paired, while others were engaged in feeding on the lower surface of the leaves which they eat away, causing them to dry up and shrivel as if from the effect of heat.

This species belongs to the *Chrysomelidæ*, and to the group *Crepidodercæ*. In systematic arrangement it comes next to *Epitrix*, and is, therefore, closely allied to the well-known cucumber flea-beetle, *Epitrix cucumeris* (Harris), which at the present time is so injurious to the potato crop in the State of New York.

In the sixth Missouri report, Professor Riley has given illustration, the life-history, etc., of another sumach-feeding Chrysomelid, *Blapharida rhois* (Forst.), which he designates as the "jumping sumach beetle." It feeds readily on all of our indigenous sumachs, and in some years completely denudes them over large tracts of territory.

THE CLOVER-LEAF WEEVIL DESTROYED BY A FUNGUS ATTACK.

Phytonomus punctatus (Fabr.)—*Entomophthora Phytonomi* Arthur.

During the latter part of May, 1885, some larvæ were received from Dr. E. L. Sturtevant, which had been taken from the grounds of the New York Agricultural Experiment Station, at Geneva, and had evidently been killed by a fungus attack. The larvæ were found attached to, and coiled around, the tips of blades of grass, dead, stiffened, shrunken, and partly covered with a whitish fungus. From a careful examination of the larvæ, it seemed probable that they were immature forms of the punctured clover-leaf weevil, *Phytonomus punctatus*. The beetle is shown in Fig. 40, in twice its natural size.

Other examples of the larvæ were received from the same source, on November third, in the same condition with those previously sent.



FIG. 40.—The punctured clover-leaf weevil, *PHYTONOMUS PUNCTATUS*; dorsal and side views,

compared with alcoholic specimens, and was found, from the structure and markings of the head of the larva, to be, beyond doubt, that of *Phytonomus punctatus*.

Dr. Sturtevant having suggested the possibility that the fungus attack may have been the result of the fertilizer used at the station, the fungus was shown to Prof. Peck, the New York State Botanist. It was pronounced by him, in all probability, an undescribed species, allied to the well-known fly-fungus, *Empusa muscæ*.

On mentioning the above facts to Hon. G. W. Clinton, he expressed his belief that the fungus may have been communicated in the manner suggested by Dr. Sturtevant, if fish-remains entered into the composition of the fertilizer, from the fact that a common fungus found infesting fishes is the *Saprolegnia ferax*, which is believed to be but the aquatic form of the *Empusa muscæ*.

The above was communicated to Dr. Sturtevant, with an inquiry of the nature of the fertilizer that had been used. Answer was returned that he had obtained from the manufacturers the formula of its composition, and that "the nitrogenous material was supplied by acidulated fish-skins, dried ground horse-meat and western blood."

If, as seems not improbable, the death through fungoid attack of the larvæ, may be shown to be the result of the use of the fertilizer, either through the discovery of the same fungus in the fertilizer, or,

better still, by experiments with healthy larvæ—the mortality of the larvæ observed at Geneva, by Dr. Sturtevant, will certainly be an event of unusual interest. It would appear to give us the means of destroying a pest which, up to the present, it has not been possible to control, while, at the same time, stimulating the infested crop and thereby enabling it the better to resist all other forms of insect attack. Nor would its efficacy be limited to this particular species, but it would be doubtless available against many other insect enemies, especially those that burrow in the ground, after the manner of the *Phytonomus*.

The fungus attack was subsequently studied by Professor J. C. Arthur, Botanist of the Experiment Station, and his report upon the same may be found in the Fourth Annual Report of the Station, 1886, pp. 258-262. It is there fully described by him, and also illustrated in four figures, under the name of *Entomophthora Phytonomi*. The following extract is made of the conduct of the infested larvæ and their appearance under the attack:

The sick larvæ of all ages crawl up the herbage during the night, and instead of again concealing themselves near the ground on the approach of light, as the healthy ones do, ascend as high as possible, and, if on grass, coil themselves in a horizontal position about the apex of the blade, as in Fig. 41, or if on other objects, take a position as nearly similar as the shape of the object permits. If disturbed before the middle of the forenoon, the majority are still able to crawl, although sluggishly: by noon most of them are quite dead, but unchanged in appearance. It will be found that they cling to the leaf with greater tenacity than during life. Examining the under sides of the body will disclose the fact that delicate, colorless holdfasts have grown out from the median line, which, attaching themselves to the leaf, hold the insect firmly in place. Late in afternoon the body has changed from the normal yellowish or pea-green and smooth appearance to velvety-gray. The next morning there is only a small blackened and shriveled mass remaining, while the surrounding foliage is powdered with a whitish, clinging dust, composed of the spores of the fungus.

* * * This is the general course of the rapid and fatal disease.



FIG. 41.—Fungus-attacked larva of *PHYTONOMUS PUNCTATUS* coiled about the tip of a blade of grass. Enlarged five diameters.

In 1886 and 1887 the insect did not appear on the grounds of the station in sufficient number to invite attention, and no further observations were made on the fungus attack.

PECILOCAPSUS LINEATUS (Fabr.).

From Mr. E. S. Goff, of the N. Y. Experiment Station, some Hemiptera, in their larval and pupal stages, feeding in the garden of the station upon sage, *Salvia officinalis*, were received June 1, 1885.

The larvæ were broadly elliptical. Head testaceous; eyes black; first joint of the antennæ testaceous, second joint pale basally, and the others pale at the joints. Thorax testaceous anteriorly, with two black spots on its hind margin, separated by a pale mesial line. Abdomen red, with eight transverse dorsal lines, broken mesially by a pale line; the rudimentary wing-pads black. Legs pale; femora darker above; tibiæ brown-spotted.

Pupæ.—Wing-pads more than one-half as long as the abdomen, shining black, with a broad whitish longitudinal line from their base, but not reaching the tip near their outer margin; this line continued in yellow upon the thorax, dividing each lateral black spot into two—the outer one being simply a marginal line. A yellowish dorsal line from the thorax over the abdomen; segments black except on their posterior margin and at their sides; femora with two black rings.

The imago from the above appeared on June thirteenth, in three examples, and proved to be the species named above, and commonly known as the "Four-lined leaf-bug." They were the variety *b*, described by Dr. Fitch as wanting the black dot at the end of the outer black stripe on the wing-covers, on the triangular piece marked off by a suture before the membranous tip. As the three examples were females, it was thought that the absence of the black spot might be a sexual feature, or possibly



FIG. 42.—The four-lined leaf-bug *PECILOCAPSUS LINEATUS*, three times the natural size. certain broods might be thus characterized. In accordance with a request made to Mr. Goff, a number of examples from the garden at the Experiment Station were sent to me. It was found from them that the spot gave no special indication, as of the thirteen males received seven were without the spot, and of the seven females, two.

Mr. Goff stated that for the past three years this insect had appeared in very nearly the same place in the garden, but in somewhat greater numbers the present season. Last year (in 1884) it made a serious attack upon gooseberry bushes at the Experiment Station, depleting the tips of the young growth, so that they shriveled, wilted down and died. It was also received from Batavia, N. Y., as injuring sage in a garden.

While so abundant and destructive in my own garden in 1881 (see *First Rept. Insects N. Y.*, p. 271), it has not been injurious since, although examples of it have been observed each year, feeding on the black currant, *Ribes nigrum*.

ATTACK ON YOUNG PEARS BY A PLANT-BUG.

Messrs. Ellwanger & Barry, of the Mount Hope Nurseries at Rochester, N. Y., have sent me under date of June 19, 1884, some specimens of young pears, blotched and injured, together with insects taken upon them.

Some of the pears, of about one-half inch in diameter, show as many as forty blotches from an eighth of an inch in diameter downward. From the minute puncture originally made, the juice as it has escaped has become hardened and granulated, and with its increase has split the skin in different directions, often in a triangular form or one wound running into another. The more seriously injured pears would be rendered unfit for sale from their knotted surface, even if after such a drain upon them they should continue upon the tree, which is not at all probable.

The insects taken upon the injured fruit were the tarnished plant-bug, *Lygus pratensis* (Linn.). Although they were not actually observed feeding upon the juices, there can be no reasonable doubt of their being the authors of the injury. This form of attack (upon the fruit) has not been previously recorded, yet their fondness for the blossoms of the pear is known, and they are also known to be destructive to the fruit of the strawberry.

In the attack above recorded, the insect has apparently shown a preference in the variety of pear it has selected. Messrs. Ellwanger & Barry



Fig. 43.—The Tarnished plant-bug, *Lygus pratensis*.

write: "The whole of the fruit in one of our *GUS PRATENSIS* orchards on the Duchesse d'Angouleme trees is affected; while on the Beurre d'Anjou and other varieties, we find nothing of the kind."

In the *American Entomologist*, ii, 1870, and in the *First Report on the Insects of New York*, 1882, statement is made of a pear orchard having been saved from the destruction of its blossom buds by this insect, by shaking them from the branches into a vessel of soap-suds, for three successive mornings. If equally effective in other instances of attack, it will prove a valuable remedy, for its control is often quite difficult, if not impossible.

This destructive plant-bug, of wide distribution over the United States, and of very injurious habits from its broad range of food-plants, has long been known as *Lygus lineolaris* Pal. Beauv., and has been but recently referred to the species described as *pratensis* by Linnæus.

AN EXPERIMENT WITH THE THIRTEEN-YEAR CICADA.

The following paper was read before the Albany Institute at its meeting on October 6, 1885, with a view of making record of the planting of a brood of the "thirteen-year locust," at Kenwood, near Albany, and of the request that observations be made of the appearance of the winged insect at the time that its development may be expected:

"It is probably known to all the members of the Institute that notwithstanding the rapidity of multiplication in the insect world — very few of the species requiring more than a year for their life-cycle, and many having several generations in the year — one species requires seventeen years for its development from the egg to the perfect insect, viz., the seventeen-year Cicada, or the *Cicada septendecim*. That so exceptional a life-period is still doubted by many is not strange, in view of the fact that the Cicadas are seen to appear at shorter intervals than seventeen years — indeed, almost every year witnesses their appearance in some part of the United States. But this admits of easy and satisfactory explanation. There are a number of distinct broods occurring within the United States — no less than twenty-one are known — having each its geographical limits, sometimes overlapping one another, but each ever true to its seventeen-year period. Within the State of New York we have five of these broods, one of which made its appearance on Long Island during the past summer, in immense numbers, and another will appear also on Long Island in 1889.

"Besides this seventeen-year Cicada, Prof. Riley has also discovered the existence of a thirteen-year Cicada.

"No specific differences in appearance between these two forms can be detected, for which reason the latter is not accepted as a distinct species, but is regarded only as a form or race. The thirteen-year Cicada is a southern form, which, in its northern extension, does not reach further than into the southern part of Illinois. We do not have it in the State of New York.

"In the possibility that this short-period southern form may, in the lapse of time, have been developed from the normal seventeen-year race, as a consequence of the higher temperature of the Southern States hastening its development, Prof. Riley has, the present year, undertaken to test the effect of climate on the permanency of the two races, by transferring them from one region to the other. He thinks it possible that a southern brood brought northward might fail to appear at the expiration of thirteen years, and a northern brood taken south, might appear in a less time than seventeen years.

"Offering to him my assistance in the interesting experiment, he has sent to me a quantity of apple twigs from Mississippi, filled with the eggs of the thirteen-year Cicada, with the request that I would place them in an orchard where the result of the experiment could be observed at the proper time, and that I would also have proper record made of the same.

"I, therefore, ask place in some publication of the institute, for the statement that the orchard of Mr. Erastus Corning, at Kenwood, was selected for the planting of the eggs, from the considerations that it was a young orchard, that it promised permanency for the desired time, and that no other brood of Cicada would occur there with which this could be confounded. The tree beneath which the eggs were placed (they were hatching at the time, and the twigs containing them set about the base of the tree, and tied to its lower branches) was marked with a zinc label, bearing this inscription:

"*Thirteen-year brood of Cicada (Riley's Brood, No. VII) — eggs from Oxford, Mississippi, planted July 4, 1885.*"

"Additional eggs from a second sending were placed beneath the same tree on July twenty-first, and also some in a wood adjoining, a few rods toward the south, to serve as a food-supply in the event of the death or destruction of the orchard.

"As I may hardly hope to see the result of this experiment, may I beg of some of the members of the Institute who are interested in Natural History, that *in the month of June, 1898*, they will make examination of the labeled tree and trees adjoining, for the pupa cases of the Cicada that should be found upon the trunks, if still obedient to their thirteen-year period, and for the insects in the vicinity, which should easily be discovered, if present, by their well-known song, which would readily reach the ear. Should they fail to appear at the time designated, then the search for them should be renewed the following year, and, if need be, for successive two or three years, until their appearance.

"The result of the observations should be communicated to the Entomological Division of the Department of Agriculture at Washington, unless it should be known that full examination had already been made by an agent delegated for the purpose from the department.

"In the planting of the eggs I was assisted by Mr. William Grey, gardener of Mr. Erastus Corning, who has been requested to communicate to others upon the farm the location of the tree in order that there may be no difficulty in finding the locality at the desired time.

"In addition to the above, other transfers of the eggs of the thirteen-year Cicada from Mississippi, have been made, to Ithaca, N. Y.;

Boston, Mass.; Kittery Point, Me.; Brunswick, Me.; and Ames, Iowa, as noticed in *Entomologica Americana*, for August, 1885, vol. 1, p. 96. Similar transfers, under direction of Professor Riley, of eggs of the seventeen-year Cicada, have been made the present year from Indiana, Michigan and Pennsylvania, to localities in Alabama, Georgia, Mississippi and Missouri."

[For a subsequent notice of the above series of experiments, see Professor Riley's report to the Department of Agriculture, for the year 1885, pp. 254-257.]

WHITE SCALE-INSECT ATTACK ON IVY.

Aspidiotus nerii Bouché.

The following note of inquiry in relation to a quite common insect attack of the ivy has been received from a lady in Watervliet, N. Y.:

"Inclosed please find a leaf of ivy. Will you kindly inform me of the cause of its peculiar appearance, and also the remedy, if any? The leaf and stem are alike infested, and the whole is in an unhealthy condition."

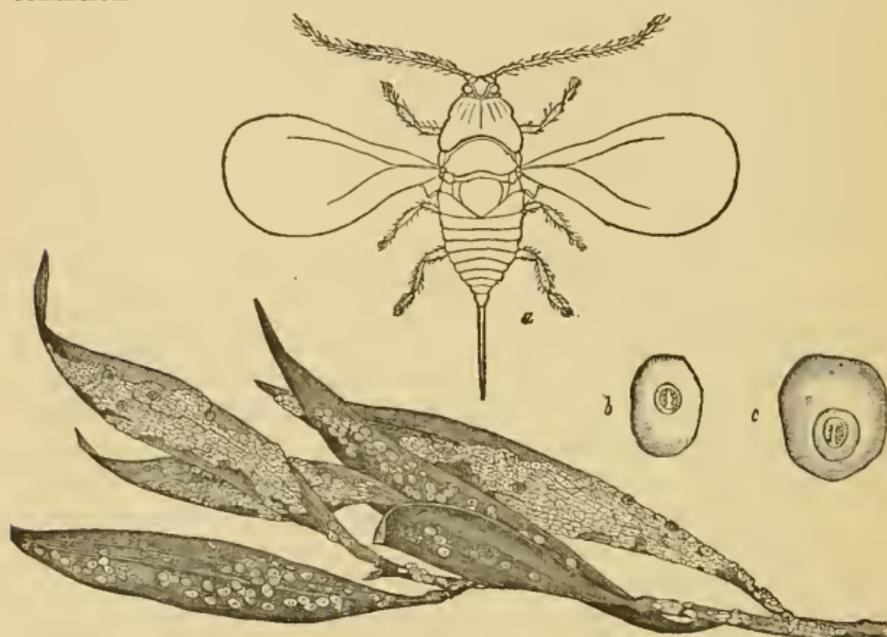


FIG. 44.—The White Scale, *ASPIDIOTUS NERII*, in natural size, on an acacia twig: a, the winged male insect; b, the male scale; c, the female scale — each enlarged.

Reply was made that the leaf sent for examination showed upon both surfaces, clustering about the veins and more thinly distributed elsewhere, and upon the leaf-stalk, many whitish, rounded, slightly

convex spots, varying in size from almost microscopic to nearly as large as the head of a common pin. Examined under a lens, their peculiar elevated centers show them to be a species of scale-insect, known as *Aspidiotus nerii* Bouché [represented in the accompanying figure]. It is quite a common species upon the oleander, from which its specific name has been taken. Prof. Comstock in his notice of it—*Second Report in the Department of Entomology of the Cornell University Experiment Station, 1883*, states that it is generally distributed throughout the United States, and occurs upon the cherry, plum, currant, English ivy, maple, upon lemons from the Mediterranean, etc. These scale-insects are very injurious to the ivy when they attack it, for multiplying rapidly, their immense number make such a draft upon the juices of the plant that it can not long withstand the drain. On the first notice of the scales, their spread should be checked, if possible. If the plant is small, each leaf should be separately treated, by scraping the scales from them, or washing them with a strong soap solution, or a kerosene emulsion.

To larger plants the application would have to be made by sprinkling or by spraying with a force-pump.

By far the best time to attack the insect is when the young are first hatched and have crept out from beneath the sheltering scales. From their minuteness this could only be ascertained by the aid of a magnifying glass, under which they would appear as small dots slowly moving over the surface of the leaf. At this stage they could be killed by a solution of one pound of soap (strong rosin soap) in two gallons of water.

If not convenient to wait and watch for this phase of the insects' life, they may be killed at any time while in the egg stage beneath the scales by a kerosene and soap emulsion prepared as follows:

Dissolve one pound of rosin soap, in one quart of boiling water; add gradually one quart of kerosene, with constant stirring, until emulsified. The result will be a gelatinous compound consisting of fifty per cent of kerosene. This emulsion diluted, when used, with two gallons of water, would give a solution containing ten per cent of kerosene, which, if properly distributed so as to reach all of the scales, should be of sufficient strength to destroy the eggs without injury to the plant. [This formula is nearly the same as that given on page 262.]

The season at which the young insects hatch upon in-door plants depends upon the temperature of the room, but would ordinarily be during the latter part of winter.

THE BLACK-KNOT OF THE PLUM-TREE AND ITS GUESTS.

A piece of a limb of a plum-tree having the well-known "black knot" upon it was received in July, with the inquiry of the kind of insect that caused its growth, and if there was any remedy for the attack. The tree from which the piece was taken was wholly free from it, it was stated, in the spring.

It is a popular belief that the black-knot, so common on plum and cherry trees, and which causes annually the death of thousands of these trees throughout the United States, is produced by an insect attack. There is some foundation for this belief in the fact that insect larvæ are frequently found within the knot. These, however, are not the cause of the obnoxious growth, but merely enter it for food or shelter during its early formation.

The common plum curculio, *Conotrachelus nenuphar*, which is so destructive to the fruit of the plum-tree, has been bred by Dr. Fitch, Mr. Walsh, and others, from larvæ inhabiting the black-knot. Mr. Walsh has also bred from it five other species of insects — two of flies, viz.: *Ceratopogon* sp. and *Diplosis septemmaculata* Walsh, and three species of small moths, referred with doubt to the genus *Hedya* (*Practical Entomologist*, i, p. 50). Larvæ have on different occasions been taken by me from their cocoons made upon the margin of the black-knot, where it was overgrowing an excision of the preceding year, and the empty pupa-cases of evidently the same moth have been seen protruding from the knot. The moth, unfortunately, was not obtained, but it was probably that of *Ægeria pictipes* Grote-Rob., which is known to infest plum-trees sometimes in great numbers (*North American Entomologist*, i, 1879, pp. 17-21, with plate).

Although it is not many years since the origin of the black-knot was in doubt, for even in 1859, Dr. Fitch pronounced it not a fungus (*Trans. N. Y. State Agricultural Society for 1859*, xix, p. 606), it is now known to be a fungus growth of a species long ago described and named as *Sphæria morbosa* Schw. Quite recently it has been transferred to the genus *Plowrightia*, and this later generic name will probably ere long be generally accepted.

The specimen sent is of a brown color, for it is not until late in July or about the first of August that it presents its well-known black appearance, caused by "numerous coal-black hemispherical plates of about the size of the head of a pin, each of which is a distinct fungus."

Professor Riley has quoted Mr. Walsh as having shown that the black-knot fungus infesting the cultivated cherry "was quite distinct from that attacking the cultivated plums." He has also indicated another species occurring upon the "Miner plum," which may be seen "at a single glance to be essentially distinct from the common black-knot

of the plum." He writes: "It would seem to follow that there are three distinct black-knots, originating, respectively, from choke-cherry, from the common wild plum and from the Chickasaw plum." (*American Entomologist*, ii, 1870, p. 231.)

Those who have studied this fungus the most thoroughly believe in the existence of but one species, which readily transfers itself from the plum to the cherry, and the reverse. According to Professor Peck, New York State Botanist, "it is now known to occur on *Prunus domestica*, *P. Americana*, *P. cerasus*, *P. Virginiana*, *P. Pennsylvanica*, and *P. serotina*. Two of these are plum trees — one introduced, the other native — and the remaining four are cherry trees, of which the last three are indigenous" (*Thirty-first Report of the N. Y. State Museum of Natural History*, 1879, p. 60*).

Remedy.

The only remedy, so far as known, for the black-knot, is the free use of the knife as early as possible after its discovery. Mr. Walsh has emphasized the following as the remedy that may be relied on: "If the diseased twigs are cut off and destroyed early in July in the latitude of New York, or a little earlier or later according to the latitude, taking care to cut a few inches below the affected part, the black-knot can be checked and probably entirely eradicated; but if this operation is delayed until August, it will be of no benefit whatever."

If the above remedy is resorted to in the early stage of growth the limb or twig need not be removed, but the fungus can be cut out with a sharp knife while still confined to one side of the branch, permitting, if properly done, the wound to heal in a short time.

Those who experience difficulty in arresting the spread of the black-knot should avail themselves of the information contained in a paper entitled "Black-knot — Cause and Remedy," by Professor C. H. Peck, published in the *Country Gentleman* for June 28, 1888 (vol. liii, page 485). No paper of higher practical value has ever been published on the subject.

· COLLECTIONS IN THE ADIRONDACK REGION, ET AL.

[From the Report of the Entomologist to the Regents of the University for 1883, published in the Thirty-seventh Annual Report of the New York State Museum of Natural History.]

The collections [for the year 1883] have mainly been made in Middleburgh, Schoharie county; at Elk lake, in Essex county; in the town of Hammond, St. Lawrence county; and in Albany.

*In addition to the species herein named, I have also observed it abundantly on the sand plum, *Prunus maritima*, on Coney Island.

Among those at Middleburgh were a number of *Trypetidæ*, of the group in which the wings are exquisitely marked with clouds and spots in the beautiful patterns so admirably delineated in the four plates of Baron Osten Sacken, and the late Dr. Loew, of Prussia, in their valuable Monographs of this interesting family. These flies had seldom fallen under my observation before, and then in only single examples; but at this time (middle of July) and place they were not at all uncommon, traveling, with the strange movements peculiar to them, over the leaves and stalks of the milkweed (*Asclepias cornuti*) and wild parsnip (*Pastinaca sativa*), within which the species may perhaps breed.

The time of my visit to Elk lake — August fifteenth to thirtieth — was favorable for the collection of two species of butterflies which are rarely met with in this State, except in localities having high elevations, approximating that of Elk lake, which is 2,000 feet above tide. *Grapta Faunus* (Edw.) and *Grapta j-album* (Boisd.-Lec.) were comparatively abundant in the roadway leading to the lake, resting for a while upon the damp soil to imbibe its moisture and then flitting away to the adjoining shrubbery. Both species had evidently but just emerged from their pupal stage. Of another species of butterfly, *Feniseca Tarquinius* (Fabr.), which appears to be quite local in its distribution and to occur more frequently within this State, in the Adirondack region than elsewhere, several examples were captured, but all in indifferent condition, showing that they had already been abroad for a number of days. Its larval food-plant was said by Mr. Glover to be hawthorn (*Cratægus*),* but in this and in both previous instances in which the butterfly has been observed by me, it has been associated with alders (*Alnus* species), and where the hawthorn was not seen to occur.

An interesting illustration of the abundance at times and in certain localities of a particular species of insect, conjoined with the absence of other allied and perhaps more common forms, was given me at this locality. With a single exception, in a solitary example of *Catocala unijuga* Walker, the only noctuid moth observed during my fortnight's sojourn here was *Agrotis clandestina* (Harris). To add to the interest, all the examples had one common hiding-place, viz., behind and about the sliding window-sashes of the exceedingly simple log structure that was dignified with the name of the Elk Lake Hotel. The only conceivable attraction of such a multitude of moths to their covert was a single kerosene hand-lamp, and later at night for a brief

* The larva has since been found to feed on the woolly plant-lice that occur in large clusters on the trunks and limbs of Alders: See 4th Rept. Ins. N. Y., 1888, p. 179.

space of time, a candle in each of the four bed-rooms. Their assemblage in such numbers, under such circumstances, was a mystery to me. A sash could not be moved without disturbing a dozen of them. Hundreds could have been captured, but as many were in poor condition and the species is a common one, twenty-five examples only were brought away.

The black-fly, *Simulium molestum*, was abundant, but not very troublesome, for in the month of August it ceases to show the insatiable disposition to gorge itself with blood that it manifests in the preceding months.* A number of specimens were captured and bottled for the Museum collections as objects of interest to the many who have never recognized this minute yet most annoying pest of our Northern Wilderness.

Upon some cut poplars (*Populus tremuloides*) piled by the way-side, a large number of a wood-boring beetle, *Agrilus torpidus* Lec., which I had never met with before, were observed alighting from their flight in the bright sunshine, and running actively, in jerking motions, over the bark. Sixty-two examples of it were taken. Its larva is probably a borer in the poplar.

COLLECTIONS IN THE ADIRONDACK REGION IN 1885.

[From the Report of the Entomologist to the Regents of the University for 1885. Published in the Thirtieth-ninth Annual Report of the New York State Museum of Natural History.]

About three weeks in the month of August were devoted to collections in the Adirondack region, at Long lake, in the northern part of Hamilton county, N. Y. The altitude of the lake is 1,632 feet above tide. This elevation is too great to admit of an abundance of insect life, while it fails to reward the collector with the rare forms which are to be met with at higher elevations—at and above 2,500 feet.

Very little is known, as yet, of the insect fauna of this interesting portion of our State. As I have previously written, "The enthusiasm of the entomologists of an adjoining State has led them to explorations of a peculiarly interesting field lying beyond the limits of their own State—the White Mountains of New Hampshire. For successive years the members of the Cambridge Entomological Club have established a midsummer encampment upon the slope of

* The guides of this region have a familiar saying, that "the black-fly doesn't bite after it has put on its white stockings," referring to the white bands upon its legs. Probably this is a different species and more blood-thirsty than the form that abounds earlier in the season and not thus marked. Unfortunately, the black-flies of the Adirondacks have not been studied, and *Simulium molestum* is only a manuscript name.

Mt. Washington, during which, through their protracted sojourn of weeks, and opportunity for collecting crepuscular and nocturnal forms, they have been able to enrich their cabinets, and those of their correspondents, with many rare boreal species, to accumulate much valuable biological information, and to present local lists of Lepidoptera, Coleoptera, and Orthoptera, which have been received as special contributions to science.

“Meanwhile the extensive Adirondack region, with its numerous lofty mountain peaks, its deep gorges, its hundreds of lakes—perhaps second only to the White mountains in point of interest to the entomologist of any locality in the United States east of the Rocky mountains—has been permitted, year after year, to bury within itself its entire entomological wealth. Previous to the collections noticed in this paper [*Lepidoptera of the Adirondack Region**], hardly an insect had been drawn from it. At the present nothing has been reported of its mountain insect fauna. Many new species are undoubtedly to be discovered there, and the first comparison of its fauna with that of other elevated and more northern regions is yet to be made.

“It is sincerely to be hoped that, from the growing interest manifested in entomology, the numerous accessions to the number of its students, the facility for study afforded by recent publications and in several extensive classified collections, the reproach resting on the entomologists of New York may speedily be removed. And while the thorough exploration of any locality can scarcely fail of bringing to light much new material, the ambitious student may have for his incentive the assurance that in the Adirondack mountains there is open to him an unexplored field where faithful search will assuredly yield him a most abundant return.”

The locality of Long lake and the season offered but few flowering plants for the attraction of insects. The collections, therefore, were mostly confined to golden rods (*Solidago*) and the hard-hack (*Spiræa tomentosa*), which were freely visited by Hymenoptera, Diptera, and Coleoptera for the pollen that they afforded.

Of the Hymenoptera, the flowers were especially prolific in *Apidæ*, *Andrenidæ*, *Eumenidæ*, and *Crabonidæ*, whilst also yielding some desirable *Ichneumonidæ*.

In Diptera, several species of the gaily-colored *Syrphidæ* (flower flies) were abundant, of which, perhaps, the most interesting form was *Spilomyia fusca* Loew—a large fly, so singularly mimicking in size,

* *Seventh Annual Report of the Topographical Survey of the Adirondack Region of New York*, 1880, pp. 375-400.

form, color, and markings the common "bald-faced hornet," *Vespa maculata* Linn., as to be easily (and generally by other than entomologists) mistaken for it. The species had never come under my observation before, nor has it been recorded as occurring in the State of New York. Its first capture was made on the eleventh of August. It continued to increase in number, in both sexes, and the day prior to my departure from the locality (twenty-third inst.) it was more abundant than before. Over forty examples of the species were taken. Nothing, I believe, is known of its larval stage. Several examples of an interesting Conopid fly, *Physocephala furcillata* Williston, which had previously been taken only on the White mountains, were also captured on the *Solidago*. A large, globose-bodied Tachinid fly, *Echinomyia* sp., having its alulae and basal portion of wings of a dull yellow, which I had in former years observed abundantly in Essex county, N. Y., was also a common visitor to the blossoms of the golden rod.

The collections in Lepidoptera were not large, the locality not being favorable to the multiplication of insects of this order. But few species of butterflies were seen, the following species being the only ones that were observed: *Colias Philodice* and *Pieris rapæ*, not abundant; *Danais Archippus*, abundant; *Argynnis Cybele*, *A. Aphrodite* and *A. Atlantis*, all in poor condition; *Argynnis Bellona*, not abundant; *Pyrameis Atalanta* abundant; *Satyrus Nephela*, rare; *Chrysophanus Americana*, very abundant, and frequent on golden rods; *Lycæna pseudargiolus*, rare, one example; *Vanessa Milbertii*, a few: no examples were seen of *Papilio*, *Grapta*, *Pamphila*, or *Nisoniades*. Of the above named, *Danais Archippus* (Fabr.) and *Pyrameis Atalanta* (Linn.) were so abundant in a field of buckwheat that three or four individuals could be taken in a single sweep of the net. Associated with them were numbers of one of the most brilliant and beautiful of our moths, *Plusia mortuorum* Guenée — a decidedly upland species. Its quick rise from the blossoms of the buckwheat, its rapid flight for a short distance, sudden dropping to the ground and running away to shelter, made it a difficult insect to capture. The elegantly marked *Homohadena atrifasciata* Morr., of which the first example taken in the Adirondacks in the year 1876, commanded in exchange with an enthusiastic lepidopterist, other insects of the value of fifty dollars, was taken from flowers of *Eupatorium purpureum*.

Coleoptera were not numerous. Several species of the pretty Lepurians were found upon the golden rods, and a single example of "the large and elegant *Leptura scalaris* Say," as characterized by Dr. LeConte (p. 313 of *Classification of the Coleoptera of North America*), now the type and only species of the genus *Bellamira*, was driven up

in a *Solidago* bordered road and taken upon the wing. It was seen under the same circumstances in other instances, and when in flight, and displaying the golden sericeous hairs clothing the tip of its abdomen, it resembled so closely a similarly tipped *Asilus* fly that it was mistaken for it. *Dicerca manca* LeC. (apparently not *tuberculata* of L. & G.—see *Trans. Amer. Ent. Soc.*, ix, p. 235), a rare Buprestid, was captured on the floor of the piazza of the Sagamore hotel.

Neuroptera, which should abound in the lake region, were few in number. The only species observed in abundance were the common *Polystecchotes punctatus* (Fabr.), of which hundreds could be seen resting on the parlor walls, and an Ephemeropterid, *Pentagonia vittigera* Walsh, on the slats of the window blinds and edge of the clapboards of the hotel.

About 1,000 insects were collected, mounted and labeled with locality and date of capture.

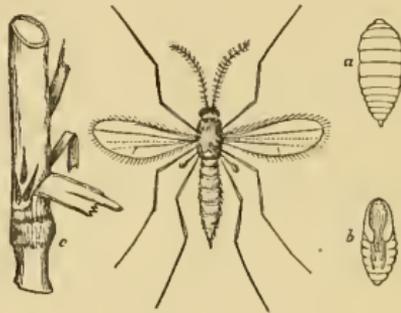


FIG. 45.—The Hessian-fly.

ACARINA AND MYRIOPODA.

A MITE ATTACK ON GARDEN PLANTS.

Leaves of various garden plants showing a mite attack upon them were received in September, from Miss A. Goodrich, of Utica, N. Y., with the following note.

For two years past I have often found the leaves of the *Calla* covered with fine webs spun by a small mite. Last year garden plants were affected. Leaves turned yellow and flowers did not open. One root of *Spiraea* was almost killed. I put it in a pail of warm suds for the night, and planted it in a new place next day. This year it was not so badly attacked, but the sweet English violets and the *Thunbergia* in my window boxes suffered most. I tried hot water of 120° Fahrenheit, on the violets with success. I send specimens of the mite.

The mite is that frequent pest of garden plants and conservatories, *Tetranychus telarius* (Linn.), commonly known as the "red spider." It owes its popular name to its habit of spinning a web, and to the brick-red color which it sometimes assumes — the color which so often brings it under the notice of horticulturists. It may, however, present a great variety of shades of green, brown, and red, dependent to quite an extent upon its food-plants, although occasionally found to offer different colors upon the same plant. Fig. 46, after Claparède, represents it at maturity, greatly enlarged.

Although generally known as a spider, it is a true mite. In classification it stands next to the spiders, and at the head of the mites, in the family of the *Trombididæ*, which contains the most highly organized species of the Acarina. A distinction available in separating the mites from the spiders is that the former are without a pedunculated abdomen. The abdomen instead of being joined to a thorax by a narrow joint of attachment is united to the last of the leg-bearing segments without any well-defined groove of separation.

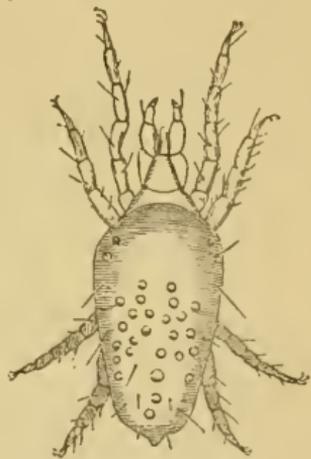


FIG. 46.—The "red spider,"
TETRANYCHUS TELARIUS—en-
larged.

The webs which this species and its associates spin on the under side of leaves and adhering closely to them, are of an extremely

fine and delicate texture. A careless observer would not suspect their true character, but would pass them by as a simple sheen upon the leaf. The separate threads are so fine that they are not to be seen even by the aid of a magnifying glass, but are only visible when combined in an extended web. The silk is secreted from a minute nipple underneath the end of the abdomen. Beneath the web may often be found a large colony of the mites, embracing both old and young, in different stages of maturity, where, under this safe shelter, they are actively engaged in feeding upon the leaf. After biting with the mandibles with which they are provided, through the surface of the leaf, they insert the sucking apparatus and imbibe the juices. Small as is each individual wound, the aggregation of the myriads soon tells upon the leaf and plant, which discolors, droops, turns yellow and perhaps dies under the attack.

It is unfortunate that this insect is so general in its food, for scarcely any tender garden plant is free from liability to its attack. In addition to the *Calla*, *Spiræa*, *Thunbergia* and violet, above-named, it was also present upon the leaves of *Mitella*, *Tropæolum*, *Adlumia*, and beans, sent with the inquiry. Their examination by Prof. Herbert Osborn, to whom they were submitted, showed the presence upon each of the same insect, in the egg, larval, and perfect stages.

This little mite, under favoring conditions, may multiply to an incredible extent, and become very injurious. A notable instance of this has lately been brought to my notice. Leaves of a quince tree infested by this species were sent to me for name, under date of August eleventh, by Prof. Arthur of the New York Agricultural Experiment Station, at Geneva. He reports the attack as occurring in one of the largest quince orchards in the State, about four miles from Geneva. The leaves upon many of the trees were like those received by me, which were nearly destroyed. The attack was rapidly spreading throughout the orchard, and the fruit upon the most seriously infested trees would be an entire loss.

Prof. Arthur was experimenting with the kerosene emulsion to kill the insect, but with what success has not been learned. Properly applied, it could not fail of accomplishing the purpose. A favorite remedy, long used in green-houses, is syringing with a soap solution in which sulphur is mixed. Quassia has also been thought serviceable when added to the mixture. It is quite important that the liquid be so applied as to reach the under surface of the leaves where the mites occur. It is worthy of note that in the above quince attack most of the mites were observable upon the upper side of the leaves.

The attack of this little mite is undoubtedly far more frequent than is supposed, for the reason that the creature can hardly be seen with the naked eye, and an ordinary pocket magnifier only shows it as an animated speck. A nasturtium in my garden, which had been for some time showing yellow leaves, or yellow blotches upon the leaves, without any apparent cause, was found, upon examination for this mite, to show its presence in considerable numbers, in the larval and in the adult stages. As an experiment, one of the infested leaves was dipped in water in which some soap had been stirred, with the result of speedily killing all of the mites upon it.

A PARASITIC MITE OF A SEXTON BEETLE.

Dr. S. A. Russell, of Albany, N. Y., has sent to me an example of one of the burying or "sexton beetles," *Necrophorus tomentosus* Web. (distinguishable from the other red-banded members of the family by the greenish-yellow down covering its thorax, and the two red bands crossing its wing-covers), thickly infested with a small red mite which runs with great rapidity. Several of them were sent to Prof. Osborn, who is making a special study of our mites with reference to a catalogue of the known species. At this present stage of his studies, he was only able to refer it to the genus *Gamasus*. He had previously obtained the same form from another species of *Necrophorus*.



FIG. 47.—The tomentose sexton-beetle, *NECROPHORUS TOMENTOSUS*.

[The catalogue — *A Preliminary List of the Acarina of North America*, by Herbert Osborn, of the Iowa Agricultural College, and Lucien M. Underwood, of Syracuse University — has been published in the *Canadian Entomologist*, for January, 1886, xviii, pp. 4-12].

A PARASITIC ATTACK ON THE COLORADO POTATO-BEETLE.

From a gentleman in Middlesex county, Mass., some live potato-beetles, *Doryphora decemlineata* (Say), were received, to which were attached numbers of "bugs or lice," with the statement that he had found many of the dead beetles thus infested, and only a few live ones that were not attacked, and it seemed as if the beetles would all be killed.

The supposed lice proved to be a very interesting parasite which has been known for several years past to attack the Colorado potato-

beetle, and, as in the present instance, to render valuable service in reducing the numbers of this pest. Its principal interest, perhaps, is in the fact that, up to the present, only two or three true parasites of this beetle have been discovered among its thirty or more known natural enemies.

As an aid in the recognition of this parasite, it may be stated that they are quite minute forms, as five of them placed closely together would not exceed in surface that of the head of an ordinary pin. Their color is yellowish-brown, and in general shape they resemble many of the lady-bugs (*Coccinellidæ*), being oval, flat beneath and convex above. When examined with a microscope, they are found to possess eight legs, and this feature, of course, removes them from the lice and all other true insects, which have but six legs.

Their scientific classification places them among the Arachnoidea, in which are included scorpions, spiders, and mites. As their body

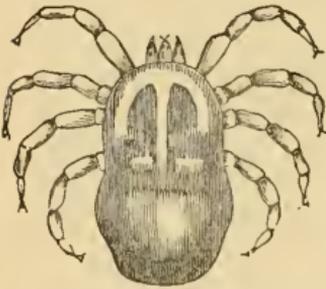


FIG. 48.—The chicken-louse, *DERMANYSSEUS AVIUM*—enlarged.

consists of but one piece, instead of being made up of several segments, they fall in the last-named order, the mites (*Acarina*). This order embraces a large number of greatly differing forms that have been arranged in several families to include, follows: The spinning and the harvest mites (*Trombididæ*), the snouted mites (*Bdellidæ*), fresh-water mites (*Hydrachnidæ*), parasitic mites (*Gamasidæ*), the ticks (*Ixodidæ*), the beetle-mites (*Oribatidæ*), the cheese-mites (*Tyroglyphidæ*), itch-mites (*Sarcoptidæ*), gall and bud-mites (*Phytoptidæ*), and others. The particular family to which this potato-beetle parasite belongs is the *Gamasidæ*, nearly all the species of which, in their wide distribution, live parasitically on mammals, fishes, birds, and insects. The common "chicken-louse," *Dermanyssus avium*, shown in Fig. 48, which is also found on caged canary birds, is a well-known species of this family.

From examples taken from some Colorado potato-beetles in Ohio, in 1873, this little Gamasid mite was described and named by Professor Riley as *Uropoda Americana*. It was found to be closely allied to a species that had long been known to infest beetles in Europe—the *Uropoda vegetans*, having the same habit of attaching itself to its host by a chord or filament, one end of which was fastened to the anal end of the mite and the other to the beetle. Many had been the surmises of the nature and object of this singular attachment in the European species. Some of the old writers had regarded it as a kind

of umbilical cord through which the mite drew its sustenance from its host, and others, that it was a silken thread spun by the mite to serve to fasten it and to prevent its being brushed off by the motions of the limbs of the beetle. Close examination showed, however, that it had no organic structure, that it was fragile and became easily detached; and finally, a French naturalist, M. Dugés, ascertained that it consisted simply of the viscous and dried excrement of the mite, which could be removed and replaced at every new excretion.

The discovery of this parasite in Massachusetts in such abundance is gratifying. There is scarcely a doubt that the dead beetles reported as covered by the "lice," were killed by the attack. (The same attack has in former years come under my observation, near Albany, where the beetles were so infested that every portion of their surface, including their legs, was so covered as to leave room for no additions unless they could be superimposed.) When received, although still upon the potato leaves, they were not feeding, but were evidently greatly debilitated and near their end. The occurrence of the parasite so early in the season (May) is also favorable, for every beetle now destroyed should serve to lessen the number of the pest that would have appeared later in the year by several hundreds. The present brood of beetles will be followed by at least one other during the year, and each female continues to deposit eggs, from time to time, during the five or six weeks of her natural life, until about a thousand have been deposited.

Our correspondent might render excellent service if he would inform himself whether this parasite is to be found in other localities in his vicinity, or in other portions of the State; and if not so found, if he will distribute the infested beetles and so extend the sphere of operations of the serviceable little mite. It would be necessary that they be sent attached to the beetle, as they die very soon after being separated from their host. If some of the potato leaves are put in the box with the beetles when packing them for transportation, there would be less liability of the mites being rubbed from them in transit.

THE CHEESE-MITE INFESTING SMOKED MEATS.

Tyroglyphus siro (Linn.).

From C. H. Wessels, provision broker, New York city, some pieces of smoked ham were received in June [1885], which were infested with myriads of a small white mite. Inquiry was made as to their nature and origin, and for some safe and effectual method of dealing with

them. No attack of the kind had previously come under the observation of Mr. Wessels, or of those engaged in the same trade with whom he had conferred.

Upon critical examination they were found to be identical with the common cheese-mite, *Tyroglyphus siro* (Linn.), a species which, although frequently occurring in vast numbers in cheese, has long

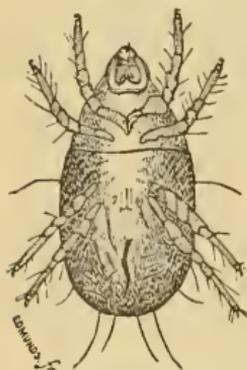


FIG. 49.—The cheese-mite, *TYROGLYPHUS SIRO*—enlarged.

been known to thrive equally well on several other articles of food. It is not at all uncommon in flour, and when observed therein by Linnæus, he presumed it to be a distinct species, and named it *Acarus farince*. When the same insect came under his notice in milk, it was designated by him as *Acarus lactis*. From unusual features presented in some examples, it was named and figured by De Geer (vol. 7, pl. 5, fig. 15) as *Acarus domesticus*, when he had found it occurring in meal, sugar, and smoked meats.

This insect had not been previously known as infesting meats in this country,* although a closely allied species, *Tyroglyphus longior* Gervais, as identified by Professor Riley, had been found in a pork-packing house in a western city, in such abundance as to form layers of half an inch thick in places, beneath sacks of fertilizing material piled upon the floor, composed of livers, lungs, and kidneys, after they had been cooked and dried by steam (*American Naturalist*, xvi, 1882, p. 599). This latter species is distinguishable from the cheese-mite (according to Murray) by its more rapid movements, larger size, longer and more cylindrical body, and more shining hairs sticking out on every side. The habits of the two are said to be much the same, and it is of interest that in a small bit of the infested ham received by me that was sent to Prof. Riley, he identified an example of *T. longior* associated with *T. siro*. The two have been also found in association on old cheese, but *T. longior* in by far the smaller proportion—in but eight per cent upon some Rochefort cheese, and only one per cent on Septmoncal. It is this species which, about half a century ago, enjoyed for a time the notoriety of having been brought into being as a human creation through the electrical experiments of Mr. Cross, named at the time as *Acarus horridus*, before its identity with *T. longior* had been ascertained.

As the origin of the mites occurring upon the ham could not be readily answered, inquiry was made of Mr. Wessels as to the source of the meat, its method of curing, and for any other information that

* See subsequent notice of the same insect infesting smoked meats in Everett, Pa., in *Fortieth Rept. N. Y. St. Mus. N. H.* for 1886, p. 130.

might be pertinent to the question. The following communication was returned:

Replying to yours of the tenth of June, we would state that the hams in question are cured in the western part of Ohio, and in a brine made of salt, saltpetre, and sweetened either with sugar or syrup. They are packed fresh from the animal in tierces, the brine poured in and the package closed—the meat being then left to cure, a process requiring from forty to sixty days, although they remain in this condition from one to twelve months. They come east in that shape and are here taken out of pickle as they are wanted, and smoked. The dipping of which you inquire, is never done to packed hams, but only to bagged or canvassed hams; and is done that the coating may protect them from the deposit of eggs by flies. The smoking that we gave them was not to exterminate the pest, but to prepare them for market. It had, however, no effect upon the insect except to make it more easily discernible. The attack seems to be increasing rapidly, through germination or some other process.

From the above statement, it seems probable that the mites had their source in the establishment in which they were packed—an infested pork-packing house, as in the instance above cited. As a remedy, simple, inexpensive and probably effectual, recommendation was made to Mr. Wessels of dipping the meat in a weak mixture of carbolic acid and water. Used in the proportion of one part of the acid to 100 parts of water, it would, with scarcely a doubt, destroy the mite, not injure the meat for food, nor would the creosotic odor of the carbolic acid impart a disagreeable smell to it.

Before venturing to recommend the above wash for a meat which is sometimes partaken of in an uncooked state, the opinion of Dr. Willis G. Tucker, the distinguished chemist of the Albany Medical College, was asked, and the following answer received:

Yours, concerning use of carbolic acid for destroying flour-mites on ham, is at hand. The internal dose of the acid is about one grain (or one drop of the diliquesced crystals) for an adult. In large enough quantity or a sufficiently concentrated state, it is a caustic, escharotic, and violent poison. It must be used with care, and I would suggest the possibility of its affecting the salableness of the hams, for its odor, slightly different from creosote, might prove objectionable. It is soluble in twenty parts of water. A strength of one to 500 is said to instantly destroy vegetable mold, both plant and spores, and to operate with equal destructiveness upon microscopic animalculæ. Hobbescyler says that all inferior organisms perish in a solution of one to 100. It is used at about this strength to kill the itch-insect, body-lice, etc. I would suggest trying a solution of this strength (1 to 100) or say an ounce to a gallon (1 to 128). If this should be effectual, I do not see how it can hurt the meat, and it certainly would be perfectly safe. If this does not kill the mites, then I would try double the strength.

THE CHEESE-MITE INFESTING FLOUR.

The following communication was submitted to me from a correspondent at Robin's Nest, Ill.:

A few days since a neighbor sent us a pan of wheat flour with the request that we examine it. Setting the pan in a quiet place for twenty-four hours, the surface presented a strange appearance—only comparable to that of an ant-hill—as though each grain was being separately moved. Slightly disturbing this surface and examining through a common sun-glass of low power, it was found to be full of very minute life. Taking a few particles from the mass upon the point of a penknife, and placing within the focus of a botanical glass, at least a half dozen lively little insects were to be seen. They somewhat resembled plant-lice in form, were white, evidently soft-bodied, and were covered with hair, possessed of two antennæ and six legs of a reddish-brown color. An apparent nest, from which a dozen or more would crawl forth, was not larger than the point of a small pin. It is much to be regretted that there was not a proper microscope at hand so that a more extensive examination might be made. Now, what are they—name, family, genus, and history? Where do they come from, and what are they doing in thus desecrating the staff of life?

Reply was made, substantially, that the insect was doubtless an *Acarus*, or mite—one of the family of the *Acaridæ*, which comprises the mites properly so called. The species could not be determined from the above description, but the conjecture was ventured that the critical examination of specimens would show it to be, if not the *Tyroglyphus siro*, well known in Europe as frequently infesting old flour (since its identity with the *Acarus farinæ* of Linnæus has been established), then a closely allied species of that genus.

In appearance it would probably bear a close resemblance to *Tyroglyphus sacchari*, or the sugar-mite, which occasionally may be found swarming in raw sugars, looking like minute white specks scattered throughout it. (The *mature* insects should have eight legs instead of six, as above stated.) As an illustration of the abundance in which these food-infesting mites may occur, it may be of interest to state that in an examination of sugars, instituted several years ago in London, England, to see to what extent the *T. sacchari* infested this material, its presence, in a living condition, was detected in sixty-nine out of seventy-two samples examined. In one sample of an inferior quality, from the number actually contained in one grain's weight, the computation was made that one pound of the sugar contained a hundred thousand of the mites. In the flour above referred to, it is probable that they were even more abundant than in the sugar.

Perhaps no satisfactory explanation can be given of the presence in such numbers of the mite in the flour, nor is it known to what extent

it occurs in the flour of our markets. If the species has been introduced in any flouring mill, then we can readily see how a few specimens could find entrance into many, or most, of the barrels sent therefrom. Although the insect multiplies in almost incredible rapidity, yet, in consideration of the ordinary ready sale and quick consumption of our great staple, it would not ordinarily increase to a sufficient extent to attract attention. If permitted to remain for several months before it is used, until it becomes *old flour*, it might easily become in a condition to be properly characterized as *alive*.

Of course it would not be at all agreeable to know that our vegetable diet was so highly charged with animal matter. Yet, as the intrusion is not of foreign material, but of elements scarcely changed—little other than transformed—we need not be deterred from partaking with our usual zest of the fresh wheaten loaf that graces our board, by the thought that, perchance (without our knowledge), a hundred thousand lives had paid tribute to its production.

FOOD OF CERMATIA FORCEPS Raf.

In the notice of this Myriapod contained in my *Fourth Report on the Insects of New York*, it is stated that it had shown itself so remarkably sensitive to confinement, that upon all the occasions that it had been brought to me alive, it had invariably died within two days thereafter. The question was asked—can it succumb so quickly for want of its proper food, or to need of moisture? The question has been answered in some experiments made by Miss L. A. Marshall, of the Industrial School of Albany, who, becoming interested in its habits, had kept an example under observation for a period of over three months in an ordinary drinking glass with a piece of thin muslin bound over its top. It was daily supplied by her with three or four drops of water, which were taken with apparent avidity. If the drops clung to the lower surface of the muslin, it would ascend the side of the glass to get them as they hung. It had also been given occasionally small flies and young croton-bugs, which it ate, and in one instance it was seen to eat a young individual of its own species.

That the *Cermatia* is dependent upon at least a daily draught of water would appear from the fate of a specimen which Miss Marshall had brought to me for my personal study after having been in her possession for some weeks. It had been placed in a muslin-covered glass and given as much water as it would accept. The following day being Sunday, it was not visited at my office. On the morning thereafter it was found lying dead in the jar.

More direct evidence of this insect being a fly-feeder has lately been communicated to me by Professor S. A. Forbes. He had learned from a very intelligent lady teacher of Golconda, Ill. (on the Ohio river), that the *Cermatia* had been very abundant a few years ago, at her house on an island in the river. It had been for some time a constant terror to the household who supposed it to be dangerous and poisonous, but later it became famous among them as a fly-killer, devoting itself entirely to the pursuit of house-flies, of which it was so greedy that it would sometimes hold one, or even two, while it caught a third, and devour each in turn.

JULUS CÆRULEOCINCTUS BENEATH CARPETS.

Mr. W. G. Warren, of Buffalo, N. Y., sends (in April) examples of this common myriapod which he had found in the corners and under the border of the carpet—a heavy Moquet—in his drawing-room. They were apparently confined to the extreme edge of the carpet, near the walls. They



FIG. 50.—Thousand-legged worm, JULUS CÆRULEOCINCTUS—enlarged.

had not occurred in any abundance. Ten examples were sent for name. An enlarged figure of it is given above.

A lady residing at Loudonville, Albany county, N. Y., has also discovered the same *Julus* under similar circumstances. Specimens were sent, in October, with the inquiry if they had any connection with the carpet-beetle, for since she had been troubled with that pest, these had been found quite frequently and usually in association with the beetle. In May of the following year, after the house had been closed during the winter, additional examples were sent me in compliance with request, with the statement that they were all that were found on the opening of the house. The broken pieces indicated about ten specimens.

No reason is known for the intrusion of these creatures in the localities where they are above reported. If drawn thither for food, the nature of their food under such circumstances is an interesting inquiry.

Although not belonging to the insects proper, this myriapod is frequently submitted to the entomologist and information of it requested.

[See notice of "A Severe Attack on Potatoes" by this myriapod in the *Report of the Entomologist for the year 1886*, p. 131—40th St. Mus. Rept.]

A P P E N D I X .

(A.)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year (1888), giving title, place and time of publication, and a summary of contents. Lists of publications during 1884 and 1885, taken from the reports of the Entomologist to the Regents of the University S. N. Y., for the years 1884 and 1885 (of which only the State Museum and Documentary editions were published) are appended :

Egg-laying of Peach-Borer Moth.* (Country Gentleman, for February 9, 1888, liii, p. 109, c. 3—32 cm.)

In reply to an inquiry from New Jersey of the length of time that the moth is on the wing, it is stated that a satisfactory answer can not be made, even for that State—much less for different States of the Union. Observations of Drs. Harris, Fitch, Packard, Kellicott, Prof. Cook, and Mr. Saunders, are quoted, which seems to indicate that the period for oviposition in New Jersey may extend from the first week in June to the middle of September. During this time preventives should be used.

Some Pests of the Pomologist. From the American Pomological Society's Report for 1887. Read before the A. P. S. at its Boston meeting, September 15, 1887. (Separates, 4to, with cover and title page, 13 pp.) Published March 1, 1888.

The paper presents the following headings: Progress in Pomology; Evils attending Progress in Pomology; Need of Scientific Study; Demands of Science on the Pomologist; Immense Fruit Production—no Overproduction; Large areas devoted to Fruit Crops; Increase in Plant Diseases; Increase of Insect Ravages; Food-habits of Insects; Change of Food-plants; Introduction from Abroad; Spread of Scale Insects; Number of Insect Pests; An Unknown Currant Insect; How Insect Ravages are to be Met; Insecticides; Publications relating to Fruit Insects; Conclusion.

[Published, also, in the *Fourth Rept. Ins. N. Y.*, 1888, pp. 183-192.]

Remedies for Scale Insects. (Country Gentleman, for March 1, 1888, liii, p. 169, c. 2-3—34 cm.)

Apple and pear trees infested with "white scale," at Perryman, Md., became nearly free from them after lady-bugs had been collected and placed on them. Previous washes of lye, potash, lime, and gas-tar seemed to be ineffectual. Inquiry is made if the lady-bugs may be credited with the result.

* The capitalization, etc., of the *Country Gentleman* is followed herein in the citation from it of titles of publications.

The scale insect is *Chionaspis furfurus* (Fitch). The washes named should have destroyed it; in all probability they aided largely. Lye, soda, and potash washes are valued as very effective against the scale insects of California. Formulæ for two of the washes are given. "Heavy oil" from W. Virginia recommended for scales. Some of the lady-bugs are very efficient in destroying them, as *Chilocorus bivulnerus*, *C. cacti*, and species of *Scymnus*. Entomological knowledge would be needed for their collection in sufficient quantities for the purpose.

[Injurious Fruit Insects of the Vicinity of New York.] (Proceedings of the New York Farmers: 1886-87, pp. 52-59.) Published March, 1888.

Following some remarks on the aid that may be given to agriculture by economic entomology, its consequent importance, its commencement within recent times, its progress, and the high position it has attained; also, on the great increase of fruit insects and the causes therefor—the following insects are noticed and best remedies for them given: The apple-maggot (*Trypeta pomonella*); the apple-worm of the codling-moth; apple-tree aphid; bark-borers (*Xyleborus pyri*, and *Scolytus rugulosus* and *S. obesus*); plum-cureulio; peach-tree borer; eight-spotted *Alypia* on grapevines; currant-worm; cabbage-butterfly (*Pieris rapæ*); and the Colorado potato-beetle.

Sulphur for the Elm Beetle. (Country Gentleman, for March 15, 1888, liii, p. 209, c. 2-3—30 cm.)

A notice in the New York Sun (copied) states that Mr. Dodd, of Orange, N. J., claims to have demonstrated that the attack of the elm-leaf beetle on elm trees can be thwarted by placing sulphur in one-inch augur holes bored in the sap wood five inches apart around the tree. Comment on this is made that the inefficacy of this method of protecting foliage, first announced sixty-six years ago, has often been shown. Sulphur could only be taken in the circulation when dissolved, and it is not soluble in sap. It has been found, unaltered, in plugged cavities of trees five years after insertion. It is doubtful if sulphur, if dissolved, would prove injurious to insects. Some experiments made by Dr. Fitch (given) indicate that it promotes their vigor and growth. [See page 240 of this Report.]

The Pea Weevil. (Country Gentleman, for March 22, 1888, liii, p. 229, c. 1-3—68 cm.)

The operations of the grub in the pea are described. It is a true weevil, belonging to the *Chrysomelidæ*. Description of the beetle is given, and its distribution in the United States and Europe stated. It has been very abundant in Canada. The eggs of the beetle are deposited on the pod, through which the larva burrows to reach the peas. Green peas containing the young larvæ may be safely eaten. Remedies and preventives are these: Keep the peas in a warm place, when the beetles will prematurely emerge in autumn, and die before they can oviposit the following season. They may be killed by dropping the peas in hot water for a minute, or by exposing them to camphor or kerosene, or by bisulphide

of carbon (mauner stated). Plant no weevil-eaten peas. For severe weevil attack, stop cultivation throughout the infested district for a year. Late planting, from June first to tenth, is believed to be a preventive of attack.

The Elm-Leaf Beetle. (Country Gentleman, for March 29, 1888, p. 249, c. 2-3 — 20 cm.)

To inquiry from New Jersey of the best protection from the beetles, and how early the remedies should be used, reply is made that London purple, one pound to 200 gallons of water, with eight quarts of flour (prepared as directed), should be applied with a force-pump, fitted with a "cyclone nozzle," or one of the finest "Nixon nozzles," in a fine spray or mist. For high trees, the nozzle may be applied to the end of a long hose, tied, for elevation, to a bamboo rod." The tallest elms should be sprayed from the principal branches, by carrying into the tree a longer hose or a portable spraying apparatus. Spray as soon as the deposit of eggs is commenced—in New Jersey early in June. Repeat in a fortnight if necessary. [See pp. 239, 240 of this Report.]

Our Worst Enemies—The Bugs. (Country Gentleman, for April 5, 1888, liii, p. 269, c. 1-2—38 cm.)

In the subject as announced for remarks at the Chatham, N. Y., Farmers' Institute, bugs must be accepted, in popular American usage, as including all orders of insects. They may be regarded as the worst enemies of the agriculturist, for these reasons: They are so numerous, so prolific, so ravenous, such epicures, so wasteful, so small, so omnipresent, so secret, so regular in occurrence, and have such wonderful instincts for finding their food-plants and for self-protection.

They are to be fought by making their acquaintance through observation and the published literature, and learning of the best insecticides and how to apply them; what these insecticides are, and instruments used with them. Importance of the study of economic entomology urged, and coöperation in it solicited.

The Striped Flea Beetle. (Country Gentleman, for April 12, 1888, liii, p. 289, c. 1-3, figure — 6½ cm.)

The insect, *Phyllotreta vittata* (Fabr.) is described and figured in both larva and imago. For killing the larva among the roots of its food-plants, solutions of pyrethrum, soap and carbolic acid, tobacco water, and kerosene emulsion may be used. For preventives of egg-deposit, strongly odorous substances, as kerosene mixed with sand, gas-tar on sticks or corn-cobs, tar water, drainage from pig-styes or the manure. Popular measures are dusting with lime, soot, ashes, snuff, tobacco dust, sulphur, and plaster. Dr. Fitch, of these, found ashes the best, as in experiments cited. He also recommended keeping young chickens and toads in gardens for hunting the beetles. Paris green or London purple sprayed over the young plants may be the best way to kill the beetle. Pyrethrum powder has been found effective.

Unrecognized Apple-Tree Attack. (Country Gentleman, for April 26, 1888, liii, p. 329, c. 2, — 17 cm.)

The injury to limbs of an apple tree, received from Mercer Co., N. J., can not be referred to any known insect. The first year's attack shows a small hole surrounded by blackened and dying bark, leading to an elongate empty egg-shell within the bark in a cyst-like cavity. No larval channel therefrom into the bark or wood is present. The second year after attack shows an unsightly scar of an inch or more in diameter, from which all the sap-wood is removed, with a new growth impinging on its border. The old bark is either removed from the dead wood beneath, or still held as a dried and depressed film over it. [Was subsequently referred to the oviposition of one of the flower-cricket.]

The White Flower-Cricket. (Country Gentleman, for April 26, 1888, liii, p. 329, c. 2-3 — 12 cm.)

Egg punctures in a Concord grapevine of a size as if made by a pin, arranged closely together in continuous, almost straight lines of two or three inches in length, are identified as those of *Ecanthus nireus* (Serv.). These punctures may kill the vines beyond them or cause them to die and break off. The insect does not feed upon any of the numerous plants in which it oviposits, but is carnivorous in its early life, eating plant-lice, etc.

The Leaf Hopper. (The Vineyardist, May 1, 1888, v. ii, p. 113, c. 1-3 — 81 cm.)

Remarks on the comparative injury caused by *Erythroneura vitis* on different varieties of grapes; its habits and nature of its injuries, description, and transformations; not a "Thrips," and what the *Thrips* is. The best remedy for it in graperies is vaporization of tobacco juice; how it is done in France. For destroying it in vineyards, spray the larvæ with tobacco water or soap-suds, or kerosene emulsion. Driving the winged insect on strips of tarred building-paper, stretched and carried between the rows of vines, has proved efficient.

To Kill Plant-lice. (Farm and Home, for May 1, 1888, ix, p. 158, c. 4.)

Plant-lice on apple trees are not difficult to kill, if attacked at the right time, with the proper apparatus and in the right manner. The proper time is early in the spring when they are hatching and before they are protected by the curling leaves, or when they are in the egg in the autumn, by spraying with a kerosene emulsion. The needed apparatus is a good force-pump and nozzle—the best of these are named. The right manner of applying the insecticide is to make it reach every insect; benefits of fine spraying stated.

[Revised, and printed in this Report, pp. 160-162.]

The Bacon-beetle attacks Comb. (The Bee Keepers' Magazine, May 1888, xvi, pp. 143, 144 — 62 cm.)

A beetle sent for name, the larvæ of which had attacked some empty honey-comb and riddled the wax, is *Dermestes lardarius* Linn. Its habits are given, together with those of some allied species, and the larva and

beetle described. This is the second recorded instance of its feeding on wax. In Europe wax is sometimes eaten by insects—possibly by this species.

Elm Leaf Beetle. (Country Gentleman, for May 10, 1888, liii, p. 366, c. 3-4—13 cm.)

Identification of *Galeruca xanthomelana* from Searsdale, N. Y., and in answer to inquiries, reference is made to notices in the *Country Gentleman*, giving full information of the insect, the principal of which are these: October 12, 1882, p. 805; October 15, 1885, p. 841; May 27, 1886, p. 409; May 26, July 21, and September 8, 1887, pp. 421, 565, and 695; March 20, 1888, p. 249—the last giving full spraying directions.

Friends, not Foes. (Country Gentleman, for May 31, 1888, liii, p. 430, c. 3—13 cm.)

Small beetles sent from West Newton, Pa., as injurious in hot-beds to flower-plants, etc., by destroying the fibrous roots and thereby killing the plants, are of two species, neither of which can cause the injury of which complaint is made. *Tachus incurvus* Say, is one of the predaceous *Carabidæ*, and it is known to eat other insects. *Homolota lividipennis* Mann., is one of the *Staphylinidæ*, a family of useful insects which serve as scavengers of decaying vegetable and animal matter.

Maple-Leaf Mite-Gall. (Country Gentleman, for June 14, 1888, liii, p. 460, c. 4—14 cm.)

Leaves of soft maple sent from Suffolk county, N. Y., are one-third covered with wart-like elevations of about the size of the head of a common pin, which are caused by the leaf-mite, *Phytoptus quadripes* (Shimer). The formation and appearance of the gall is described, and burning the infested leaves or spraying with a tobacco solution the latter part of June is recommended.

A Grapevine Pest. (Orange County Farmer, for June 21, 1888, vii, p. 5, c. 1—15 cm.)

The galls of *Lasioptera vitis* O. S., identified on the leaves and tips of a Muscadine vine, from Port Jervis, N. Y. Description of the gall, the insect that produces it, the contained larva, its escape from the gall and subsequent transformations. Removal and burning of the infested leaves and tips the best preventive of future attack.

Cockscorb Elm-Gall. (Country Gentleman, for June 28, 1888, liii, p. 496, c. 1—10 cm.)

The galls sent on the "weeping slippery elm," from Charlottesville, Va., are described and identified as those of *Colopha ulmicola* (Fitch), and reference for a more extended notice of them, made to the C.-G. for September 23, 1886, p. 713. The gall, thus far, has only been recorded on the white elm, *Ulmus Americana*, and the leaves sent seem to be of that species.

[See, also, *Glyphina ulmicola*, in *Fortieth Rept. N. Y. St. Mus. N. H.*, 1887, pp. 126-128.]

Apple-Tree Tent-Caterpillar: *Clisiocampa Americana*. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 2, 3 — 28 cm.)

The best preventive of the injuries of this pest is the removal of the belts of eggs, which may be easily done when the trees are leafless. The next best is to destroy the nest with its occupants as soon as it can be recognized in the forks of the branches. The caterpillars may be poisoned by spraying the foliage with one pound of London purple in 200 gallons of water. The amount of harm done by this insect is in diminishing the yield of fruit and its quality in proportion to the amount of defoliation. The abundance of the insect the present year in this State has been phenomenal, nothing approaching it having been previously observed. For this no satisfactory cause can be assigned.

Honey-Dew on Hickory Leaves. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 3 — 16 cm.)

Hickory leaves, apparently of *Carya alba*, received from Clarksburg, W. Va., are thickly coated, on their upper side, with "honey-dew." Several species of Aphides are known to secrete this material, but in some instances it results from a diseased condition of the leaves, causing the excretion of a honeyed substance. In this case it is thought to have been excreted from the leaves, for reasons stated. Reference is made to *Lachnus caryæ* occurring on the pig-nut, *C. porcina*.

Grape-Leaf Galls. (Country Gentleman, for July 5, 1888, liii, p. 511, c. 4 — 8 cm.)

Galls on a Rogers' seedling, from Worcester, Mass., are identified as those of *Lasioptera vitis*, the larva of which is briefly noticed. The best preventive known of this attack is to remove and burn the infested leaves and tips during early June, before the larvæ leave them for their further development in the ground.

A New Pest Threatens the Hay Crop. (Albany Evening Journal, for July 7, 1888, p. 7, c. 3.)

A correspondent from Delmar, Albany county, N. Y., writes of a minute insect infesting the base of the upper joint of Timothy grass, and arresting its development. From examples submitted, it proves to be a species of *Thrips* which may be identical with that which has long infested June grass (see Report of Entomologist for 1886, in 40th Rept. St. Museum Nat. Hist., pp. 96-98), but being at present in the larval stage, can not be determined.

Stalk-borer. (Country Gentleman, for July 12, 1888, liii, p. 532, c. 1-2 — 16 cm.)

A larva from Rock Hall, Md., where it is known as the "bud-worm," and is infesting young corn by burrowing downward into the stalk, is identified as *Gortyna nitela* Guenée. Distinguishing features of it are given, vegetation that it attacks, and the best remedies for it. Reference is made to other notices of the insect.

An Entomological Friend. (Orange County Farmer, for July 12, 1888, vii, No. 45, p. 8—12 cm.)

An insect sent for name from Port Jervis, N. Y., as destructive to the plum crop, by eating into the fruit, is identified as the harmless 15-spotted lady-bug, *Anatis 15-punctata* (Oliv.). [The parti-colored slugular looking pupæ, fastened to the fruit, were probably mistaken for excremental matter thrown out by borers within.] The service rendered by the insect is stated, and the importance of its protection.

The Ash-Grey Blister-Beetle. (Country Gentleman, for July 19, 1888, liii, p. 547, c. 2-3—47 cm.)

Beetles very destructive to the foliage of potatoes at Charlottesville, Va., are *Macrobasis unicolor* (Kirby), one of the four common species of blister-beetles of the Northern and Middle United States. Their blistering properties are referred to and compared with that of the imported Spanish fly, *Cantharis vesicatoria*, a notice of which is given. *M. unicolor* is described and its habits and food-plants stated. Recent study of our blister-beetles is mentioned, and observations which have shown them to possess carnivorous habits. A remedy is found in Paris green; preventives in lime, plaster, or road dust.

Insects on Apple Trees. (Country Gentleman, for July 19, 1888, liii, p. 548, c. 1—8 cm.)

Insects sent from Norfolk, Va., and represented as causing the so-called "black knot" on apple trees, particularly on the "Early Harvest," can not have caused the injury complained of, as one is the apple-worm of the codling-moth, and the other an unknown Lepidopterous pupa. What is commonly known as the "black knot," does not occur on apple trees, and what this "knot" on the apple trees is, can not be told without examination of specimens.

The Light-Loving Grapevine-Beetle. *Anomala Lucicola*. (Country Gentleman, for July 26, 1888, liii, p. 565, c. 3-4—23 cm.)

Beetles from grapevines at Hightstown, N. J., are *Anomala lucicola* (Fabr.). Their general features are given and colorational characters which apparently indicate the sexes. Instances are narrated of their fondness for, and injuries to, the foliage of the grapevine. Preventives of attack are dusting the leaves with air-slacked lime. Spraying at night when collected on the vines, with pyrethrum water, should be serviceable.

The Black Long-sting. (New England Homestead, for August 4, 1888, xxii, p. 286, c. 5—30 cm.)

Thalessa atrata (Fabr.) is described and illustrated in a figure from Harris' Insects Injurious to Vegetation. It and *T. huator* (Fabr.), in their larval stage, feed externally as parasites on the larva of *Tremex columba* within its burrows in maple, elm, etc. They are usually to be found associated with *Tremex* attack, and are very serviceable in its arrest.

A Grapevine Caterpillar — *Thyreus Abbotii*. (Country Gentleman, for August 19, 1888, liii, p. 599, c. 2-4 — 43 cm.)

A caterpillar taken from the "common ivy" is sent, with inquiry, as "a revolting specimen" of insect life. Its common food-plants are grapevine and *Ampelopsis* or the woodbine—the latter probably the "ivy" named. The principal features of the moth and of the dimorphic forms of the larva are described: The form marked by the large, yellow, subquadrate spots is far from "revolting." No cause can be assigned for these two quite distinct forms, which are not sexual, seasonal, or dependent on food. The white color and the caudal horn of the young larva are referred to, also the contortions, when disturbed, of the adult. Absurd ideas of the poisonous nature of these Sphinx larvæ are quoted.

The Spittle Insects. (New England Homestead, for September 15, 1888, xxii, p. 333, c. 1-2 — 34 cm.)

Insects on grass in a substance resembling spittle, at Auburn, Mass., are Hemiptera in their larval stage, of the group known as "spittle-insects." The "spittle" is produced, according to Uhler, by expulsion from the beak, while observations of DeGeer are quoted on its expulsion from the anus. Different species are named and their food-plants given. In Vermont they have seriously damaged the hay crop, but they seldom occur in injurious numbers.

[For notice of these insects, see pp. 243-246 of this Report.]

Fly on the Heads of Cattle. (Country Gentleman, for September 20, 1888, liii, p. 705, c. 4 — 10 cm.)

Inquiry is made from Hamilton Square, N. J., of a fly which is exciting much interest and anxiety from its reported habit of boring in the horns of cattle and depositing an egg, the grub from which burrows into the brain and causes the death of the animal. Nothing is known of such an insect. If such existed, it and its habits would have been known to entomologists. It would, therefore, not be worth while to coat the horns with tar, as is being done, for a preventive.

[For notice of this insect, see pp. 220-227 of this Report.]

The Melon Plant Louse. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 2-3 — 30 cm.)

Muskmelon leaves sent from Lowell, Mass., as showing destruction of the crop when about half-grown, are infested with a plant-louse which seems to be *Aphis cucumeris* Forbes. The aphid is described, and its history given, and a notice of a parasitic attack upon it in Illinois. Some shoots of the plants also sent have been transformed into galls which have disclosed a *Cecidomyia*. If undescribed, it may be named as *Cecidomyia cucumeris*.

The Hag-Moth Caterpillar. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 3-4 — 17 cm.)

A caterpillar found on an apple tree at Buckner's Station, Va., is sent as an example of mimicry in insects, from its resemblance to a dead and curled leaf. It is *Phobetron pithecium* (Sm.-Abb.), its common name

meaning a shriveled and monkey-faced old woman. Its singular appearance is described and its habits and food-plants given — the latter, apple, cherry, plum, and some of the forest trees.

[For an extended notice of this insect, see pp. 183-192 of this Report.]

An Ichneumonized Caterpillar. Interesting Case of Parasitism. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 4 — 20 cm.)

A caterpillar taken from a hop-vine and sent from Wabash, Ind., for name and other information, is one of the Sphinges, too much changed for positive identification, but probably, *Darapsa Myron* (Cram.), a common gravevine-caterpillar which, after reaching maturity, may have wandered to hops. The cocoons covering its body were probably those of *Apanteles congregatus* (Say); but instead of giving out their *Microgaster* ichneumon, through a nicely-fitting hinged lid, a minute Chalcid had emerged from each cocoon through an irregular hole eaten in the side, presenting an interesting case of secondary parasitism. The Chalcid has not been determined.

Thousand-Legged Worms. (Country Gentleman, for September 27, 1888, liii, p. 725, c. 4 — 10 cm.)

Worms destroying geraniums by eating their roots, at Cape May, N. J., are *Julus cæruleocinctus* (Wood). These thousand-legged worms are difficult to kill when buried in the ground. Applications recommended are lime-water as strong as may be safely made, soot applied to the surface, and nitrate of soda to be followed by watering, or to be used in solution. Possibly quassia water might make the roots distasteful to them.

Bee-Keeper's Guide. (Country Gentleman, for September 27, 1888, liii, p. 727, c. 2 — 13 cm.)

Notices the *Manual of the Apiary* of Professor A. J. Cook, just published, in its thirteenth edition, which has been entirely rewritten, greatly enlarged, and much improved. Some of the new features introduced in this edition are noticed. It has been pronounced the best book on bees ever published.

Yellow-Necked Apple-Tree Caterpillar. (Country Gentleman, for October 4, 1888, liii, p. 743, c. 4 — 27 cm.)

Caterpillars sent from New York city, as devastating apple trees, are *Datana ministra* (Drury). The caterpillar is described, and its feeding habits, its injuries, its food-plants and its history given. Remedy — cutting off the branch on which the colony is clustered and crushing.

The Cow-Fly, Horn-Fly, or Texan-Fly. (Country Gentleman, for October 11, 1888, liii, p. 759, c. 2-3 — 36 cm.)

Examples of the cow-fly, noticed in the *Country Gentleman* of September twentieth, page 705, have been received from Kenneth Square, Pa. The species is unknown to me and is reported as unknown to the Entomological Department at Washington. It has been submitted to Baron Osten Sackeu, of Germany. Its habits as gleaned from different sources are given. It seems to have been first noticed in Chester Co., Pa., in 1886.

Oak Galls. (Country Gentleman, for October 18, 1888, liii, p. 775, c. 2—7 cm.)

Small, round, pubescent galls, sometimes single, oftener confluent on oak leaves (*Quercus* sp.?) from Kingston, R. I., are identified as those of *Neuroterus verrucarum* O. S.—one of the *Cynipidæ*. No means are known by which these galls can be prevented. Their multiplication can be arrested by picking off and burning the leaves containing them, when not involving too much labor.

The Cow-Fly or Texas Fly. (Country Gentleman, for October 18, 1888, liii, p. 779, c. 2—7 cm.)

The fly is stated by Dr. Williston to be a species of *Stomoxys*, apparently undescribed and which he purposes to name *S. cornicola* [erroneously given as *cervicola*]. Now that it is known to be allied to *Stomoxys calcitrans*—a biting species with which we have been long familiar, the many stories of the serious and sometimes fatal injuries to cattle of this new insect, are effectually disproved.

Caterpillar on the Chestnut. (Country Gentleman, for October 18, 1888, liii, p. 786, c. 2—12 cm.)

Caterpillars sent from Rochester, N. Y., from a Spanish chestnut tree, are *Halesidota tessellaris* (Sm.-Abb.). The general appearance of the moth is given. The caterpillar feeds on several of the forest trees and is common on the sycamore. It has not been recorded from the chestnut.

The White Grub of the May-beetle. (Bulletin of the New York State Museum of Natural History, No. 5, November, 1888, pp. 31, figs. 5.) Reprinted, with additions, from the Forty-third Annual Report of the New York State Agricultural Society for the year 1883.

The following are the subheads of the paper: The White Grub.—The Egg.—Injurious Character of the Insect.—Injuries from the Grubs.—Injuries by the Beetle.—Life-History.—Distribution.—Its Enemies.—Preventives and Remedies.—Study of the Insect Desired.

[Published, also, in *Trans. N. Y. St. Agricul. Soc.*, xxxiv, for 1883-1886, pp. 5-33.]

Cut-worms. (Bulletin of the New York State Museum of Natural History, No. 6, November, 1888, pp. 36, figs. 28.) Reprinted, with additions, from the Forty-fourth Annual Report of the New York State Agricultural Society, for the year 1884-1885.

The contents are as follows: What are Cut-worms?—Their Appearance.—Their Habits.—Habits of the Moths.—Natural History.—Conditions Favorable to Cut-worms.—Their Food-plants.—Abundance of Cut-worms.—Literature of the Cut-worms.—List of Species.—Natural Enemies.—Parasites.—Preventives and Remedies.—Two Preventives specially Commended.

[Published, also, in *Trans. N. Y. St. Agricul. Soc.*, xxxiv, for 1883-1886, pp. 66-100.]

Red-Humped Apple-Tree Caterpillar. (Country Gentleman, for November 22, 1888, liii, p. 875, c. 2-3 — 26 cm.)

Caterpillars feeding in company on an apple tree in New York, are *Edemasia concinna* (Sm.-Abb.). They are described, and their habits and range of food-plants given. From their gregarious habit, they should not be permitted to inflict serious injury on fruit trees. Orchards should be inspected from time to time during August, and as soon as noticed the branch containing the company should be cut and each individual killed.

A Familiar Pest. (New England Homestead, for November 24, 1888, xxii, p. 421, c. 1-2 — 12 cm.)

A pupa sent for name and other information is that of *Sphinx quinquemaculata* Haworth, the larva of which is known as the potato-worm. The moth that it produces, feeding habits of the "humming-bird moths," features of their caterpillars, the tongue-case of the pupa, the "tobacco-worm," and "worming tobacco fields" are remarked upon.

Fourth Report on the Injurious and other Insects of the State of New York [November 23], 1888, pp. 237, Figs. 68. (From the 41st Report of the N. Y. State Museum of Natural History, 1888, pp. 123-358.)

The Contents are: INTRODUCTORY. INSECT ATTACKS AND MISCELLANEOUS OBSERVATIONS [as follows]: The Insects of the Hemlock: The Chalcid Parasites of *Cecidomyia betulæ*: *Isosoma hordei* (Harris)—the Joint-worm Fly: *Thalessa lunator* (Fabr.)—the Lunated Long-sting: *Amphibolips prunus* (Walsh)—the Oak-plum gall Cynips: *Aulacomerus lutescens n. sp.*—the Poplar Saw-fly: Currant Bushes Girdled by an Unknown Insect: *Orgyia leucostigma* (Sm.-Abb.)—the White-marked Tussock: *Lagoa opercularis* (Sm.-Abb.)—the Rabbit Moth: *Nephelodes violans Guenée*—the Bronze-colored cut-worm: Homoptera *lunata* (Drury), as a Rose Pest: A Hemlock Leaf-miner: *Cecidomyia balsamicola n. sp.*, and its Gall: *Lasioptera vitis O. S.*, and its Galls.: *Chloropisca prolifica O. S. n. sp.*, and its Winter Gatherings: *Phytomyza lateralis Fullen*—the Marguerite Fly: *Megilla maculata DeGeer*—the Spotted Lady-bird: *Chauliognathus marginatus* (Fabr.)—the Margined Soldier-Beetle: *Sitodrepa panicea* (Linn.), as a Leather-Beetle: *Xylotrichus colonus* (Fabr.), occurring in a Dwelling: *Haltica bimarginata* (Say)—the Alder Flea-Beetle: *Crepidodera rufipes* (Linn.)—the Red-footed Flea-Beetle: *Scolytus rugulosus* (Ratz.)—the Wrinkled Scolytus: *Corythuca ciliata* (Say)—the Ciliated Tingis: *Melanolestes picipes* (H. S.)—the Black Corsair: *Mytilaspis pomorum* (Bouché)—the Apple-tree Bark-louse: *Ptyelus lineatus* (Linn.)—the Lined Spittle-hopper: *Ephemera natata Walker*, and other Ephemeridæ: Hair-snakes as Parasitic on Insects: *Cermatia forceps* (Raf.), as a Household Pest. BRIEF NOTES ON VARIOUS INSECTS: *Dolerus sp.*; *Danais Archippus*; *Thecla strigosa*; *Nisoniades Persius*; *Sphinx Canadensis*; *Melittia cucurbitæ*; *Hyppa xylinoides*; *Erebus odora*; *Zerene catenaria*; *Anisopteryx pometaria*; *Tinea pellionella*; *Mallota sp.*; *Anthrenus scrophulariæ*; *Alaus oculatus*; *Thanasimus dubius*; *Macroductylus*

subspinus; *Lema trilineata*; *Chrysochus auratus*; *Trirhabda Canadensis*; *Galeruca xanthomelæna*; *Hylesinus opaculus*; *Phlæotribus liminaris*; *Belostoma Americanum*; *Ceresa bubalus*; *Chermes pini-corticis*; *Æcanthus niveus*. APPENDIX. (A.) SOME EXTRA-LIMITAL INSECTS: *Carpocapsa saltitans Westw.*, and its Jumping Seeds: *Systema blanda (Mels.)*—the Broad-striped Flea-Beetle: *Leptocoris trivittatus (Say)*—the Box-elder Plant-bug: *Mantis Carolina Linn.*—the Carolina Mantis. (B.) ENTOMOLOGICAL ADDRESSES: The Present State of Entomological Science in the United States: Annual Address of the President of the Entomological Club of the American Association for the Advancement of Science: Some Pests of the Pomologist: (C.) LIST OF PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEAR 1887: (D.) CONTRIBUTIONS TO THE DEPARTMENT DURING THE YEAR 1887. (E.) ERRATA IN FORMER REPORTS. GENERAL INDEX. PLANT INDEX.

Identification of the Cow-Fly — *Hæmatobia serrata*. (Country Gentleman, for November 29, 1888, liii, p. 893, c. 2-3 — 20 cm.)

The fly, which has been the subject of former communications in the *Country Gentleman* and which Dr. Williston purposed soon to describe as *Stomoxys cornicola*, has been determined by Baron Osten Sacken, of Germany, to be identical with *Hæmatobia serrata* of R. Desv., of Southern France and Italy. Other generic references of the fly are given.

[See notice of this insect on pp. 220-227 of this Report.]

Wire-Worms. (Country Gentleman, for November 29, 1888, liii p. 893, figs. 1-6, c. 3-4 — 51 cm.)

To an inquiry from Potter county, Pa., for means of relief from excessive injuries from wire-worms, three of the best remedies are named and remarked upon at some length, viz., starvation, a crop of buckwheat, and a crop of mustard. As a guard against mistakes often made, the difference between wire-worms, cut-worms, and thousand-legged worms are pointed out and illustrated by figures.

Egg Deposits of Flower Cricket. (Country Gentleman, for December 6, 1888, liii, p. 911, c. 1 — 24 cm.)

Grapevine from Eaglesville, O., show egg-deposits in rows (described) which have hitherto been referred to the white-flower cricket, *Æcanthus niveus* Harris; but there are reasons for believing them to be those of *Æ. fasciatus* DeGeer—a valid species, and not a variety of *niveus*. The remedy for the attack is cutting off and burning. Food-habits of the insect stated.

The grape leaf eating beetle of which inquiry is made, is *Pelidnota punctata* (Linn.)—remarks upon it.

White-Marked Tussock Egg-Clusters. (Country Gentleman, for December 6, 1888, liii, p. 911, c. 1-2 — 16 cm.)

The eggs on cocoons sent for name from Salem, N. J., are those of *Orygia leucostigma* (Sm.-Abb.). The insect is pernicious. Its egg-bearing cocoons (these only) should be destroyed, and where they may be looked for. One of the cocoons gave out a parasite, *Pimpla conquisitor* Say.

PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1884 AND 1885.

A New Sexual Character in the Pupæ of Some Lepidoptera. (Psyche, iv, No. 115-116, November-December, 1883, pp. 103-106 — Issued February 11, 1884.) An abstract in Proceedings of the American Association for the Advancement of Science, held at Montreal, Canada, August, 1882, xxxi, 1883, pt. ii, p. 470-471.

Remarks upon the interest attaching to the sexual characteristics of insects; mentions a number of such sexual features; they are fewer and less marked in the earlier stages. The particular feature noticed in this paper is one pertaining to the *Cossinæ* and to the *Ageriada*, viz., in the male, the tenth segment (not counting the head as one) is furnished with two rows of teeth, while the female uniformly has but one (as have the two following segments in each sex).

[Published in the *Second Report on the Insects of N. Y.*, 1885, pp. 213-217.]

A Horn-Tail — *Urocerus Cressoni*. (Country Gentleman, for January 3, 1884, xlix, p. 9, c. 1 — 11 cm.)

In reply to an inquiry from Perth Amboy, N. J., the species is named, and its affinities given, and its habits in the larval and perfect stages. It occurs in the Middle States, and interesting varieties have been recorded from Albany, N. Y.

Fuller's Rose Beetle — *Aramigus Fulleri*. (Country Gentleman, for January 17, 1884, xlix, p. 49, c. 2 — 32 cm.)

The species identified from Stamford, Conn. Its first notice as a pest in conservatories in 1874, and its subsequent distribution; its life-history, as given by Prof. Riley, in the *Rept. Commis. Agricul.* for 1878; remedies for it, and reference to publications upon it.

[See *Second Report on the Insects of N. Y.*, 1885, pp. 142-144.]

The Lunated Long-Sting — *Thalessa lunator* (Fabr.). (Country Gentleman, for April 17, 1884, xlix, p. 331, c. 3-4 — 52 cm.)

Captured in Augusta, Ga., while ovipositing April first; identified, a figure given, and method of oviposition stated; the insect upon the larva of which it is parasitic, *Tremex columba*, is also shown. A note from Prof. Riley is added, which gives the statement that the parasite feeds on the *Tremex* larva while attached to its exterior.

[Extended in the *Fourth Report on the Insects of N. Y.*, 1888, pp. 35-42.]

An Insect Attack on a *Julus*. (The Canadian Entomologist, for April, 1884, xvi, p. 80 — 7 cm.)

Communicating an observation of a swarm of minute insects surrounding, darting upon, and seriously annoying a *Julus*. Could they have been *Ichneumon* flies?

Insect Injury to Grapevines. (Country Gentleman, for May 8, 1884, xlix, p. 397, c. 1 — 25 cm.)

Some pieces of grapevines, bearing pinhole-like punctures, from Hopkinsville, Ky., are recognized as having been punctured for oviposition,

by *Ecanthus latipennis*—one of the flower crickets, closely allied to *E. niveus*. The punctures and method of oviposition are described, and reference made to figures in Fifth Missouri Report on Insects, page 119. The punctures are not injurious to the vine, but the crickets may possibly cut the stems of the grapes.

Squash Borers. (Country Gentleman, for May 8, 1884, xlix, p. 397, c. 2 — 6 cm.)

Injuries to squash vines, noticed in the Country Gentleman of April twenty-fourth, and there ascribed by the editor to the striped cucumber beetle, *Diabrotica vittata* (Fabr.), are recognized as caused by the squash-vine borer, *Melittia cucurbitæ* (Harris).

The Punctured Clover-Leaf Weevil. (Country Gentleman, for May 29, 1884, xlix, p. 457, c. 2-3 — 56 cm.)

Larvæ submitted from East Avon, Livingston county, N. Y., prove to be the mature forms of *Phytonomus punctatus* (Fabr.). Its present known distribution is given, the transformations, description of its cocoon, and reference to writings upon it. Prompt resort to effective remedies are urged, of which are thorough plowing, and rolling the clover after twilight, at which time the larvæ are feeding.

[The same in the *Ontario County Times*, extra, of May 29, 1884.]

A New Clover Pest — Its ravages in the southern portion of Canandaigua. (*Ontario County Times*, extra, May 29, 1884 — 30 cm.; *Ontario County Times* of June 4, 1884, p. 3, c. 4-5 — 85 cm.)

Examples of the larvæ sent by the editor are identified as *Phytonomus punctatus*. To resist the attack plowing is recommended, rolling not being as useful now after the insect has entered the ground for pupation. Reference is made to the notice of the insect in the *Country Gentleman* of May twenty-ninth, and its republication suggested to the editor.

A Corn Cut-worm. (Bulletin No. lxxxvi, of the New York Agricultural Experiment Station, Geneva, May 31, 1884 — 32 cm.)

In reply to an inquiry from Batavia, N. Y., of a cut-worm cutting off corn at the surface of the ground, the different habits of cut-worms are referred to, and recommendation is made of poisoning them by sprinkling London purple over the plants. Another method, which has proved quite effective, is to employ boys to dig them from the hills; mention of a crop saved by this means.

The White Grub of the May-beetle — *Lachnosterna fusca*. Read before the New York State Agricultural Society at the annual meeting January 16, 1884. (Forty-third Annual Report of the New York State Agricultural Society, for the year 1883, [June fifth], 1884, pp. 20-87, 5 figures.)

Gives an epitome of what is known of this serious pest, and indicates what is needed to complete its life-history. It is treated of under the following heads: The beetle; the white grub; the egg; injurious

character of the insect; injuries from the grub; injuries of the beetle; life-history; distribution; its enemies; preventives and remedies; study of the insect desired.

The Squash-Vine Borer — I. *Melittia Cucurbitæ*. (Country Gentleman, for June 5, 1884, xlix, p. 477, c. 2-4 — 50 cm.)

Gives, in reply to inquiries made from Coxsackie, N. Y., descriptions of the caterpillar and moth of the above-named insect, and remarks upon the family of *Aegeriade*, to which it belongs.

The Squash-Vine Borer — II. (Country Gentleman, for June 12, 1884, xlix, p. 497, c. 2-3 — 40 cm.)

The life-history, so far as known, and habits of the insect are given. Its injuries appear to be increasing with the increase of cultivation of the Hubbard squash. Its abundance at times is shown in the fact that 142 larvæ have been cut from a single vine.

The Squash-Vine Borer — III. (Country Gentleman, for June 19, 1884, xlix, p. 517, c. 1-3 — 74 cm.)

Treats of remedies and preventives, viz: Autumn plowing and harrowing, gas-lime, kerosene, strong-smelling substances as counter-odorants (especially bisulphide of carbon), covering the plants with netting, cutting out the larvæ, rooting the plants at the joints, guano, and London purple, and saltpetre. Additional observations are asked for upon points mentioned.

[The above notices embodied in the *Second Report on the Insects of N. Y.*, 1885, pp. 55-68.]

The Bacon Beetle — *Dermestes Lardarius*. (Country Gentleman, for June 26, 1884, xlix, p. 537, c. 2 — 25 cm.)

The beetle and larva are described, their food stated, allied species referred to, and inclosing bacon, etc., in whitewashed paper or cloth bags recommended as the best protective from attack. No method is known of preventing attack on salted meats if exposed to the insect.

The Maple-Tree Scale-Insect. (Country Gentleman, for July 3, 1884, xlix, p. 556-7, c 4-1 — 20 cm.)

Identifying *Lecanium innumerabilis* (Rathvon), from Phoenix, N. Y., June 6, describing the scales as at present with the eggs beneath them, and later, when the eggs are extruded, enveloped in waxy fibres. The active larval stage the best time for killing the insects, with whale-oil soap solution or kerosene and milk emulsion. [Is *Pulvinaria innumerabilis*.]

The Spring Canker-Worm — *Anisopteryx vernata* (Peck). (Country Gentleman, for July 10, 1884, xlix, p. 577, c. 2-3 — 30 cm.)

In answer to inquiries and examples sent from two localities in Westchester county, N. Y.—identification of the species; remarks upon the importance of arresting its spread in the State, and recommendation of destroying the pupæ in the ground beneath the trees; arresting the

ascent of the female moth by tarring the trunks or by tin bands; jarring the larvæ from the limbs into a straw fire beneath, and spraying the tree with Paris green or London purple in water.

The Buffalo Gnat. (Country Gentleman, for July 10, 1884, xlix, p. 577, c. 3-4 — 52 cm.)

The gnat, of which inquiry is made from Memphis, Tenn., is an undescribed species of *Simulidæ*, few of which family have been studied — even the “black fly” of the Adirondack region bears only a manuscript name. The habits and transformations of the *Simulidæ*, in general, are given, with reference to particular species observed. Various notices of the buffalo-gnat are quoted.

[It has subsequently been named by Professor Riley as *Simulium pecuarum*. See his extended notice of it in *Rept. Comm. Agricul.* for 1888, pp. 492-517, plates vi-ix.]

The Carpet-bug. (Amsterdam, N. Y., Daily Democrat of July 21, 1884, p. 3, c. 3-4 — 68 cm.)

In a letter to the editor in reply to inquiries, are given — What the insect is; habits of the insect; not possible to exterminate it; means of protection; means of destruction; hunting the “bug” urged.

The Elm-tree Beetle. (New York Weekly Tribune, for July 23, 1884, p. 10, c. 4 — 13 cm.)

Referring to a recent statement in the *Tribune* that the elm trees in Flushing, L. I., were being destroyed by this insect, recommendation is made of the method given by Mr. Glover in the Agricultural Report for 1870, of placing frames around the base of the trees, so constructed as to prevent the egress of the larvæ that descend the trunks for pupation and their entrance into the ground by a layer of cement. The northward progress of the insect in New York is stated.

[See pp. 234-242 of this Report.]

The Carpet Beetle — *Anthrenus Scrophulariæ* Linn. (Country Gentleman, for August 14, 1884, xlix, p. 676-7, c. 4-1 — 48 cm.)

Gives in reply to inquiries from Manchester, Vt., its habits, habitat, injuries, materials eaten, and transformations. Among the best preventives and remedies are mentioned carbolic acid, creosote, gas-tar paper, benzine and kerosene, cyanide of potassium, fumigations of closets with sulphur, and frequent searches for the larvæ.

Insects Mining Beet Leaves. (Country Gentleman, for August 14, 1884, p. 677, c. 2 — 13 cm.)

Leaves sent from Erie, Pa., are infested with larvæ of a species of the *Anthomyiidae*, probably one of the three species mentioned in the *First Report on the Insects of New York*, 1882, pp. 203-211. Some of the characteristics of these flies are given, with notice of their mining operations in this country.

Peach Root Aphis. (Gardener's Monthly and Horticulturist, Phila., September, 1884, xxvi, pp. 271-2—29 cm.)

A root aphid which is destroying all the seedling peach trees of Mr. Lorin Blodget, at Philadelphia, is believed to be *Myzus persicæ* Sulzer. For destroying it the following are suggested: Hot water, leached ashes and sulphur, bisulphide of carbon and soluble phenyle. As superior to the above, the sulpho-carbonates are recommended, and M. Dumas, of the French Academy, quoted upon their use.

A New Rose Pest—Homoptera Lunata. (Country Gentleman, for September 1, 1884, xlix, p. 737, c. 1-2—25 cm.)

Caterpillars feeding at night on rose buds in a rose-house in Madison, N. J., proved to be *Homoptera lunata*. This food-plant had not been previously recorded. The life-history of the species, as detailed by Prof. French, is given, together with Guenée's description of the caterpillar; also mention of the sexual difference in the moths, and the distribution of the species. Injury from the larvæ in rose-houses best prevented by hand-picking them.

[A revision of the above in the *Fourth Report on the Insects of N. Y.*, 1888, pp. 57-59.]

Jumping Seeds. (Country Gentleman, for September 11, 1884, xlix, p. 757, c. 1-2—40 cm.)

The seed-vessels described; said to be a species of *Euphorbia*. The contained insect (a lepidoptera) causing the motion, was described and named as *Carpocapsa saltitans*, by Prof. Westwood, in 1858—later by M. Lucas as *C. Deshaisiana*. The interesting generic relation of the insect is referred to, its leaps described, their cause explained, and period of emergence of the moth stated. Three other kinds of jumping seeds are known. Reference to further information.

[Extended, in *Fourth Report on the Insects of N. Y.*, 1888, pp. 151-154.]

The White Grub—Lachnosterna fusca. (Country Gentleman, for September 11, 1884, xlix, p. 757, c. 2-3—22 cm.)

In reply to inquiries from West Stockbridge, Mass., of remedies, etc., reference is made to a paper upon the insect giving about all that is known of it published in the *Forty-third Annual Report of the New York State Agricultural Society*, for 1883. The starvation remedy, as there given and believed to be effectual, is quoted.

An Insect Attack New to the State—*Isosoma tritici*, on wheat, in Geneva. Bulletin 100, New York Agricultural Experiment Station, Geneva, N. Y., October 4, 1884—86 cm.)

First noticed in Illinois in 1880; its difference from *Isosoma hordei*; location in the upper internodes of the straw; the larvæ more abundant in the straw examined than elsewhere seen; the wheat greatly shriveled; life-history of the insect; its description; two parasites infest it; remedies found in burning the stubble and straw; preventive in rotation of crops.

[Is *Isosoma hordei* (Harris); see *Fourth Report on the Insects of N. Y.*, 1888, pp. 27-35.]

A Stinging Bug — *Melanolestes Picipes* (H. S.). (Country Gentleman, for October 23, 1884, xlix, p. 877, c. 2-3 — 40 cm.)

An insect reported as inflicting a painful sting upon a lady in Natchez, Miss., is *Melanolestes picipes*, or the "Black Corsair." It is distributed over the United States, and has been previously noticed for the serious wounds it inflicts. Other Hemiptera of the *Reduviidæ* having similar stinging habits, are the *Conorhinus sanguisuga* LeConte, *Melanolestes abdominalis* (H.-S.), *Reduvius personatus* (Linn.), and *Prionotus cristatus* (Linn.). The above are briefly noticed in their habits and painful wounds.

[Extended, in the *Fourth Report on the Insects of New York*, 1888, pp. 109-114.]

An Attack on the Apple Worm — A Friend, Not a Foe. (Country Gentleman, for October 30, 1884, xlix, p. 897, c. 2-4 — 52 cm.)

A larva sent from Crozet, Va., as injurious to apples, from eating large holes into their sides and causing rot, proves to be *Chauliognathus marginatus* (Fabr.). It is not injurious, but enters apples through holes already made, to feed upon the apple-worm — the larva of *Carpocapsa pomonella*. The larva and beetle are described, the latter by comparison with *Ch. Pennsylvanicus*. The holes in quinces, thought to have been made by the same larva, are probably those of the quince curculio, *Conotrachelus crategi*, in leaving the fruit.

[Extended, in the *Fourth Report on the Insects of New York*, 1888, pp. 84-88.]

Clover Insects. (Transactions of the N. Y. State Agricultural Society, xxxiii, 1877-1882, [October], 1884, pp. 206-207.)

In the republication of the paper on "The Insects of the Clover Plant," from the annual report of the society for the year 1880, a list of the names with reference to authorities of twenty-four species is given, as an addition to the forty-six previously recorded, making the number now known seventy. Mention is made of the list of apple insects (additions in MS.) being extended to one hundred and eighty.

The White Grub. (The New England Homestead, for November 8, 1884, xviii, p. 393, c. 1-3 — 80 cm.)

Treats of the insect under the following heads: The grub; the beetle; its distribution; its food-plants; injuries by the beetle; life-history; its enemies; preventives and remedies. Under the latter head salt is recommended as an experiment, while starvation is pronounced infallible.

Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1883. (Thirty-seventh Annual Report on the New York State Museum of Natural History, by the Regents of the University of the State of New York, [November], 1884, pp. 45-60.)

Reports upon the collections made during the year and other work of the entomologist. Among insects of special interest collected are some

Trypetidæ, *Grapta Fannus*, *G. j-album*, *Feniseca Tarquinius*, and *Agrilus torpidus*; remarks upon *Agrotis clandestina* and *Simulium molestum*; notice of the operations of *Orgyia leucostigma* in girdling elm twigs, and causing them to drop; the English sparrow promoting insect injury; an extended notice of the appearance of the chinch-bug, *Blissus leucopterus*, in northern New York, with recommendations made, and distributed in a circular, for the arrest of its ravages.

The Apple-leaf Bucculatrix. (The Husbandman, Elmira, N. Y., for December 3, 1884, xi, No. 537, p. 1, c. 5 — 31 cm.)

Apple twigs received from Malcolm, Seneca county, N. Y., are covered with the cocoons of *Bucculatrix pomifoliella*. The cocoon is described and life-history of the species given. The remedies mentioned are spraying, or scouring with a stiff brush the infested branches with a kerosene and soap emulsion, of which the formula is given, for killing the insect within the cocoon; Paris green in water for poisoning the caterpillars, and jarring the caterpillars from the trees and burning them in the months of July and September.

[Extended, in the present Report, pp. 260-262.]

On some Rio Grande Lepidoptera. (Papilio, iv, Nos. 7-8, September-October, 1884, pp. 135-147.) [Published February, 1885.]

Gives an annotated list of collections made by Messrs. Sennett and Webster, in 1877 and 1878, viz.: In Rhopalocera, fifty-two species (*Kricogonia Lanice* and *Apatura Cocles*, being new species); in Sphingidæ, four species (*Sphinx insolita* n. sp.); in Egeriadæ, two species; in Bombycidæ, three species (*Epantheria Sennettii* n. sp.).

Scale-Insect Attack on Ivy. (Country Gentleman, for February 26, 1885, l, p. 169, c. 2 — 22 cm.)

Ivy leaves (*Hedera helix*) received from Watervliet, N. Y., and infested on both surfaces and the stem also by *Aspidiotus nerii* Bouché—a scale-insect which infests the cherry, plum, currant, maple, oleander, etc., throughout most of the United States. Remedies recommended under different conditions are scraping, a soap solution, and a soap and kerosene emulsion made in accordance with the formula given.

[Printed, also, in this Report, see pp. 278, 279.]

The Owl Beetle — *Alaus Oculatus*. (Country Gentleman, for April 9, 1885, l, p. 307, c. 4 — 14 cm.)

The beetle received alive in May, from Aiken, S. C., is described and its habits given. Proves upon later examination to be *Alaus myops* (Fabr.).

Remedies for the White Grub. (The New England Homestead, for May 16, 1885, xix, p. 205, c. 2 — 28 cm.)

The remedies usually recommended for the beetle, insufficient; the grubs may be destroyed by starvation; crops of buckwheat and mustard repel the grubs; how and when salt may be used with benefit.

Cut-worms. Read before the New York State Agricultural Society, at the Annual Meeting, January 21, 1885. (Forty-fourth Annual Report of the New York State Agricultural Society, for the year 1884, [May], 1885, pp. 56-80, figs. 1-20.) (Separate, with cover and half-title [June, 1885], pp. 25, figs. 20.)

The subject is treated of under the following heads: What are Cut-worms?—Their Appearance—Their Habits—Habits of the Moths—Natural History—Conditions Favorable to Cut-worms—Their Food-plants—Abundance of Cut-worms—Literature of the Cut-worms—List of Species—Natural Enemies—Parasites—Preventives and Remedies—Two Preventives Specially Commended—Conclusion.

A Potato-bug Parasite. (The New England Homestead, for June 6, 1885, xix, p. 237, c. 2—34 cm.)

A mite infesting and killing Colorado potato-beetles received from Middlesex county, Mass., is identified as *Uropoda Americana* Riley. Description is given of it, its peculiar connecting filament remarked upon, habits of the family of *Gamasidae* to which it belongs, noticed, together with the importance of the attack, and recommendation of distribution of the serviceable parasite.

[Printed, also, in this Report, see pp. 289-291.]

The Visitation of Locusts. (The Argus [Albany], June 7, 1885, p. 4, c. 5—33 cm.)

The announced co-appearance of the seventeen-year locusts and the thirteen-year locusts will not occur in New York; why "locust" is a misnomer; not 221 years, as stated, since the two forms of Cicadas co-appeared, but only thirty years, also thirty-nine years ago; no ground for alarm, as the Cicada harms fruit trees only, and those usually not seriously; notice of the brood of seventeen-year Cicadas to appear about the present time in New York, at Brooklyn and Rochester.

The Pear-Blight Beetle. (Country Gentleman, for June 18, 1885, l, p. 517, c. 2, 3—46 cm.)

Xyleborus pyri (Peck), infesting the trunks of young apple trees and killing them, at Annapolis, Md., is identified; description of the beetle; origin of its common name; its two forms of attack; the burrows in the limbs and in the trunk described; the latter ascribed to a second brood but are probably made by the mature insect for food and shelter; remedy for the limb attack, cutting off and burning with the insect; for the trunk attack, not yet known.

The Canker Worm. (Country Gentleman, for June 18, 1885, l, p. 519, c. 2, 3—20 cm.)

Spread of the Canker-worm, *Anisopteryx vernata* (Peck) in the State of New York; notice of its presence in large numbers at Loudonville, Albany county; the attack is controllable at the outset, and should not be allowed to extend. The preventives and remedies are, bands, etc., to

prevent the ascent of the wingless female, spraying with Paris green water to kill the larvæ, and working the ground beneath the trees to crush the pupæ.

[Printed in present Report, pp. 258, 259.]

Insect Eggs on Strawberries. (Country Gentleman, for June 25, 1885, 1, p. 537, c. 3—21 cm.)

The eggs do not indicate an attack that need impair our enjoyment of the fruit. Their presence is unusual and probably accidental. They are the eggs of some hemipterous insect, belonging probably to one of the larger plant-bugs. Description is given of them. The nauseous taste imparted to raspberries by the presence of a small bug, known as *Corimelaena pulicaria*, is referred to, and the insect described. This same insect attacks the blossoms and the stems of strawberries.

Plant-lice, Elm-beetles, etc. (New England Homestead, for July 4, 1885, xix, p. 269, c. 1-2—15 cm.)

Identification of *Schizoneura Americana* as injuring leaves of elms at West Stockbridge. The insect reported as stripping the leaves of the elms, is probably the elm-leaf beetle, *Galeruca xanthomelana*, although not known before to extend so far into Massachusetts. May-flies perhaps mistaken for mosquitoes.

The Apple Tree Bark-louse. (New England Homestead; for July 4, 1885, xix, p. 269, c. 4-5—20 cm.)

Scales on bark of an apple tree sent are those of *Mytilaspsis pomorum* of Bouché (*M. pomicorticis* Riley). Directions for destroying the insect, by scraping the scales and by spraying kerosene emulsion.

The Cut-Worm and Onion Maggot. (Country Gentleman, for July 9, 1885, 1, p. 574-5, c. 4, 1—20 cm.)

For the arrest of cut-worm ravages reported from Globe Village, Mass., the inquirer is referred to remedies given in the paper published in the 44th Rept. N. Y. St. Agricul. Society. For controlling *Anthomyia brassicæ* and *Phorbia ceparum*, the remedies are removing the plants with the soil containing the larvæ, and killing the pupæ with gas-lime or plowing and harrowing repeatedly. Preventives are, strong-smelling substances, and not planting in infested ground.

Peach and Cherry Borers. (Country Gentleman, for July 9, 1885, 1, p. 575, c. 1—18 cm.)

Peach trees in Annapolis infested by *Phlocotribus liminaris*. It attacks the elm also. The cherry trees are probably infested by *Scolytus rugulosus* Ratz., recently introduced from Europe; see an interesting article upon this species in the Canadian Entomologist for September, 1884. The injuries of *P. liminaris* seem to be rapidly increasing in localities in the State of New York.

The Fig-Eater — Allorhina Nitida. (Country Gentleman, for July 9, 1885, 1, p. 575, c. 2-3—15 cm.)

The species identified from Madison, N. J., and briefly described; its fondness for juicy fruits; is not known to occur in New York; the larva

is one of the white grubs, and is quite injurious to the roots of grass; its abundance in Washington; the beetle is a pollen feeder and sometimes occurs in great numbers, as in an instance cited. The "trim flower-chafer" might be a better common name for it.

The Roundheaded Apple-tree Borer—*Saperda Candida* Fabr. (Country Gentleman, for July 16, 1885, 1, pp. 590-1, c. 4, 1—33 cm.)

Borers in hawthorn [in Westchester Co., N. Y.], are probably the *Saperda candida*; its burrows and method of destroying the grubs with a strip of flexible steel; recommendation by Dr. Fitch of cutting out the grub; discovering the location and crushing the egg; killing the eggs by application of lye; benefit of mounding about the tree; washing with soap, and soap placed in the forks of the trees for preventives; principal publications upon the insect.

Entomological. [Answers to inquiries.] (Country Gentleman, for July 16, 1885, 1, p. 592, c. 2-3 — 20 cm.)

Paris green recommended for killing the potato-beetle infesting egg-plants; road-dust may prevent their attack. For the injuries of the rose-bug, at Waddington, N. Y., to apples and cherries, beating them from the trees recommended; to the former, Paris green might be applied. The abundance of this insect upon fruit trees at times, cited.

The Cause of Black-Knot. (Country Gentleman, for July 23, 1885, 1, p. 607 c. 1-2 — 26 cm.)

It is not, as is popularly believed, of insect origin, but is produced by a fungus originally named *Sphaeria morbosa*, but recently transferred to the genus *Plowrightia*. There are not "three distinct species," but the same one attacks *Prunus domestica*, *P. Americana*, *P. cerasus*, *P. Virginiana*, *P. Pennsylvanica* and *P. serotina*—two plum trees and four cherry trees. Six species of insects have been bred from the black-knot. The remedy is to cut off and destroy attacked twigs and branches early in July.

[Revised, and printed in this Report, see pp. 280, 281.]

The Cucumber Moth. (Country Gentleman, for July 23, 1885, 1, p. 607, c. 2, 3 — 28 cm.)

The borer attacking a melon patch in Carp, Tenn., is, from the description sent, probably the larva of *Phakellura nitidalis* (Cramer), popularly known as the "pickle-worm." In New York and the Eastern States the squash-vine borer *Melittia cucurbitæ* takes its place. The appearance and the habits of the pickle-worm are described. The moth is also described. For remedies, destroy the bored melons, sprinkle with London purple or Paris green water while the moth is ovipositing. Figures of the insects are referred to. The borer may possibly be *P. hyalinatalis*, of which the habits are different.

Apple Insects and the Rhinoceros-beetle. (Country Gentleman, for July 30, 1885, 1, p. 623, c. 2-3—25 cm.)

Of apple insects sent from Coffee, Va., one is *Orgyia leucostigma*, and the other had spun up in a cocoon [subsequently emerged and proved to be *Acronycta* sp.]. The information sent of the *Dynastes Tityus*, that the beetle comes from the ground among the ash trees where its larva had probably been feeding on living vegetable matter, is a new and interesting fact. The record of the manner in which the beetles eat the bark of the ash is also interesting, as also the mention of their being very destructive to tobacco plants, killing all that they attack. [See page 230 of this Report.]

Another Potato Pest. (New England Homestead, for August 8, 1885, xix, No. 32, p. 309, c. 3.)

Macrobasis unicolor (Kirby), one of the blister-beetles, identified as the insect injurious to the foliage of potatoes, in Furnace, Mass. Beating the insects into a basin of water and kerosene, or if very abundant, sprinkling with Paris green or London purple in water, is recommended.

Roestelia aurantiaca. (Country Gentleman, for August 13, 1885, 1, p. 661, c. 3-4—10 cm.)

Determination of the above fungus occurring on quinces received from Charlton, Mass. It has usually been found associated with insect attack, as in this instance, where the fruit has been burrowed by probably the apple-worm of the codling-moth.

The False Chinch Bug. (Country Gentleman, for August 13, 1885, 1, p. 661, c. 4—26 cm.)

Insect described (but no examples sent) and reported as injurious to radishes, turnips, horseradish, strawberries, and raspberries, in Boulder, Col., are, without much doubt, the *Nysius angustatus* of Uhler. It had not previously been known to injure ripe strawberries, but had, according to observations of Professor Forbes, been quite injurious to the foliage of strawberries in Illinois. Kerosene emulsion or pyrethrum could be used to destroy the bug when upon strawberries, until the fruit is about half grown.

The Bag-Worm—*Thyridopteryx Ephemæraformis*. (Country Gentleman, for October 1, 1885, 1, p. 801, c. 4—20 cm.)

To an interesting account of the habits of a "worm" destroying arbor vite hedges in Franklin Park, N. J., and request for information in regard to it, reply is made of its name as above, and the best methods for checking its injuries, viz., application of Paris green, and hand-picking, and destroying the cases of the female moth. A figure illustrating the several stages of the insect is also given.

The Red Spider—*Tetranychus Telarius* (Linn.). (Country Gentleman, for October 8, 1885, 1, p. 821, c. 3-4—38 cm.)

Mites infesting various garden plants, at Utica, N. Y., are this species which, standing at the head of the Acarina, approaches near to the

spiders. It spins webs on the under side of the leaves for shelter, while sucking the juices of the various plants upon which it occurs; those upon which it was noticed at Utica are mentioned. It has this summer been discovered in an injurious attack on a quince orchard near Geneva, N. Y. Kerosene emulsion, soap solution with sulphur mixed, and quassia infusion may be used for killing it. It was the cause of the yellow discoloring of the leaves of a nasturtium in the garden of the writer.

[Printed, also, in this Report, see pp. 287-289.]

The Thirteen-year Cicada. (The Argus [Albany], for October 11, 1885, p. 4 — 32 cm.)

A paper read before the Albany Institute, containing remarks upon the exceptional long life-period of the *Cicada septendecim*; the number of broods occurring in the United States and in the State of New York; notice of a thirteen-year brood, and that its occurrence only in the Southern States may be the result of hastened development through higher temperature; Professor Riley's experiments in transferring the two forms from one region to another; and record of the planting of the eggs of a thirteen-year brood at Kenwood, near Albany.

[Printed, also, in this Report, see pp. 276-278.]

The Elm Leaf Beetle. (Country Gentleman, for October 15, 1885, 1, p. 841, c. 3-4 — 23 cm.)

The inquirer, from Bordentown, N. J., of methods for killing the insects destroying the foliage of his elm trees, is referred to a notice of the insect, *Galeruca xanthomelæna*, in the *Country Gentleman* for October 12, 1882 (p. 805), and to Bulletin No. 6 of the Division of Entomology of the U. S. Agricultural Department. Of the arsenical insecticides recommended, London purple is preferred, in the proportion of one-half pound to three quarts of flour and a barrel (forty gallons) of water. Directions for mixing are given, and the advantages of its use stated.

The Clubbed Tortoise-beetle. (Country Gentleman, for October 15, 1885, 1, p. 841, c. 4 — 12 cm.)

Remarks upon *Coptocycla clavata* (Fabr.), its appearance, habits and food-plants. Reference to its occurrence on the potato, tomato, and egg-plant.

A Leaf-mining Insect. (Home Farm [Augusta, Me.], for October 15, 1885, p. 1, c. 6 — 20 cm.)

A leaf-miner reported in Maine, and in the vicinity of Boston, Mass. is identified as one of the Anthomyiids, and probably *Chortophila betarum* Lintn., which is known to have distribution in New York and Connecticut. The approved methods for meeting its attack, are prevention of egg-deposit by the use of counterodorants, and burning the infested leaves.

The Death-Watch, *Clothilla Pulsatoria*. (Country Gentleman, for October 22, 1885, l, p. 861, c. 3-4 — 21 cm.)

A supposed parasite found in cow-stalls in Warren, O., is this insect, a figure of which is given. The habits of the *Psocidae* are briefly stated, and the reason why this species has received the name of the "death-watch." It has previously occurred in immense numbers in barn refuse after threshings, and in straw-packings in a wine cellar.

[See *Second Report on the Insects of N. Y.*, pp. 201, 202.]

Eggs of a Katydid. (Country Gentleman, for October 29, 1885, l, p. 881, c. 4 — 23 cm.)

Eggs sent from Lexington, Va., arranged in two rows upon the opposite sides of the back fold of a copy of the *Country Gentleman*, are those of *Microcentrus retinervis*, an insect common in some of the warmer States of the Union, and classed by some writers with the katydids, although strictly, the name of katydid would belong only to *Platyphyllum concavum*. The eggs are described, and reference made for the illustration and life-history of the species to the 6th Missouri Report.

[The name should have been given as *Microcentrum retinervum*.]

A New Insect Foe to the Cut-worm. (New England Homestead, for October 31, 1885, xix, No. 44, p. 405, c. 3-4 — 19 cm.)

A correspondent from Winsted, Ct., sends for information a fly hatched from some cabbage cut-worms kept in confinement. The fly is a species of *Gonia* belonging to the *Tachinidae*, the parasitic habits of which are given. Caterpillars bearing upon their body the white eggs or the egg-shell of these flies should not be destroyed, but permitted to furnish food for the beneficial larvæ that are feeding within them. The cabbage cut-worm was probably *Mamestra trifolii* (Rott.).

Saw Fly on Fruit Trees. (Country Gentleman, for November 12, 1885, l, p. 921, c. 3-4 — 25 cm.)

In answer to an inquiry from Edinburgh, Scotland, of some small, thin, nearly transparent objects nearly half an inch long and looking like a leech, which for several years had nearly destroyed the leaves of plum, pear, and cherry trees, reply is made that it is the larva of some species of saw-fly, and probably of *Eriocampa adumbrata*. Its ravages may be prevented by means of powdered hellebore, to be obtained pure, and applied to the foliage by the hand or by a bellows. Its efficacy is illustrated by an account of its use in the Hammond Nurseries at Geneva, N. Y. Directions are given for using the hellebore mixed with water, if more convenient in this form.

(B.)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the contributions that have been made to the Department during the year (1888):

IN HYMENOPTERA.

Cocoons of *Nematus Erichsonii* Hartig, and the imago, May 8th. From Rev. H. W. SWINNERTON, Cherry Valley, N. Y.

Galls of *Neuroterus verrucarum* (O. S.), on *Quercus* sp.? From J. CARTER BROWN, Kingston, R. I.

Apanteles congregatus (Say) cocoons on ?*Darapsa Myron*. From Mrs. K. M. BUSICK, Wabash, Ind

IN LEPIDOPTERA.

Larvæ of *Thyreus Abbotii* Swainson, July 26th. From A. J. RICHMOND, Canajoharie, N. Y. The same, from Dr. R. H. SABIN, Troy, N. Y. The same (spotted form), from HORACE B. DERBY, Albany, N. Y., July 6th. The same (striated form), from S. C. BRADT, Albany, N. Y., July 8th.

Datana ministra (Drury) larvæ from apple tree, Sept. 4th. From M. T. RICHARDSON, New York city.

Edemasia concinna (Sm.-Abb.) larvæ from apple tree early in September. From JOHN C. SHAW, Brooklyn, N. Y.

Callosamia Promethea (Drury) cocoons on wild cherry. From E. J. REDDY, Bayville, N. Y. The same, on plum, from Mrs. E. W. K. LASELL, Orange, N. J. The same, from BERTHOLD FERNOW, Albany, N. Y.

The regal walnut-moth, *Citheronia regalis* (Fabr.), taken at the State Camp, Peekskill, N. Y., August 5th. From Dr. C. W. CRISPELL, Kingston, N. Y.

Larva of *Eacles imperialis* (Drury) with puparia of a Tachinid-fly, Sept. 10th. From S. C. BRADT, Albany, N. Y.

Olisiocampa Americana Harris, larvæ and cocoon. From BERTHOLD FERNOW, Albany, N. Y.

Larvæ of *Gortyna nitela* Guenée, burrowing in stalks of young corn, June 22. From Rock Hall, Md.

Larvæ of *Cacœcia argyrospila* (Walk.) eating into young pears, June 13th; and of *Coleophora* sp.? eating into the same, June 8th. From P. BARRY, Rochester, N. Y.

IN DIPTERA.

"Flax-seeds" (puparia) of the Hessian-fly, *Cecidomyia destructor* Say, in wheat. From Prof. F. M. WEBSTER, LaFayette, Ind.

Galls of *Lasioptera vitis* O. S., June 27th. From H. I. FISK, Worcester, Mass.

Tipulid larvæ found in association with cocoons of *Nematus Erichsonii*, May 18th. From Rev. H. W. SWINNERTON, Cherry Valley, N. Y.

The "cow-fly," *Hematobia serrata* Desvd. From SAMUEL W. SHIMER, Mount Holley, N. J.

IN COLEOPTERA.

Dytiscus fasciventris Say. From JOSEPH HARVEY, Albany, Oct. 20th. The same from JOHN D. COLLINS, Utica, N. Y., Nov. 5th.

Dytiscus Harrisii Kirby, October 24th. From H. G. SETTLE, Saratoga Springs, N. Y.

The carpet-beetle, *Anthrenus scrophulariæ* Linn., from Crocus, April 27th. From Mrs. HOAGLAND, Albany, N. Y.

Alaus oculatus (Linn.). From Mrs. E. W. K. LASELL, Orange, N. J.

Anomala lucicola (Fabr.), the light-loving grapevine-beetle, July 13th. From W. W. SWEET, Hightstown, N. J.

Pelidnota punctata (Linn.), *Desmocerus palliatus* (Forst.), and *Saperda candida* Fabr. From C. G. BELKNAP, Branchport, N. Y.

Oak twigs cut by the oak-tree pruner, *Elaphidion parallelum* Newm. From GEORGE T. LYMAN, Bellport, N. Y.; also, from Dr. JAMES W. HALL, Sea Cliff, L. I., N. Y.; also, from C. FRED JOHNSON, Bayport, N. Y.

Monohammus confusor (Kirby). From BERTHOLD FERNOW, Albany, N. Y.

A Cerambycid-beetle (four inches in length, species undetermined), from Colon, Central America. From M. B. HARRIOT, Albany, N. Y.

The elm-leaf beetle, *Galeruca xanthomelena* (Schr.), May 1st. From D. J. GARTH, Scarsdale, N. Y.

Aramigus Fulleri Horn, from a rose-house, June 30th. From W. J. PALMER, Rochester, N. Y.

Plum curculio oviposition in young pears, June 8th. From P BARRY, Rochester, N. Y.; also, the same, in young cherries, June 7th, from GEORGE S. POWELL, Ghent, N. Y.

The grain-weevil, *Calandra granaria* (Linn.), in wheat. From ABNER L. BACKUS & SONS, Toledo, O.

Young Duchess pear trees (sections) girdled by *Xyleborus pyri* (Peck), and containing the beetle, May 22d. From NORMAN POMROY, Lockport, N. Y.; also from E. S. GOFF, Geneva, N. Y.

Phloeotribus liminaris (Harris) — the living beetle in bark of peach tree, October 19th. From DAVID HUNTINGTON, Somerset, Niagara Co., N. Y.

IN HEMIPTERA.

Lygus pratensis (Linn.) *C. lineolaris* of Beauv., with young pears punctured and gnarled by it. From P. BARRY, Rochester, N. Y.

The melon plant-louse, *Aphis cucumeris* Forbes. From T. C. BARKER, Lowell, Mass.

The cockscomb elm-gall, *Glyphina ulmicola* (Fitch) on "weeping slippery elm," *Ulmus* sp.? From C. H. HEDGES, Charlottesville, Va.

The grapevine bark-louse, *Pulvinaria innumerabilis* (Rathvon), on soft maple. From H. E. HAYES, New York.

The cottony-cushion scale, *Icerya Purchasi* Maskell, on *Acacia* in Lamonda Park, Los Angeles Co., Cal. From A. O. OSBORNE, Waterville, N. Y.

The scurfy bark-louse, *Chionaspis furfurus* (Fitch), on a pear tree twig. From J. M. CLARKE, Albany, N. Y.

IN ORTHOPTERA.

Eggs of *Microcentrum retinervum* (Burm.) on currant stem and on *Cercis Japonica*. From Prof. W. S. ROBINSON, Elizabeth, N. J.; also from S. B. HUSTED (April 20th), Blauvelt, N. Y.

Eggs of *Ecanthus niveus* Serv. in Concord grapevines. From W. D. BARNES, Middlehope, N. Y. The same, from St. Catherines, Ontario; from E. S. GOFF, Agricultural Experiment Station, Geneva, N. Y.

Ecanthus niveus (De Geer) ♂. From JONAS BROOKS, Albany, N. Y.; also in both sexes, from Mrs. E. B. SMITH, Coeymans, N. Y.

Apple-tree twigs showing oviposition of an *Ecanthus*, not *niveus*. From W. L. DEVEREAUX, Clyde, N. Y.

Gryllotalpa longipennis Scud. From Dr. C. W. CRISPELL, Kingston, N. Y.

IN NEUROPTERA.

Corydalid cornutus (Linn.), the hellgrammite fly, August 5th. From Dr. C. W. CRISPELL, Kingston, N. Y.

IN ARACHNIDA.

Galls of *Phytoptus quadripes* (Shimer) on leaves of soft maple, June 5th. From E. DAYTON JOSLIN, Lake Grove, Suffolk Co., N. Y.

IN MYRIAPODA.

Julus ceruleocinctus Wood, from beneath a carpet. From W. M. G. WARREN, Buffalo, N. Y., and from Mts. IRA HARRIS, Loudonville, N. Y. The same, from roots of geraniums, September 27th. From JOHN B. HOFFMAN, Cape May, N. J.

GENERAL INDEX.

A.

- Abbotil, Thyrens, 175, 177, 306, 324.
abdominalis, Melanolestes, 316.
Acarina, 287-295.
Aearus domesticus, 292.
 farinæ, 292, 294.
 horridus, 292.
 lactis, 292.
acerifolliella, Incurvaria, 216-219.
 Ornix, 216, 216, 218.
achemon, Phillampelus, 176.
Aceronycta sp? 321.
Actias Luna, 188.
Adirondack insects, 260.
Adirondack Region, its insect fauna neglected, 284.
adumbrata, Eriocampa, 323.
Egerladæ, 311, 313, 317.
Egerla pictipes, 280.
Agarista octomaculata, 179.
Aglla tau, 188.
Agrilus torpidus, 283, 317.
Agrotis clandestina, 282, 317.
 Cochranii, 210.
 inermis, 200, 201.
 Ortoni, 201.
Agrotis saucia, 200-206.
 at sugar, 206.
 bibliography, 200.
 distribution, 206.
 double-brooded, 205.
 eggs, 201.
 figures of, 204.
 food-plants, 200, 203, 205.
 injuries of, 205.
 moth, habits of, 204.
 pupa and pupation, 204.
 remedies, 206.
 transformations, 202.
Alaus myops, 317.
 oculatus, 317, 325.
Alder spittle-insect, 242-246.
 bibliography, 242.
 enemies of, 244.
 injuries from, 246.
 larva described, 243.
 observations on, 243.
 other spittle-insects, 245.
 popular names, 245.
 production of the spittle, 243.
 purpose of secretion, 244.
 spittle mass, 243.
Alder woolly plant-lice, 282.
Allorhina nitida, 319.
Alypia octomaculata, 179-183.
 bibliography, 179, 180.
 caterpillar described and figured, 18.
 feeding habits, 180, 182.
 flight of, 182.
 food-plants, 181, 182.
 moth described and figured, 181.
 remedies, 183.
 resemblance to other larvæ, 180, 183.
 synonymy, 179, 180.
Americana, Chrysophanus, 285.
Cfisiocampa, 152, 304, 324.
Schlzoneura, 319.
Uropoda, 290, 318.
Ammoniacal liquor for insects, 158.
Ampelophaga Myron, 174.
Anatis 16-punctata, 305.
Anisota senatoria, 192-200.
 abundance at Center, N. Y., 196.
 Livingston, N. Y., 196.
 Michigan locality, 196.
 Pennsylvania locality, 196.
 Saratoga Springs, 185.
 associated species, 199.
 bibliography, 192, 193.
 distribution, 197.
 egg-laying, 193.
 enemies, 198.
 food-plants, 197.
 larval stages, 194.
 life-history, 198, 199.
 mating, 193.
 mature caterpillar, 195.
 moth described, 198.
 parasites, 198.
 pupation, 199.
 remedies, 200.
 stinging powers, 197.
Angus, James, on elm-leaf beetle, 237, 238, 239.
angustatus, Nysius, 321.
Anisopteryx vernata, 242, 268, 313, 318.
Anisota bicolor, 199.
 bisecta, 199.
 Helligbrodti, 199.
 pellucida, 199.
 rubicunda, 197, 198.
 stigma, 197, 199.
 Virginlensis, 199.
Anomala lucicola, 305, 325.

- Anthomyia brassicæ*, 168, 266, 319.
Anthomyiidae, 314.
Anthonomus sycophanta, 173.
Anthrenus, scrophulariæ, 267, 268, 314, 326.
 varius, 267, 268.
Antithesla nimbata, 213.
Apanteles congregatus, 177, 307, 324.
Apatura Cocles, 317.
Aphides, 163.
Aphides causing honey-dew, 304.
Aphididae, 246-257.
Aphidiinae, 253.
Aphidius avenæ, 253.
Aphidivorous Ichneumonidae, 253.
Aphis, apple-tree, 163, 160.
Aphis avenæ, 246, 250.
 cerasi, 253.
 cerealis, 246, 251.
 cucumeris, 306, 326.
 granaria, 246, 250.
 hordei, 246, 251.
 mali, 161.
 rose, 162.
 woolly, 160.
Aphrodite, Argynnis, 286.
Aphrophora parallela, 245.
 quadrangularis, 246.
 quadrinota, 245.
 Signoretii, 245.
Apidæ on flowers, 284.
Apple-leaf Bucculatrix, 260-262, 317.
 cocoons of, 260.
 distribution, 261.
 figures of, 260.
 life-history, 261.
 New York localities, 261.
 remedies, 262.
Apple-maggot, 300.
Apple-tree aphis, 163, 160, 300.
Apple-tree bark-louse, 319.
Apple-tree tent caterpillar, 152, 241, 304.
Apple-worm, 300, 305, 316, 321.
Arachnoidea, 290.
Aramigus Fulleri, 154, 311, 325.
Archippus, Danaï, 285.
arctica, Hadena, 212.
Argynnis Aphrodite, 286,
 Atlantis, 286.
 Bellona, 285.
 Cybele, 286.
argyrosbila, Cacoecia, 324.
Army-worm (Hierwurm), 264.
Arsenites for insects, 231, 239, 314, 320, 321,
 322.
Arthur, Prof. J. C., cited, 288.
 on fungus-attacked Phytonomuslarvæ,
 273.
Ashes and sulphur for insect attack, 315.
Ashes for repelling insects, 301.
Ash-gray blister-beetle, 305.
Ashmead [Wm. H.], on *Aphidiinae*, 253.
Ashton [T. B.], cited, 246.
Aspidiotus nerii, 278, 317.
Atalanta, Pyrameis, 285.
Atkins, Chas. G., on *Saperda candida*, 271.
Atkinson, Prof. G. F., cited, 227.
 on Anisota, 197, 198.
 on odor of Dynastes, 228.
Atlantis, Argynnis, 285.
atrata, Thalesa, 305.
atrifasciata, Homohadena, 285.
Attack of mites on garden plants, 287.
Attack on pears by a plant-bug, 275.
Aulacomeris lutescens, 171.
Autumn plowing for insect attack, 313.
avenæ, Aphidius, 253.
 Aphis, 246.
 Siphonophora, 246.
avenaphis, Praon, 263.
avium, Dermanyssus, 290.
- B.**
- Backus & Sons, Abner S.*, insects from, 326.
Bacon-beetle, 302, 313.
Bag-worm, 321.
Bailey [Dr. James], referred to, 212.
Bald-faced hornet, 235.
Bark-borer, 300.
Barker, T. C., insects from, 326.
Barnes, W. D., Insects from, 326.
Barry, P., insects from, 201, 324, 325, 326.
basalis, Oberea, 231.
Bdellidae, 290.
Beans for repelling cucumber beetle, 159.
Beating from foliage for insect attack, 231.
Beautiful woodnymph, see Eudryas grata,
 179.
Beet-leaf miners, 314.
Beetle-mites, 290.
Belknap, C. G., insects from, 325.
Bellamira scalaris, 285.
Bellona, Argynnis, 285.
Benzine for insect attack, 314.
betarum, Chortophila, 322.
Bethune [Rev. C. J. S.], cited, 246.
bicolor, Anisota, 199.
 Sphingicampa, 199.
bimaculata, Oberea, 231-233.
 Saperda, 231.
bimarginata, Haltica, 170.
Birds feeding on caterpillars, 198.
bisecta, Anisota, 199.
 Sphingicampa, 199.
Bisulphide of carbon for insects, 266, 300,
 313, 315.
Biting flies, 221.
Biting measuring-worms, 260.
hivulnerus, Chilocorus, 267, 300.
Black aphis, 254.
Black fly, 283, 314.
Black-knot, 306, 320.
Black-knot and its guests, 280.
Black long-sting, 305.
Blapharida rhois, 271.
Blissus leucopterus, 317.

Blister-beetle, 321.
 Blodget, Lorin, aphides from, 315.
 Blue caterpillars of the vine, 180, 183.
 Blue jay eats *Anisota senatoria*, 198.
 Boder, E., on habits of cow-horn fly, 224, 225.
 Bolsduval [Dr.], cited, 179, 180, 193, 200, 210.
 Bombycidae, 183, 192, 317.
 Bombyx grata, 180.
 Boss spraying nozzle, 161.
 Braconidae, 177, 253.
 Bradt, S. C., insects from, 324(2).
 brassicæ, *Anthomyia*, 158, 265, 319.
 Brine for insect attack, 156.
 Brooks, Jonas, insects from, 326.
 Brown, J. Carter, galls from, 324.
 Brunn, A. E., on apple-leaf *Bucculatrix*, 261.
Bucculatrix pomifollella, 260, 317.
 Buckton, (G. B.), cited, 246, 247, 250, 253(2), 255, 256.
 Buckwheat crop for repelling insects, 317.
 Bud-mites, 290.
 Dud-worm, 304.
 Buffalo fly, 220, 226.
 Buffalo gnat, 314.
 Burdock infusion for insects, 158.
 Burning for insect attack, 154, 303, 304, 308, 310, 314, 315, 317, 318, 322.
 Burying-beetles, 289.
 Buslok, Mrs. K. M., insects from, 324.
 Bussing, Isaac, insects from, 261.
 Butterflies in the Adirondacks, 285.

C.

Cabbage butterfly, 300.
 Cabbage cut-worm, 323.
 Cabbage-fly, 157, 265.
 Cabbage-maggot, 157, 158.
Cacœcia rosaceana, 213.
 argyrospila, 324.
 cacti, *Chilocorus*, 300.
cæruleocinctus, *Julus*, 296, 307, 326.
Calandra granaria, 325.
calcitrans, *Stomoxys*, 221, 222, 225, 308.
Callosamia Promethea, 324.
Calmariensis, *Chrysomela*, 234, 236.
 Galeruca, 234.
 Camphor for insects, 300.
candida, *Saperda*, 269, 320, 325.
 Canker-worm, 242, 258, 318.
Cantharis vesicatoria, 306.
 Carabidae, 303.
 Carbolic acid insecticide, 293, 314.
 Carpet beetle, 267, 314, 325.
Carpocapsa, *Deshaisiana*, 315.
 pomonella, 316.
 saltitans, 315.
 caryæ, *Lachnus*, 304.
Catocala unijuga, 282.
 Caulfield [F. B.], cited, 207.
Cecidomyia cucumeris, 306.
 destructor, 263, 325.
 legumnicola, 262.
ceparum, *Phorbia*, 319.

Cerambycidae, 231.
 Cerambycid beetle from Colon, S. A., 325.
Ceramlea exusta, 206, 207.
ceusii, *Aphis*, 253, 254.
 Myzus, 263-257.
Ceratocampade, 199.
Ceratopogon from black-knot, 280.
 Cercopidae, 242.
Cercopis obtusa, 242.
cerealis, *Aphis*, 246, 261.
Cermatia forceps, food of, 295.
cervicola, *Stomoxys*, 308.
chamænerii, *Deilephila*, 176.
 Chambers [V. T.], cited, 216.
 Chatfield [A. S.], referred to, 212.
Chauliognathus marginatus, 316.
 Pennsylvanicus, 316.
 Cheese-mite, 290.
 Cherry aphid, 253-257.
 abundance, 254.
 bibliography, 253.
 description, 255.
 introduced from Europe, 254.
 lady-bugs for killing, 257.
 life-history, 254.
 number on a cherry tree, 254.
 remedies, 256.
 root-form, 256.
 Chestnut caterpillar, 308.
 Chicken louse, 290.
 Chickens for catching insects, 301.
Chilocorus bivulnerus, 267, 300.
 cacti, 300.
 Chinch-bug, 317.
Chionaspis fufurur, 300, 326.
Chionaspis pinifolii, 266.
 Chloris, *Parasa*, 186.
Chœrocampa pamphatrix, 174.
Chortophila betarum, 322.
 Chrisman, Mrs. L. T., on brine for the currant worm, 156.
Chrysomela californiensis, 236.
Chrysomelida, 271, 234, 235, 300.
Chrysopa larvæ, 244.
Chrysophanus Americana, 286.
 Cicada broods in New York, 276.
Cicada septendecim, 276, 322.
 spumaria, 245.
Citheronia regalis, 324.
clandestina, *Agrotis*, 282, 317.
 Claparède cited on red spider, 287.
 Clarke, J. M., insects from, 326.
 Clarkson, F., cited, 193, 196, 199, 200, 234.
Clastoptera obtusa, 242-246.
 Proteus, 246.
clavata, *Coptocyclo*, 322.
 Claypole, Prof., on *Anisota senatoria*, 193.
 Clemens [Dr. B.], cited, 213, 215.
 Climbing cut-worms, 210.
 Clinton, Hon. G. W., cited, 272.
Clisiocampa Americana, 152, 304, 324.
Clothilla pulsatoria, 323.

- Clover insects, publication on, 316.
 Clover-leaf weevil killed by a fungus, 272.
 Clover-seed mildew, 262.
 Clubbed tortoise beetle, 322.
 Cnotus, Myron, 174.
 Coal-tar, an insect repellent, 155, 301.
 Coccinellidæ, 254.
 Cochlidia, 184, 185, 188.
 Cochranii, Agrotis, 210.
 Cockscomb elm gall, 303, 326.
 Coeles, Apatura, 317.
 Cocoon of *Apanteles congregatus*, 177.
 bag-moth caterpillar, 187.
 larch saw-fly, 165, 169.
 Microplitis mamestræ, 208.
 Sphingicampa, 199.
 Codling-moth, 300, 305, 321.
 Coleophora sp.? 324.
 Coleoptera, 227, 231, 234, 267, 268, 269, 271, 272.
 Colias Philodice, 285.
 Colopha ulmicola, 303.
 Colorado potato-beetle, 153, 289, 300.
 columba, Tremex, 305, 311.
 Colvin, Verplanck, on abundance of Geometrid larvæ, 260.
 Comstock [Prof. J. H.], cited, 153, 242, 262, 267, 269.
 concavum, *Platyphyllum*, 323.
 concinna, *Edemasia*, 169, 309, 324.
 confusor, *Monohammus*, 325.
 congregatus, *Apanteles*, 177, 307, 324.
 Conopid fly, 285.
 Conorhinus sanguisuga, 316.
 Conotrachelus nenuphar, 280, 316.
 conquisitor, *Pimpla*, 310.
 contrariana, *Pentbina*, 213.
 convergens, *Hippodamia*, 249-50, 257.
 convergent lady-bug, 257.
 Cook [Prof. A. J.], cited, 198, 234, 299, 307.
 copalina, *Orthaltica*, 271.
 Cope, Prof. [E. D.], referred to, 220.
 Coptocycla clavata, 322.
 Coquillett [D. W.], cited, 193, 207, 213, 214.
 Corimelæna pulicaria, 319.
 Corn cut-worm, 312.
 cornicola, *Hæmatobia*, 220, 223.
 Stomoxys, 220, 222, 308, 310.
 Corning, Erastus, cicada eggs planted in orchard of, 277.
 cornutus, *Corydalis*, 326.
Corydalis cornutus, 326.
 Cossinæ, 311.
 Cottony-cushion scale, 326.
 Counterodorants for repelling insects, 313, 319, 322.
 Cow-dung for insect attack, 159.
 Cow-horn fly, 220-227, 306, 307, 308, 310, 325.
 bibliography, 220, 223.
 described as a new species, 223.
 distribution, 226.
 enemies of, 225.
 fly figured, 224.
 Cow-horn fly — (*Continued*):
 habits, 221, 222, 225.
 horses and mules not attacked, 222.
 identified with European species, 222.
 injuries to cattle, 225.
 introduced in United States, 220.
 life-history, 224.
 occurrence in Europe, 220.
 preventives, 226.
 remedies, 226.
 sensational reports of, 220, 226.
 synonymy, 220.
 Crabonidæ on flowers, 284.
 Crachat de coucou (cuckoo-spittle), 245.
 Cramer cited, 174.
 crategi, *Conotrachelus*, 316.
 Creosote for insect attack 314.
 Crepidoteræ, 271.
 Cresson [E. T.], cited, 164, 173.
 Cressoni, *Urocercus*, 311.
 crispata, *Lagoa*, 186, 188.
 Crispell, Dr. C. W., insects from, 324, 326(2).
 cristata, *Cyanocitta*, 198.
 cristatus, *Prionatus*, 316.
 Croton bug eaten by *Cermatia*, 295.
 Crushing insects, 206, 209, 215, 219, 307, 309, 320.
 Cuckoo-spittle, 245.
 Cucumber flea-beetle, 271.
 Cucumber moth, 320.
 cucumeris, *Aphis*, 306, 326.
 Cecidomyia, 306.
 Epitrix, 271.
 cucurbitæ, *Melittia*, 153, 312, 313, 320.
 Currant-worm, 156, 300.
 Curtis [John], cited, 246, 250, 251, 253.
 Cut-worms, 206.
 publication on, 308, 318, 319.
 Cyanide of potassium for insect attack, 314.
Cyanocitta cristata, 198.
 Cybele, *Argynnis*, 285.
 Cynipidæ, 308.
- D.**
- Danaïs Archippus 285.
 Darapsa Myron, 174-179, 307, 324.
 Datana ministra, 169, 307.
 Death-watch, 323.
 decemlineata, *Doryphora*, 289.
 DeGeer on spittle-insects, 243.
Deilephila chamæneril, 175.
 lineata, 175.
 Derby, H. B., insects from, 324.
Dermanyssus avium, 290.
Dermestes lardarius, 302, 313.
 Deshaiesiana, *Carpocapea*, 315.
Desmocercus palliatus, 325.
 Destroying eggs for insect attack, 304.
 nests of caterpillars, 304.
 destructor, *Cecidomyia*, 263, 325.
 Desvoidy, Robineau, cited, 220, 223.
 Devereaux, W. L., insects from, 325.
Diabrotica vittata, 235, 312.

- Dicorca manca*, 286.
tuberculata, 286.
 Digging-out for insect attack, 156, 271, 312, 313, 319, 320.
 Dimmock (Dr. George), cited, 227.
 Dimmock, Mrs., cited, 193, 184.
Diplosis septemmaculata, 280.
 Diptera, 220, 262, 263, 264, 265.
 Dodd, W. H., on sulphur for elm-leaf beetle, 240, 300.
domesticus, *Acarus*, 292.
Doryphora decemlineata, 289.
 Dowd, A. F., Hessian-fly from, 263.
 Driving insects on tarred paper, 302.
Dryocampa rubicunda, 300.
 senatoria, 192.
 Dugés, M., on cord in Uropoda, 291.
 Duncan cited, 183.
 Dyar (H. G.) cited, 234.
Dynastes Grantii, 227, 321.
Dynastes Tityus, 227-231.
 bibliography, 227.
 description of beetle, 229.
 distribution, 230.
 feeding habits, 230.
 figure of male beetle, 229.
 food-plants, 230.
 offensive odor of, 228.
 popular names, 228.
 variation in, 229.
Dytiscus fasciventris, 325.
 Harrisii, 325.
- E.**
- Eacles imperialis*, 324.
Echinomyia sp. ?, 285.
Ecnomidea pitheciun, 183.
Ecpantheria Sennettii, 317.
Ecume printanière (spring-froth), 245.
 Egg-clusters of white-marked Tussock, 310.
 Egg-deposits of flower-cricket, 310.
 Eggs of *Agrotis saucia*, 210.
 Anisota senatoria, 193.
 cow-horn fly, 224, 225.
 elm-leaf beetle, 235.
 Eudryas grata, 182.
 katydid, 323.
 larch saw-fly, 165.
 Mamestra grandis, 211.
 Phobetrion pitheciun, 190, 191.
 Saperda candida, 269, 320, 325.
 Eggs on strawberries, 319.
 Egg-punctures of flower-cricket, 302.
 Eights, Dr. James, on abundance of a caterpillar, 196.
 Eight-spotted *Alypia*, 179, 300.
Elaphidion parallelum, 153, 268, 325.
 Elevation of Lake Pleasant, 160.
 of Long Lake, N. Y., 283.
 Ellwanger & Barry, insect attack from, 275.
 Elm-leaf beetle, 234-242, 301, 303, 314, 319, 322, 325.

- Elm-leaf beetle — (*Continued*):
 apparatus for spraying, 234, 240.
 appears in New York, 234, 240.
 beetle described, 235.
 bibliography, 234.
 boxing for, 242.
 double-brooded?, 238.
 early stages figured, 235.
 European reputation, 235.
 hibernation, 238.
 introduced in United States, 236.
 life-history, 237.
 operations on elms figured, 235.
 oviposition, 239.
 pupation, 239.
 ravages of, in Flushing, etc., 236.
 remedies, 239.
 sulphur remedy?, 240.
 Emmons (E.) cited, 231, 234.
Empretia stimulea, 186, 188.
 Enemies of larch saw-fly, 169.
Ephedrus flagiator, 253.
ephemeraformis, *Thyridopteryx*, 321.
Epitrix cucumeris, 271.
Erichsonii, *Nematus*, 164, 324, 325.
Eriocampa adumbrata, 323.
Erythroneura vitis, 302.
Euclea quereeti, 186.
Eudryas grata, 179-183.
 bibliography, 180.
 caterpillar described and figured, 182.
 description and figure of moth, 181.
 egg figured, 182.
 food-plants, 81, 82.
 rarity of, 182.
 remedies, 183.
 resemblance to other caterpillars, 180, 183.
Eudryas unio, 183.
Eumenes fraternus, 268.
Eumenidæ on flowers, 284.
Everyx Myron, 174.
 Experiment with 13-year Cicada, 276.
exusta, *Ceramica*, 206, 207.

F.

- Fabricius* cited, 179, 180, 227, 232, 234, 246, 260, 263.
 Falconer, Wm., on mushroom fly, 265.
 False chinch-bug, 321.
farina, *Acarus*, 292, 294.
fasciatus, *Ecanthus*, 310.
fasciventris, *Dytiscus*, 325.
Faunus, *Grapta*, 282, 317.
 Fear of caterpillars, 185.
Feniseca Tarquinius, 282, 317.
 Fernald (Prof. C. H.), cited, 213.
 Fernow, Berthold, insects from, 324(2), 325.
 Field Force Pump Company, 162.
fifteen-punctata, *Anatis*, 305.
Fifteen-spotted lady-bug, 305.
 Fig-eater, 319.

- Figure of *Agrotis saucia* moth, 204.
Alypia octomaculata, larva and moth, 181.
Anisopteryx vernata, 258.
Anisota senatoria, 195.
Anthreus scrophulariæ, 268.
Aphis mali, 161.
apple-leaf *Bucculatrix*, 260.
apple-root plant-louse, 160.
apple-tree aphid, 161.
Aspidiotus nerii, 278.
Bucculatrix pomifoliella, 260.
carpet-beetle, 268.
caterpillar of *Agrotis saucia*, 204.
caterpillar of *Anisota senatoria*, 195.
caterpillar of *Darapsa Myron*, 176.
caterpillar of *Eudryas grata*, 182.
caterpillar of *Mamestra picta*, 207.
caterpillar of spring canker-worm, 258.
cheese-mite, 292.
chicken-louse, 290.
Chilocorus bivulnerus, 267.
Chionaspis pinifolii, 266.
cocoon of apple-leaf *Bucculatrix*, 260.
cocoon of hag-moth, 188.
convergent lady-bug, 257.
cow-horn fly, 224.
Darapsa Myron moth, 179.
Dermanyssus avium, 290.
Dynastes Tityus beetle, 229.
eggs of *Agrotis saucia*, 201.
eggs of canker-worm moth, 258.
eggs of elm-leaf beetle, 235.
egg of *Eudryas grata*, 182.
eight-spotted Forester, 181.
elm-leaf beetle, 235.
Eudryas grata moth, 181.
four-lined leaf-bug, 274.
fungus-attacked *Phytonomus* larva, 273.
Galeruca xanthomckena, 235.
grain-aphid, 247.
grapevine hog caterpillar, 176.
green grapevine moth, 179.
Hæmatobia serrata fly, 224.
hag-moth, 189.
hag-moth caterpillar, 184.
Hessian-fly, 286.
Hippodamia convergens, 257.
ichneumonized *Darapsa Myron* larva, 179.
Incurvaria acerifoliella moth, 219.
Julus cæruleocinctus, 295.
larch saw-fly, 165.
larva of *Saperda candida*, 270.
Lygus pratensis, 275.
Mamestra grandis moth, 212.
Mamestra picta moth, 207.
maple-leaf cutter, operations of, 217.
Melittia cucurbitæ larva, 155.
Neorophorus tomentosus, 289.
Nematus Erichsonii, 165.
- Figures of insects—(Continued):
Oberea himaculata, 232.
operations of elm-leaf beetle, 235.
Penthina nimbata moth, 214.
Phobetron pithecium, 183-192, 306.
Phytonomus punctatus, 272.
pine-leaf scale-insect, 266.
Pœcilopsus lineatus, 274.
punctured clover-leaf weevil, 272.
raspberry cane-borer, 232.
red spider, 287.
rhinoceros beetle, 229.
rose-leaf tyer moth, 214.
round-headed apple-tree borer, 270.
Saperda candida, 270.
Schizoneura lanigera, 160.
Siphonophora avenæ, 247.
spring canker-worm, 258.
squash-vine borer, 155.
tarnished plant-bug, 275.
Tetranychus telarius, 287.
thousand-legged worm, 206.
tomentose sexton-beetle, 289.
twice-stabbed lady-bird, 267.
Tyroglyphus siro, 292.
white-scale insect, 278.
- Fish-fungus, 272.
Fish oil for repelling insects, 226.
Fisk, H. L., insects from, 325.
Fitch [Dr. A.], 184, 185(2), 192, 197(2), 215, 219, 227, 230(3), 234, 242, 246-254, 256(2), 268, 274, 280(2), 299, 300, 301, 326.
on apple-tree borer, 270.
on cherry-aphid, 254, 255, 257.
on grain-aphid, 252.
on larva of *Anisota senatoria*, 195.
on maple-leaf cutter, 218.
on sulphur for insects, 241.
Flaxseeds of Hessian fly, 263, 325.
Flea-beetle, striped, 301.
Fletcher (James), cited, 164, 216.
on maple-leaf cutter, 218.
Flies eaten by *Cermatia*, 296.
Flower cricket, egg-deposits of, 310.
Flower crickets, 302.
Flower-flies, 284.
Fly-fungus, 272.
Forbes, Prof. S. A., cited, 321.
ou food of *Cermatia*, 296.
forceps, *Cermatia*, 295.
Force-pumps, 161, 162.
Forest-flies, 245.
Forsyth, Judge, on cow-horn fly, 226.
Four-lined leaf-bug, 274.
fratorna, *Eumenes*, 268.
Parasa, 190.
French [Prof. G. H.], 193, 201, 207, 315.
Fresh-water mites, 290.
Frog-hoppers, 245.
Frog-spittle, 245.
fucata, *Sciara*, 265.
fugitiva, *Limneria*, 198.

- Fuller [A. S.], cited, 234.
 Fulleri, *Aramigus*, 154, 311, 325.
 Fuller's rose-beetle, 154, 311.
 Fungus killing insects, 273.
 Fungus on quince, 321.
 furcellata, *Physocophala*, 285.
 furfurus, *Chionaspis*, 300, 326.
 fusca, *Lachnosterus*, 154, 312, 315.
 Splomyia, 284.
 Fyles [T. W.], cited, 164, 218.

G.

- Galorua Calmarionis*, 234.
 xanthomelana, 234-242, 303, 319, 322, 326.
 Gall-mites, 290.
 Galls, 173, 308.
 Galls of *Glyphina ulmicola*, 303.
 Lasioptera vitis, 303, 304.
 maple-leaf mite, 303.
 Nematus salicis-pomum, 173.
 Phytoptus quadripes, 326.
 Gamasidae, 318.
Gamasus sp.?, 289.
 Garth, D. J., insects from, 325.
 Gas-lime for insect attack, 158, 160, 253, 313,
 319.
 Gas-tar for insect attack, 163, 299, 314.
 Geometridæ, 202, 258.
 Geometrid larvæ, abundance of, 259.
Geotrypes Tityus, 227.
 Giraudii, *Sciara*, 265.
 Glover [T.], cited, 192, 227, 231, 234, 236, 242, 245,
 246, 248, 252.
 on boxing for elm-leaf beetle, 242.
 on life-history of elm-leaf beetle, 237.
Glyphina ulmicola, 303, 326.
 Goff [E. S.], cited, 209, 273, 274.
 insects from, 325, 326.
 on saltpetre for cabbage-fly, 157.
 quoted, 155.
Gonia sp.?, 323.
 Goodrich, Miss A., mites from, 287.
 Gooseberry-worm, 156.
Gortyna nitela, 304, 324.
 Goulds Manufacturing Co.'s spraying
 pumps, 162.
 Graduating spray nozzle, 161.
 Grain aphid, 246-253.
 abundance in 1861, 249.
 bibliography, 246.
 description of, 247.
 different names, 250.
 endurance of cold, 252.
 figures of, 247.
 forms of, 247.
 incomplete life-history, 247.
 male unknown, 252.
 method of attack, 248.
 migration of, 251.
 parasites, 253.
 parasitized forms, 253.
 remedies, 253.

Grain aphid — (Continued):

- synonymy, 246.
 winter form, 252.
 Grain-weevil, 325.
 granaria, *Aphis*, 246.
 Calandra, 325.
 Nectarophora, 246.
 Siphonophora, 246.
 Grantii, *Dynastes*, 227.
 Grapevine bark-louse, 326.
 beetle, 229.
 Grapta, 285.
 Faunus, 282, 317.
 J-album, 282, 317.
 grata, *Bombyx*, 180.
 Eudryas, 180.
 Green grapevine Sphinx, *Darapsa Myron*,
 174-179.
 Apanteles parasito, 179.
 distribution, 176.
 generic changes, 174.
 injuries from, 176.
 larva described, 175.
 larva figured, 176.
 moth figured, 179.
 parasitized usually, 175, 177.
 prolonged larval stage, 176.
 pupation, 178.
 remedy, 174.
 synonymy, 174.
 Grey, William, reference to, 277.
 Grote [A. R.], cited, 174, 192, 199, 201, 207, 210.
Gryllotalpa longipennis, 326.
 Guano for insect attack, 158, 313.
 Guenée, cited, 200, 206, 210.
 Guérin-Mônevillle cited, 265.
 Guest-beetle, 173.

H.

- Hadona arctica*, 212.
Hæmatobia cornicola, 220, 223, 310, 325.
 Hagen, Dr. H. A., cited, 166.
 Hag-moth caterpillar, 183-192, 306.
 appendages of, 184, 188.
 bibliography, 183, 184.
 caterpillar described and figured, 184.
 cocoon described and figured, 188.
 degree of abundance, 186.
 eggs of, 190.
 flight of moths, 191.
 food-plants, 187.
 mating of moths, 191.
 mimicry in, 184.
 moths described and figured, 189.
 parasites, 192.
 premature spinning up, 187.
 stinging powers, 185, 186.
 synonymy, 183, 184.
 young stage, 190.
 Haldeman, cited, 231, 232.
Halesidota tessellaris, 308.
 Hall, Dr. J. W., insects from, 325.

- Hallowell Brass Company atomizer, 161.
 spraying nozzle, 161.
- Haltica bimarginata*, 170.
- Hand-picking, for insect attack, 179, 183, 209, 233, 300, 321.
- Harrington (W. H.), cited, 164.
- Harris (Dr. T. W.), cited, 174, 180(3), 183, 184(2), 186, 187, 192, 199, 200, 206, 231(2), 268, 299.
- Harrie on green grapevine caterpillar, 176.
- Harrisii, *Dytiscus*, 325.
- Harris, Mrs. Ira, myriapods from, 326.
- Hartig cited, 164.
- Harvest mites, 290.
- Harvey, Joseph, insects from, 325.
- Hayes, H. E., insects from, 326.
- Heavy oil for insect attack, 300.
- Hedges, C. H., insects from, 326.
- Hedya* sp. from black-knot, 280.
- Helligbrodti, *Anisota*, 199.
Sphingicampa, 199.
- Hellebore for insect attack, 157, 323.
- Hellgrammite fly, 326.
- Hemileuca Maia*, 186.
- Hemiptera, 242, 246, 263, 273, 275, 278.
- Hemiteles* sp.? 199.
- Henderson, Peter, on prevention of rose aphid, 162.
- Henshaw (Samuell), cited, 227, 232, 234.
- Hessian-fly, 263, 325.
 emergence from puparia, 264.
 figures, 286.
 flaxseeds, 263, 286.
 in New York in 1884, 263.
 preventives of, 264.
- Hill (W. W.), referred to, 212.
- Hippodamia convergens*, 249-60, 257.
- Hoagland, Mrs., insects from, 267, 325.
- Hoffman, John B., myriapods from, 326.
- Homohadena atrifasciata*, 285.
- Homoleta lividipennis*, 303.
- Homoptera lunata*, 316.
- Honey-comb eaten by *Dermestes*, 302.
- Honey-dew on hickory leaves, 304.
- Hop aphid, 153.
- hordei*, *Aphis*, 246, 257.
- hordei*, *Isosoma*, 315.
- Horn (Dr. G. H.), cited, 227, 232.
- Horn-fly, 306, 307, 308.
- Horn-tail, 311.
- horridus*, *Acarus*, 292.
- Hot water for insect attack, 183, 231, 287, 316.
- Howard (L. O.), cited, 220, 224, 227.
- Hubbard (H. G.), cited, 184, 186, 188,
 on the hag-moth caterpillar, 187.
- Hübner, cited, 174, 180, 192, 200.
- Hulst, Rev. Mr., on elm-leaf beetle, 238.
- Humming-bird moths, 309.
- Huntington, David, insects from, 325.
- Husted, S. B., insects from, 326.
- hyalinatalis*, *Phakellura*, 320.
- hyalipennis*, *Sciara*, 265.
- Hydrachnidæ*, 290.
- Hymenoptera, 164, 173.
- Hyperchiria*.Io, 186.
- I.
- Icerya Purchasi*, 326.
- Ichneumonidæ* on flowers, 284.
- Ichneumonized* caterpillars, 175.
- Identical American and European insects,
 206, 222, 234, 247, 264, 267, 319.
- imperialis*, *Eacles*, 324.
- Incurvaria acerifoliella*, 216-219.
iridella, 216.
- incurvus*, *Tachus*, 303.
- inermis*, *Agrotis*, 200, 201.
- innumerabilis*, *Lecanium*, 313.
Pulvinaria, 326.
- Insect friends and foes, 178.
- Insects received from New York localities:
 Adirondaeks, 281-286.
 Albany, 265(2), 267, 289, 324(3), 325(4), 326.
 Batavia, 312.
 Bath, 187.
 Bayport, 325.
 Bayville, 324.
 Bellport, 268, 325.
 Bethlehem, 261.
 Blauvelt, 326.
 Branchport, 325.
 Brooklyn, 324.
 Buffalo, 296, 326.
 Canajoharie, 324.
 Canandaigua, 312.
 Center, 193, 210.
 Cherry Valley, 167, 170, 324, 325.
 Clyde, 326.
 Coeymans, 326.
 DeKalb Junction, 167.
 Delmar, 304.
 East Avon, 312.
 Essex county, 281.
 Geneva, 272, 273, 325, 326.
 Ghent, 207.
 Glen Cove, 265.
 Hammond, 281.
 Jefferson county, 154.
 Karner, 193, 210.
 Kingston, 324, 326(2).
 Lake Grove, 326.
 Lockport, 325.
 Long Lake, 283.
 Loudonville, 259, 296, 326.
 Lyons, 261.
 Lyons Falls, 154.
 Malcolm, 260, 317.
 Middleburgh, 281.
 Middlehope, 326.
 New Windsor, 191, 192.
 New York, 291, 307, 324, 326.
 North Huron, 263.
 Orleans county, 262.
 Peekskill, 324.

Insects received from New York localities—

(Continued):

Phoenix, 313.
 Pleasantville, 258.
 Port Jervis, 303, 305.
 Potsdam, 232.
 Poundridge, 258.
 Rochester, 154, 206, 275, 308, 324, 325, 326.
 Sageville, 170.
 Saratoga Springs, 325.
 Scarsdale, 213, 303, 325.
 Sea Cliff, 325.
 Somerset, 325.
 Suffolk county, 303.
 Troy, 324.
 Utica, 287, 321, 325.
 Waterloo, 261.
 Waterville, 326.
 Watervliet, 278, 317.
 Wayne county, 258.
 West Albany, 173, 243.
 Westchester county, 313, 320.
 West Farms, 239.

Insects received from various localities:

Alken, S. O., 317.
 Annapolis, Md., 318.
 Auburn, Mass., 306.
 Augusta, Ga., 311.
 Bordentown, N. J., 322.
 Buckner's Station, Va., 306.
 Cape May, N. J., 326.
 Carp, Tenn., 320.
 Centralia, Kans., 201.
 Charlottesville, Va., 303, 305, 326.
 Charlton, Mass., 321.
 Clarksburg, W. Va., 304.
 Coffee, Va., 321.
 Colon, Cent. Amer., 325.
 Crozet, Va., 316.
 Engleville, O., 310.
 Edinburg, Scotland, 323.
 Elizabeth, N. J., 326.
 Erie, Pa., 314.
 Franklin Park, N. J., 321.
 Furnace, Mass., 321.
 Hightstown, N. J., 305, 325.
 Hopkinsville, Ky., 311.
 Kennett Square, Pa., 221, 307.
 Kingston, R. I., 308, 324.
 LaFayette, Ind., 325.
 Lexington, Va., 323.
 Los Angeles, Cal., 326.
 Lowell, Mass., 306, 326.
 Madison, N. J., 315, 319.
 Middlesex, Mass., 289, 318.
 Mount Holly, N. J., 325.
 Natchez, Miss., 316.
 Norfolk, Va., 305.
 Orange, N. J., 324, 325.
 Oxford, Miss., 277.
 Perrowville, Va., 227.
 Perth Amboy, N. J., 311.

Insects received from various localities—

(Continued):

Philadelphia, Pa., 315.
 Pittsford, Va., 216.
 Rock Hall, Md., 304, 324.
 Salom, N. J., 310.
 Stamford, Conn., 311.
 St. Catharines, Ont., 326.
 Toledo, O., 325.
 Wabash, Ind., 307, 324.
 Warren, O., 323.
 West Newton, Pa., 303.
 West Stockbridge, Mass., 315, 319.
 Winsted, Conn., 323.
 Worcester, Mass., 304, 325.
 Insolita, Sphlux, 317.
 Introduced insects, 222, 234, 247, 254, 267, 319.
 Io, Hyperbirla, 180.
 Iridella, Tinea, 216.
 Irritans, Lyperosia, 223.
 Isosoma hordei, 315.
 tritici, 315.
 Itch-mites, 290.
 Ixodidae, 290.

J.

Jack [John J.], cited, 164.
 J-album, Grapta, 282, 317.
 Johnson, C. Fred., insects from, 325.
 Johnson [L. C.], cited, 227.
 Joslin, E. Dayton, insects from, 326.
 Julius attacked by insects, 311.
 Julus caruleocinctus, 307, 328.
 beneath carpets, 296.
 Jumping seeds, 315.
 Jumping sumach beetle, 271.
 Junkins, E. W., on Saperda oviposition, 269.

K.

kalmia, Sphinx, 177.
 Kaltenbach cited, 246, 251, 252.
 Kellicott [D. W.], cited, 299.
 Kerosene emulsion for insect attack, 162, 256, 262, 263, 279, 288, 301, 302, 313, 314, 317, 319, 321, 322.
 formula for, 161, 262, 279.
 Kerosene for insect attack, 160, 226, 300, 313, 321.
 Kirby cited, 246, 250.
 Kirby's description of Aphis avenae, 250.
 Knickerbocker, D. M., canker-worms from, 259.
 Kowarz, F., identification of cow-horn fly, 223.
 Kricogonia Lanice, 317.
 Kyber [J. F.], cited, 246, 251, 252.

L.

Lachnosterna fusca, 154, 312, 315.
 Lachnus caryae, 304.
 lactis, Acarus, 292.
 Lady-bird, twice stabbed, 267.

PROPERTY OF
Z. P. METCALF

- Lady-bug attack on scale-insects, 256.
 Lady-bug, 15-spotted, 305.
 Lady-bugs, 249, 254, 257, 300.
Lagoa crispata, 185, 188.
 Lake Pleasant, larch saw-fly at, 169.
 Lanice, *Kricogonia*, 317.
lanigera, *Schizoneura*, 160.
 Larch saw-fly, 164-173.
 appearance in United States, 166.
 bibliography, 164.
 cocoon, 169.
 disparity of sexes, 171.
 enemies, 169, 170.
 European injuries, 166.
 figure of, 165.
 food-plants, 165.
 in Canada, 172.
 Lake Pleasant region, 168.
 Otsego county, 187.
 Schoharie county, 168.
 St. Lawrence county, 167.
 injuries, extent of, 171.
 introduced from Europe, 184.
 larvæ difficult to rear, 170.
 life-history, 165.
 migration, 187, 168.
 New England distribution, 166.
 New York distribution, 165.
 parasites, 169, 170.
 probable range, 171.
 remedies, 171.
lardarius, *Dermestes*, 302, 313.
 Lasell, Mrs. E. W. K., insects from, 324, 325.
Lasioptera vitis, 304, 325.
 Late planting for insect attack, 300.
latipennis, *Ceanthus*, 312.
 Latreille cited, 179.
 on *Sciara*, 264.
 Leaf-hopper, 302.
 Leaf-miner, 322.
 Leaf-mite, 303.
 Le Baron [Dr. Wm.], cited, 227.
Lecanium innumerabile, 313.
 LeConte [Dr. J. L.], cited, 231, 232, 234.
legumficola, *Cecidomyia*, 262.
Lepidoptera, 174, 179, 183, 192, 200, 206, 210, 213,
 215, 258, 259, 280.
Leptura scalaris, 285.
Lepyronia, 245.
leucopterus, *Blissus*, 317.
leucostigma, *Orgyia*, 310, 317, 321.
 Lewis, P. C., spraying force-pump, 162.
 Light-loving grapevine beetle, 305.
Limacodes pithecium, 183.
 Lime for insects, 157, 158, 160, 163, 227, 299, 305.
 Lime wash for insect attack, 163.
 Lime water for insects, 307.
liminaris, *Phlæotribus*, 319, 325.
Limneria fugitiva, 198.
Limothrips poaphagus, 153.
lineata, *Deilephila*, 175.
lineatus, *Pœcilocapsus*, 273.
lineatus, *Ptyelus*, 245.
lineolaris, *Lygus*, 275.
 Linnæus, cited, 227, 231, 232, 234, 246, 250, 263.
 Linsley, D. M., on clover-seed midge, 262.
lividipennis, *Homolota*, 303.
 Lockwood [Rev. Samuel], cited, 234.
 Locust visitation, 318.
 Loew, Dr., referred to, 282.
 London purple for insect attack, 162, 200,
 219, 240, 301, 304, 312, 313.
longipennis, *Gryllotalpa*, 326.
longipes, *Sciara*, 265.
lucicola, *Anomala*, 305, 325.
 Luna, *Actias*, 188.
lunata, *Homoptera*, 315.
 Lunated long-sting, 311.
lunator, *Thalassia*, 305.
 Tremex, 311.
lutescens, *Aulacomeris*, 171.
Lycæna pseudargiolus, 285.
 Lye for insect attack, 163, 299, 320.
Lygus lineolaris, 275.
 pratensis, 275, 326.
 Lyman, Geo. T., insects from, 268, 325.
Lyperosia irritans, 223.
 serrata, 220.
- M.**
- Macquart, cited, 220.
Macrobasis unicolor, 305, 321.
Macrodactylus subspinosus, 154.
Macrosila quinquemaculata, 179.
maculata, *Sesia* 8, 179.
 Vespa, 285.
 Zygæna 8, 179.
 Maia, *Hemileuca*, 188.
mali, *Aphis*, 161.
 Sciara, 255.
Mamestra grandis, 210-213.
 bibliography, 210.
 distribution, 212.
 eggs, 211.
 larval habits, 211.
 life-history, 211, 212.
 moth figured, 212.
 poplar feeding, 210.
 pupation, 212.
 stages of larva, 211.
Mamestra picta, 206-210.
 bibliography, 207.
 double-brooded, 208.
 experiment with pyrethrum, 209.
 figures, 207.
 food-plants, 209.
 parasitic attack, 208.
 remedies, 209.
 transformations, 208.
 young larva, 207.
Mamestra trifolii, 323.
mamestræ, *Microplitis*, 208.
manca, *Dicercæ*, 286.
 Maple-leaf cutter, 215-219.

- Maple-leaf cutter — (*Continued*):
 bibliography, 215, 216.
 history of, 218.
 leaf-cases of, 216.
 moth described and figured, 219.
 operations on maple leaf, 217.
 ravages in New York, 218.
 Ontario, 219.
 Quebec, 218.
 Vermont, 218.
 remedies, 219.
 synonymy, 215, 216.
- Maple-leaf mite-gall, 303.
- Maple-tree scale insect, 313.
- marginatus, *Chauliognathus*, 316.
- Marshall, Miss L. A., on food of *Cermatia*, 295.
- Marten [John], cited, 201.
- Mating of *Anisota senatoria*, 193.
- May-beetle, 308.
- May-flies, 319.
- Measuring worms, 260.
- Melanolestes abdominalis*, 316.
picipes, 318.
- Melittia cucurbitæ*, 155, 312, 313, 320.
- Melon plant-louse, 306, 326.
- Melshelmer, Dr., cited, 179, 180.
- Merula migratoria*, 198.
- Mesko [O.], referred to, 212.
- Microcentrum retinervum*, 323, 326.
- Microgaster coecoonis*, 177.
- Microgaster* sp.? 170.
- Microplitis mamestræ*, 208.
migratoria, *Merula*, 198.
- Milbertil, Vanessa, 285.
- Milliere, cited, 205.
- Mimicry in hag-moth caterpillar, 184.
- ministra, *Datana*, 160, 307, 324.
- Mites, abundance in pork packing-house, 222.
 carbolic acid for, 293.
 catalogue of, 289.
 families of, 290.
 feeding habits of, 288.
 infesting flour, 294.
 in maple-leaf galls, 303.
 on canary birds, 290.
 on chickens, 290.
 on Colorado potato-beetle, 289.
 on garden plants, 287.
 on sexton beetle, 289.
 on smoked meats, 291.
 remedies for, 288.
 webs of, 288.
- modestus*, *Podisus*, 170.
- molestum*, *Simulium*, 283, 317.
- Monohammus confusor*, 325.
- morhosa*, *Plowrightia*, 280, 320.
Sphæria, 280, 320.
- Morris [Dr. J. G.], cited, 184, 192.
- Morrison [H. K.], cited, 201.
- Morton, Miss E. L., on *Phobetrox*: *Egge*, 190; flight, 190; food-plants, 187; habits, 190, 191; larvæ, 190; male moth, 182; parasites, 192; stinging powers, 188.
mortuorum, *Plusia*, 285.
- Mosquitoes, 319.
- Murray [Andrew], on mites, cited, 292.
- Murrell, G. E., on *Dynastes Tityus*, 230.
- Murrell, J. W., on spotted horn-bug, 230.
- Muscidæ from cow-droppings, 225.
- Museum pest, 268.
- Mushrooms infested by flies, 265.
- Mustard crop for repelling insects, 317.
- Mycetophilidæ*, 264.
- Myops*, *Alaus*, 317.
- Myriopoda*, 251, 296.
- Myron, *Ampelophaga*, 174.
Darapsa, 174-179, 301, 324.
Everyx, 174.
Otus, 174.
Sphinx, 174.
- Mytilaspis pomicorticis*, 319.
pomorum, 319.
- Myzue cerasi*, 253-257.
- Myzue persicæ*, 256, 315.

N.

- Necrophorus tomentosus*, 282.
- Nectarophora granaria*, 246.
- Nematus Erichsonii*, 164-173, 324, 352.
salscis-pomum, 173.
ventricosus, 156.
- nemphar*, *Conotrachelus*, 280.
- Nephele*, *Satyus*, 285.
- nerli*, *Aspidiotus*, 278, 317.
- nervosa*, *Sciara*, 265.
- Netting to prevent insect attack, 313.
- Neuroptera at Long Lake, 286.
- Neuroterus verrucarum*, 308, 324.
- Night soil for repelling insects, 159.
- nimbataana*, *Antithesia*, 213.
Penthina, 213-215.
- Nisoniades*, 285.
- nitela*, *Gortyna*, 304, 324.
- nitida*, *Allorhina*, 319.
- nitidalis*, *Phakellura*, 320.
- Nitrate of potash for insect attack, 157.
- nivens*, *Ceanthus*, 302, 310, 312, 326.
- Nixon climax nozzle, 161, 301.
- Noctua saucia*, 200.
- Noctuidæ, 200, 206, 210.
- Norton [Edward], cited, 173.
- Nozzles for force-pumps, 161, 239.
- Nysius angustatus*, 321.

O.

- Oak galls, 308.
- Oak-pruner, 153, 268.
- Oak-tree pruner, 325.
- Oberea basillis*, 231, 232.
bimaculata, 231-233.

- Oherea perspicillata*, 231, 232.
 Schaumii, 233.
 tripunctata, 231, 232.
Oberndorf, Jr., A., on cut-worm eggs, 201.
obesus, *Scolytus*, 300.
obtusa, *Cercopis*, 242.
 Clastoptera, 242.
octomaculata, *Agarista*, 179.
 Alypia, 179-183.
 Sphinx, 179.
oculatus, *Alaus*, 317, 325.
Ɔecanthus fasciatus, 310.
Ɔecanthus latipennis, 312.
Ɔecanthus niveus, 302, 310, 312, 326.
Ɔedemasia concinna, 169, 309, 324.
Oestland [O. W.], cited, 246, 251, 262.
Olivier cited, 231, 232, 234.
Onion maggot, 319.
Orgyia leucostigma, 310, 317, 321.
Oribatida, 290.
Ormcrod [Miss E. A.], cited, 246.
 on fruit insects, 162.
Ornix acerifoliella, 215, 216, 218.
Orthaltica copalina, 271.
Ortoni, *Agrotis*, 201.
Osborne, A. O., insects from, 326.
Osborn, Prof. H., on mites, 288, 289.
Osten Sacken [Baron], cited, 282, 307, 309.
 on *Sciara*, 256.
 on the cow-horn fly, 222.
Otus Cnotus, 174.
 Myron, 174.
Oviposition of elm-tree beetle, 239.
 Ɔecanthus latipennis, 312.
 peach-borer moth, 299.
 Saperda candida, 269.
Owl beetle, 317.
Oyster-shell lime for insect attack, 158.
- P.**
- Packard [Dr. A. S.]*, cited, 164, 184, 192, 207, 216,
 218, 234, 246, 299.
 on larch saw-fly, 165, 166.
palliatus, *Desmocerus*, 325.
Palmer, W. J., insects from, 325.
 quoted, 154.
Pamphila, 286.
pampinatrix, *Chorocampa*, 174.
 Sphinx, 174.
Pandorus, *Philampelus*, 175, 177.
 parallela, *Aphrophora*, 245.
 parallelum, *Elaphidion*, 153, 268, 325.
Parasa Chloris, 186.
 fraterna, 190.
Parasite of Col. potato-beetle, 289, 318,
 of *Darapsa Myrou*, 177.
 Mamestra picta, 208.
 (?) *Mamestra trifolii*, 323.
 Orgyia leucostigma, 310.
 Philampelus Pandorus, 177.
 Sphinx kalmiæ, 177.
 Parasite of Thyreus Abbotii, 177.
 Tremex columba, 311.
Parasites of Anisota senatoria, 198.
 grain-aphis, 249, 253.
 larch saw-fly, 169.
 Phobetron pitheciun, 192.
Parasitic mites, 290.
Parasitism, interesting case of, 307.
Paris green for insect attack, 165, 162, 262,
 301, 305, 317, 319, 320, 321.
Passerini on grain-aphis, 262.
Peach and cherry borers, 319.
Peach-root aphis, 315.
Peach-tree borer, 299, 300.
Pear-blight beetle, 318.
Pea-weevil, 300.
Peck, Prof. C. H., cited, 166, 272.
 on black-knot, 281.
pecuarum, *Simulium*, 314.
Pelidnota punctata, 229, 310, 312, 326.
pellucida, *Anisota*, 199.
Pennsylvanicus, *Chauliognathus*, 316.
Pentagonia vittigera, 286.
Penthina contrariana, 213.
 nimbatana, 213-215.
Peridroma saucia, 200.
persica, *Myzus*, 266, 315.
personatus, *Reduvius*, 316.
perspicillata, *Oherea*, 231, 232.
Pests of the Pomologist, 299.
Phakellura hyalinatalis, 320.
 nitidalis, 320.
Phalæna pitheciun, 183.
 senatoria, 192.
Philænus spumaria, 345.
Philampelus achemon, 175.
 Pandorus, 176, 177.
Philodice, *Colias*, 285.
Phlæotribus liminaris, 319, 326.
Phobetron pitheciun, 183-192, 306.
Phobetrum pitheciun, 184.
Phorbia ceparum, 319.
Phyllotreta vittata, 301.
Phylloxera in France, 241.
Physocephala fureillata, 285.
Phytonomus punctatus, 272, 312.
Phytoptidæ, 290.
Phytoptus quadripes, 303, 326.
 picipes, *Melanolestes*, 316.
Pickle-worm, 320.
 picta, *Mamestra*, 206-210.
 pictipes, *Ægeria*, 280.
 Pieris rapæ, 285, 300.
Pig-manure for repelling insects, 301.
Pig-sty drainage for repelling insects
 301.
Pimpla couquisitor, 310.
Pimpla sp.? from Nematus, 170.
 pinifolli, *Chionaspis*, 266.
 pitheciun, *Ecnomidea*, 183.
 Limacodes, 183.
 Phalæna, 183.

- pitheclium, Phobotron, 183-192, 306.
 Phobetrum, 184.
 plaglator, Ephedrus, 253.
 Plant-bug eggs on strawberries, 319.
 Plant-bugs, 170.
 Plant-lice, how to kill, 302.
 on elms, 319.
 on melons, 306.
 on peach-tree roots, 315.
 Plaster for insect attack, 301, 305.
 Platyphyllum concavum, 323.
 Plowing and harrowing for insect attack, 319.
 Plowing under for insect attack, 156, 206, 312.
 Plowrightia morbosa, 280, 320.
 Plum curculio, 280, 300, 325.
 Plusia mortuorum, 285.
 poophagus, Limothrips, 153.
 Podilus modestus, 170.
 Pœllocapsus lineatus, 273.
 Poisoned bait for insects, 206.
 Polystochotes punctatus, 286.
 pomicorticis, Mytilaspis, 319.
 pomifoliella, Bucculatrix, 260, 317.
 pomonella, Carpocapsa, 316.
 Trypeta, 300.
 pomorum, Mytilaspis, 319.
 Pomroy, Norman, insects from, 325.
 Poplar-feeding cut-worm, 210.
 Poplar saw-fly, 171.
 Potash for insect attack, 163, 299.
 Potato-beetle, 320.
 Potato-bug parasite, 318.
 Potato-worm, 309.
 Powell, Geo. T., insects from, 207, 325.
 Praon avenaphis, 253.
 pratensis, Lygus, 275.
 Preventive of Anisopteryx venata, 259.
 Anomala lucicola, 305.
 apple-tree borer, 163.
 apple-tree tent caterpillar, 304.
 ash-gray blister-beetle, 305.
 bacon-beetle, 313.
 beet-leaf miner, 322.
 cabbage-fly, 157, 158, 159.
 canker-worm, 253.
 cherry-aphis, 256.
 cow-horn fly, 226, 227.
 cucumber-beetle, 159.
 cut-worms, 157, 159.
 Dermestes lardarius, 313.
 grape-leaf galls, 304.
 Isosoma hordel, 315.
 joint-worm fly, 315.
 larder beetle, 313.
 onion-maggot, 157, 159, 319.
 peach-tree borer, 163.
 radish maggot, 157, 159.
 rose-aphis, 162.
 round-headed apple-tree borer, 270.
 squash-vine borer, 313.
 Preventive of striped flea-beetle, 301.
 white grub, 317.
 woolly-aphis, 160.
 Preventives of insect attack:
 ashes, 301.
 beans for cucumber-beetle, 159.
 bisulphide of carbon, 313.
 buckwheat crop for white grub, 317.
 burdock infusion, 158.
 burning, 304, 322.
 coal-tar, 155, 301.
 countorodants, 313, 319, 322.
 cow-dung, 159.
 destroying caterpillar nests, 304.
 destroying eggs, 304.
 fish-oil, 226.
 gas-lime, 158, 160.
 guano, 158.
 hellebore, 159.
 kerosene, 226.
 lime, 301, 305.
 mustard crop for white grub, 317.
 night-soil, 159.
 netting, 313.
 oyster-shell lime, 158.
 pig-manure, 301.
 pig-sty drainage, 301.
 plaster, 301, 305.
 printers'-ink bands, 259.
 road dust, 305, 320.
 rotation of crops, 315, 319.
 salt, 317.
 sulphur, 157.
 sheep dip, 226.
 snuff, 301.
 soap-wash, 270.
 soluble phenyle, 226.
 soot, 159, 301.
 sulphur, 301.
 tallow and carbolic acid, 226.
 tansy decoction, 159.
 tar, 220, 226.
 tarred bands, 259.
 tar-water, 301.
 Printers'-ink bands for insect attack, 259.
 Prionotus cristatus, 316.
 Priophora serrata, 220, 223.
 Probing for apple-tree borer, 320.
 Promethea, Callosamia, 324.
 Proteus, Clastoptera, 245.
 Provancher [l'Abbé], cited, 164, 232, 242, 253.
 on the larch, 172.
 Prunus Americana, 281, 320.
 cerasus, 281, 320.
 domestica, 281, 320.
 maratima, 281.
 Pennsylvanica, 281, 320.
 serotina, 281, 320.
 Virginiana, 281, 320.
 pseudargiolus, Lycæna, 285.
 Paocidæ, 323.

Ptyelus lineatus, 246.
Ptyelicaria, *Corlimelæna*, 319.
Sciara, 265.
pulsatoria, *Clothilla*, 323.
Pulvinaria innumerabilis, 326.
punctata, *Pelidnota*, 229, 310, 312, 325.
punctatus, *Phytonomus*, 272.
Polystæchotes, 286.
Punctured clover-leaf weevil, 312.
Purchasi, *Icerya*, 326.
Pyrameis Atalanta, 285.
Pyrethrum for insect attack, 209, 301, 306, 321.
pyri, *Sciara*, 265.

Q.

quadrangularis, *Aphrophora*, 246.
quadrinota, *Aphrophora*, 246.
quadripes, *Phytoptus*, 303, 326.
Quassia for insect attack, 288, 307, 322.
quercei, *Eulca*, 186.
Quince curculio, 316.
quinquelineata, *Sciara*, 265.
quinquemaculata, *Macrosila*, 179.
Sphinx, 309.

R.

Railroad train stopped by caterpillars, 196.
rapæ, *Pleris*, 285, 300.
Raspberry-cane girdler, 231-233.
 bibliography, 231, 232.
 cane-girdling, 233.
 description of beetle, 232.
 figure of beetle, 232.
 food-plants, 233.
 life-history, 233.
 remedy, 233.
 synonymy, 231, 232.
Rathvon [S. S.], cited, 234.
Ratzburg, cited, 164, 165.
Reddy, E. J., insects from, 324.
Red-humped apple-tree caterpillar, 309.
Red spider, 287, 321.
Reduviidæ, 316.
Reduvius personatus, 316.
Reed [E. B.], cited, 216, 219.
regalis, *Citheronia*, 324.
Regal walnut-moth, 324.
Remedies for insect attack:
 Ammoniacal liquors, 168.
 Arsenites, 231, 239, 314, 320, 321, 322.
 Ashes and sulphur, 315.
 Autumn plowing, 313.
 Beating from foliage, 231.
 Benzine, 314.
 Bisulphide of carbon, 266, 300, 315.
 Boxing for elm-leaf beetle, 314.
 Brine, 166.
 Buckwheat crop, 310.
 Burdock infusion, 168.
 Burning, 164, 303(2), 308, 310, 314, 316, 317, 318.

Remedies for insect attack — (*Continued*):
 Camphor, 300.
 Carbolic acid, 293, 314.
 Chickens, 301.
 Creosote, 314.
 Crushing, 206, 209, 216, 219, 307, 309, 320.
 Cyanide of potassium, 314.
 Digging-out, 156, 271, 312, 313, 319, 320.
 Driving on tarred paper, 302.
 Feeding stock, 219.
 Fungus, 273.
 Gas-lime, 153, 253, 313, 319.
 Gas-tar, 163, 299, 314.
 Guano, 313.
 Hand-picking, 179, 183, 209, 233, 300, 321.
 Heavy oil, 300.
 Hellebore, 323.
 Hot water, 183, 231, 287, 315.
 Kerosene, 160, 300, 303, 321.
 Kerosene emulsion, 161, 266, 262, 263, 279, 288, 301, 302, 313, 314, 317, 319, 321, 322.
 Late planting, 300.
 Lime, 157, 168, 160, 163, 227, 239.
 Lime-wash, 163.
 Lime-water, 307.
 London purple, 162, 200, 219, 240, 301, 304, 312, 313, 322.
 Lye, 163, 299, 320.
 Mustard crop, 310.
 Nitrate of potash, 157.
 Paris green, 155, 162, 262, 301, 305, 317, 319, 320, 321.
 Plowing and harrowing, 319.
 Plowing under, 156, 206, 312.
 Poisoned halts, 206.
 Potash, 163, 299.
 Probing for apple-tree borer, 320.
 Pyrethrum powder, 209, 301, 321.
 Pyrethrum spraying, 306.
 Quassia, 288, 307, 322.
 Rolling, 206, 264, 312.
 Salt, 253, 316.
 Saltpetre, 157, 313.
 Scraping (bark-lice), 319.
 Shaking from foliage, 172, 183, 262, 314, 317, 320, 321.
 Soap and carbolic acid wash, 301.
 Soap and sulphur, 288, 322.
 Soap-suds, 161, 256, 275, 287, 302.
 Soap wash, 160, 270, 279, 317, 320.
 Soft soap, 163.
 Soluble phenyle, 316.
 Soot, 253, 307.
 Spraying, 161, 172, 200, 219, 239, 240, 266, 269, 301, 302, 306, 319.
 Starvation, 310, 316.
 Sulphur fumigation, 314.
 Tansy decoction, 159.
 Tarred hands, 313, 318.
 Toads, 301.
 Tobacco, 160, 161.
 Tobacco water, 266, 301, 302, 303.

Remedies for insect attack — (Continued):

- Tronching, 200.
 Vaporized tobacco-juice, 302.
 Whale-oil soap, 163, 313.
 Working the ground, 259.
- Remedy for *Anisota senatoria*, 200.
 apple-tree aphid, 160, 302.
 apple-tree bark-louse, 319.
 apple-leaf Bucculatrix, 202, 317.
 ash-gray blister-beetle, 305.
Aspidotus nerii, 317.
 bag-worm, 321.
 bark-lice, 163.
 cabbage-fly, 157, 158.
 carpet-beetle, 314.
 cherry-aphid, 256.
 clover-seed midge, 263.
 cow-horn fly, 227.
 cucumber moth, 320.
 currant-worm, 156.
Dynastes Tityus, 231.
 eight-spotted Alydidae, 183.
 elm-leaf beetle, 239, 300, 301, 314.
Eriocampa saw-fly, 323.
Eudryas grata, 183.
 false chinch-bug, 321.
 gooseberry-worm, 156.
 grain-aphid, 253.
 grapevine leaf-hopper, 302.
 green grapevine caterpillar, 179.
 Hessian-fly, 263.
Isosoma hordei, 315.
 lady-bugs, 257.
 larch saw-fly, 172.
Mamestra picta, 209.
 maple-leaf cutter, 219.
 maple-leaf gall-mite, 303.
 maple-tree scale-insect, 313.
 mites, 287, 288, 293.
 oak-pruner, 154.
Oberia bimaculata, 233.
Edemasia concinna, 309.
 onion-worm, 159.
 peach-root aphid, 315.
 pear-blight beetle, 318.
 pea-weevil, 300.
Phakellura nitidalis, 320.
 raspberry-cane girdler, 233.
 red-humped apple-tree caterpillar, 309.
 red spider, 322.
 rose-bug, 320.
 rose-leaf tyer, 215.
 round-headed apple-tree borer, 271, 320.
 scale-insects, 163, 279, 299, 317.
 spotted horn-bug, 231.
 spring canker-worm, 303, 318.
 squash-vine borer, 155, 313.
 strawberry insects, 156.
 striped flea-beetle, 301.
 thousand-legged worms, 307.
 white-grub, 159, 316, 317.
 wire-worms, 310.

- Remedy for woolly-aphid, 160.
Xyleborus pyri, 318.
 yellow-necked apple-tree caterpillar, 307.
 retinorvum, *Microcentrum*, 323, 326.
Rhinoceros beetle, 228, 321.
 rhols, *Blapharida*, 271.
 Richardson, M. T., insects from, 324.
 Richmond, A. J., insects from, 324.
 Riley-Monell, cited, 246.
 Riley (Prof. C. V.), cited, 180(2), 183-185, 197(2), 200, 205, 207, 209, 227, 232-234, 239, 256, 257, 271, 290, 292, 311, 314, 322.
 on apple-tree borer, 270.
 on black-knot, 280.
 on lady-bugs for killing plant-lice, 257.
 on 13-year cicada, 276-278.
- Rio Grande Lepidoptera, paper on, 317.
 Road-dust for repelling insects, 305, 320.
 Robin eats *Anisota senatoria*, 198.
 Robinson, Prof. W. T., insects from, 326.
 Rondani cited, 220, 223.
 rosaceana, *Coccinea*, 213.
 Rose aphids, 162.
 Rose-bug, 154, 320.
 Rose-leaf Tyer, 213-215.
 bibliography, 213.
 caterpillar described, 213.
 double-brooded, 215.
 food-habits, 214.
 infesting a green-house, 213.
 life-history, 214, 215.
 moth figured, 214.
 remedies, 215.
- Rotation of crops for insect attack, 315, 319.
 Rouast, M., cited, 205.
 Round-headed apple-tree borer, 269, 320.
 rubicunda, *Anisota*, 197, 198, 200.
 Dryocampa, 200.
 rugulosus, *Scolytus*, 300, 319.
 Rumsey & Co.'s spraying force-pumps, 162.
 Russell, Dr. S. A., insects from, 289.

S.

- Sabin, Dr. R. H., insects from, 324.
 sacchari, *Tyroglyphus*, 294.
 Sageville, N. Y., collections at, 170.
 salicis-pomum, *Nomatus*, 173.
 Salt for insect attack, 253, 316, 317.
 saltitans, *Carpocapsa*, 315.
 Saltpetre for insect attack, 151, 157, 313.
 sanguisuga, *Conorhinus*, 316.
 Saperda affinis, 231.
 bimaculata, 231.
 candida, 269, 320, 325.
 tripunctata, 231.
 Sarcopitidae, 290.
 Sargent, Prof. C. S., larch saw-fly from, 166.
 on the larch, 171, 172.
 Satyrus Nephelæ, 285.

- saucia, *Agrotis*, 200-206.
 Saunders [Wm.], cited, 164, 180(2), 184, 231, 253, 299.
 Saw-fly on fruit trees, 323.
 Say [Dr. Thomas], cited, 227, 242, 245.
 scalaris, *Bellamira*, 285.
 Leptura, 285.
 Scale-insect, maple-tree, 313.
 on ivy, 317.
 on pine, 256.
 Scale-insects, 300.
 destroyed by a lady-bug, 266.
 Scarabæidæ, 227.
 Scarabæus *Tityus*, 227.
 Schaumii, *Oberea*, 233.
 Schizoneura *Americana*, 319.
 Schizoneura *lanigera*, 160.
 Schmitz, H. C., on squash-vine borer, 155.
 Schrank, cited, 234.
 Schwarz [E. A.], cited, 233.
 Sciara *fucata*, 265.
 Giraudii, 265.
 hyalipennis, 265.
 longipes, 265.
 mali, 265.
 nervosa, 265.
 pulicaria, 265.
 pyri, 265.
 quinquelineata, 265.
 sp.? in wheat, 264.
 Thomæ, 264.
 tillicola, 265.
 vittata, 265.
 Scolytus *obesus*, 300.
 rugulosus, 300, 319.
 scrophulariæ, *Anthrenus*, 267, 268, 314, 325.
 Scurfy bark-louse, 326.
Sceymnus species, 300.
 Seeley, D. W., insects from, 265.
 senatoria, *Anisota*, 192-200.
 Dryocampa, 192.
 Phalæna, 192.
 Senatorial oak moth, 192.
 Sennett and Webster's collections, 317.
 Sennettii, *Epantheria*, 317.
 septemmaculata, *Diplosis*, 280.
 septendecim, *Cicada*, 276, 322.
 serrata, *Hæmatobia*, 220, 310, 325.
 Lyperosia, 220.
 Priophora, 220.
 Sesla *s* *maculata*, 179.
 Settle, H. G., insects from, 325.
 Seventeen-year Cicada, 276.
 Seventeen-year locusts, 318.
 Sexton-beetles, 289.
 Sexual character in pupæ, 311.
 Shaking from foliage for insect attack, 172, 183, 262, 314, 317, 320, 321.
 Shaw, John C., insects from, 324.
 Sheep dips for insect attack, 226.
 Shimer, Samuel W., insects from, 325.
 Signoretii, *Aphrophora*, 245.
Simulium molestum, 283, 317.
 pecuarum, 314.
 Siphonophora *avenæ*, 246-253.
 granaria, 245.
 siro, *Tyroglyphus*, 291-295.
 Smerinthus *Myron*, 174.
 Smith-Abbot, cited, 174, 179, 183, 192.
 Smith, Miss E. A., cited, 218.
 Smith, Mrs. E. B., insects from, 326.
 Smith, Prof. J. B., cited, 220, 227(2), 228.
 on cow-horn fly, 223, 224, 225.
 on elm-leaf beetle, 238.
 Snake-worm, 264.
 Snouted mites, 290.
 Snow [Prof. F. H.], cited, 197.
 Snuff for repelling insects, 301.
 Soap and carbolic acid wash, 301.
 Soap and sulphur for insect attack, 288.
 Soap-suds for insects, 161, 256, 275, 287, 302.
 Soap-wash for insects, 160, 270, 279, 317, 320.
 Soft soap for insects, 163.
 Soluble phenyle for repelling insects, 226, 315.
 Soot for insect attack, 253, 307.
 Soot for repelling insects, 159, 301.
 Spanish-fly, 305.
 Speyer [Dr. A.], cited, 201.
 Sphæria *morboæa*, 320.
 Sphingicampa *bicolor*, 199.
 bisecta, 199.
 Heiligbrodti, 199.
 Sphingidæ, 174, 317.
 Sphinx *insolita*, 317.
 kalmiæ, 177.
 Myron, 174.
 octomaculata, 179.
 pampinatrix, 174.
 quinquemaculata, 309.
 Spilomya *fusca*, 284.
 Spinning mites, 290.
 Spittle-insects, 243-306.
 Spotted horn-bug, 227-231.
 Spraying apparatus, 161.
 Spraying, directions for, 162.
 Spraying for insect attack, 161, 172, 200, 219, 239, 240, 256, 259, 301, 302, 305, 319.
 Spring canker-worm, 313.
 spumaria, *Cicada*, 245.
 Philænus, 245.
 Squash-vine borer, 155, 312, 313, 320.
 Stag beetle, 228.
 Stainton [H. T.], cited, 200.
 Stalk-borer, 304.
 Staphylinidæ, 303.
 Starvation for insect attack, 310, 316.
 stigma, *Anisota*, 197, 199.
 stimulea, *Empretia*, 186, 188.
 Stinging bug, 315.
 Stinging caterpillars, 185, 197.
 Stomoxys *calcitrans*, 221, 222, 225, 308.
 cervicola, 222, 308.
 cornicola, 220, 222, 308, 310.

Strocker, Herman, cited, 186.
 Stretch (R. H.), cited, 180(2).
 Striped cucumber beetle, 235.
 Striped flea-beetle, 301.
 Sturtevant, Dr. E. L., insects from, 167, 260, 262, 264, 272.
 subspinosus, *Macrodaetylus*, 164.
 Sugar mite in England, 294.
 Sulpho-carbonates for insect attack, 315.
 Sulphur for insect attack, 301.
 for the elm-beetle, 300.
 fumigation for insect attack, 314.
 remedy? for the elm-beetle, 240.
 Swederus referred to, 232.
 Sweet, W. W., insects from, 325.
 Swinerton, Rev. H. W., insects from, 323, 325.
 on larch saw-fly, 167, 170.
 sycophanta, *Anthonomus*, 173.
 Syrphidæ, 284.

T.

Tachina from Phobetrion, 192.
 Tachinidæ, 323.
 Tachinid fly, 285, 324.
 Tachus incurvus, 303.
 Tallow and carbolic acid for repelling insects, 236.
 Tansy decoction for insects, 169.
 Tar for repelling insects, 220, 226.
 Tarnished plant-bug, 275.
 Tarquinius, *Fenisoca*, 282, 317.
 Tarred bands for insect preventive, 259, 313, 318.
 Tar water for repelling insects, 226.
 tau, *Aglla*, 188.
 telarius, *Tetranychus*, 287, 321.
 Tenthredinidæ, 164, 173.
 tessellaris, *Halesidota*, 308.
Tetranychus telarius, 287, 321.
 Texas fly, 220, 226, 307, 308.
Thalassa atrata, 305.
 lunator, 305, 311.
 Thirteen-year Cicada, 322.
 Thirteen-year locust, 276, 313.
 Thomæ, *Sciara*, 264.
 Thomas (Dr. Cyrus), cited, 207, 227, 246, 253, 256.
 on grain aphid, 251.
 Thousand-legged worms, 296, 307.
 Thrips, 302, 304.
Thyreus Abbotii, 175, 177, 306, 324.
Thyridopteryx ephemereformis, 321.
 Ticks, 290.
tilleola, *Sciara*, 265.
Tinea iridella, 216.
Tineidæ, 215, 261.
 Tipuïd larvæ, 325.
Tityus, *Dynastes*, 227-231, 321.
 Geotypes, 227.
 Scarabæus, 227.
 Tongs for catching insects, 301.
 Tobacco dust for repelling insects, 158, 162, 226, 301.

Tobacco for insect attack, 160, 161.
 Tobacco water for insects, 256, 301, 302, 303.
 Tobacco-worm, 309.
 Tomato-worm reported venomous, 186.
tomentosus, *Neerophorus*, 289.
torpidus, *Agrilus*, 283, 317.
 Tortricidæ, 213.
Toxares triticaphis, 253.
 Treat (Mrs. M.), cited, 193.
 Tree-hoppers, 245.
 Treitschke, cited, 200.
Tromex columba, 305, 311.
 Treuching against insects, 200.
 trifoli, *Mamestra*, 323.
 Trim flower-chaffer, 320.
triticaphis, *Toxares*, 253.
triticæ, *Isosoma*, 315.
Trombididæ, 287, 290.
Trypeta pomonella, 300.
Trypetidæ, 282, 317.
tuberculata, *Dicercæ*, 286.
 Tucker, Dr. W. G., on carbolic acid for mites, 293.
 Twice-stabbed lady-bird, 267.
Tyroglyphidæ, 290.
Tyroglyphus longior, 292.
 sacchari, 294.
 airo, 291-295.

U.

Uhler (P. R.), cited, 242, 243, 245, 306.
ulmicola, *Colopha*, 303.
 Glyphina, 303, 326.
 Unarmed rustic, 200.
 Underwood, L. M., on mites, 289.
 unicolor, *Macrobasis*, 305, 321.
unijuga, *Catocala*, 282.
 Unrecognized apple-tree attack, 302.
Urocerus Cressoni, 311.
Uropoda Americana, 290, 318.
 vegetans, 290.
 Urticating caterpillars, 186.

V.

Vanessa Milbertii, 295.
 Van Wagenen (G. H.), cited, 234.
 Vaporized tobacco-juice repellent, 302.
 Variegated cut-worm, 200-206.
varius, *Anthrenus*, 267, 268.
 vegetans, *Uropoda*, 290.
ventricosus, *Nematus*, 156.
vernata, *Anisopteryx*, 242, 258, 313, 313.
verrucarum, *Neuroterus*, 308, 324.
vesicatoria, *Cantharis*, 305.
Vespa maculata, 285.
Virginiensis, *Anisota*, 199.
vitis, *Erythroneura*, 302.
 Lasioptera, 304, 325.
vittata, *Diabrotica*, 235, 312.
 Phyllotreta, 301.
 Sciara, 265.
vittigera, *Pentagonia*, 286.

W.

- Walker [F.], cited, 174, 192, 213, 251, 252.
 Walsh [B. D.], cited, 173, 192, 197, 207, 246, 280(2), 281.
 Walsh-Riley, cited, 173, 197.
 Walsingham [Lord], cited, 216.
 Warren, W. G., *Julus* from, 296.
 myriapode from, 326.
 Webster, Geo., on sulphur for insects, 241.
 Webster [Prof. F. M.], cited, 227, 246, 264.
 insects from, 325.
 on grain-aphis, 251.
 Weed [C. M.], cited, 207, 208.
 Wessels, C. H., mites from, 291.
 Westwood [Prof. J. O.], cited, 234, 265, 315.
 Whale-oil for insect attack, 163, 313.
 White flower-cricket, 302, 310.
 White grub, 154, 316, 317.
 publication on, 308, 312, 315.
 Whitehead, Charles, on fruit caterpillars, 152.
 White-marked tussock, 310.
 White-scale attack on ivy, 278.

- Wicks, Isaac, experiment on insects with sulphur, 241.
 Williston, Dr. S. W., cited, 220, 222, 223, 308, 309.
 Willow-apple gall saw-fly, 173.
 Wire-worms, 310.
 Woolly aphid, 160.
 Woolly plant-lice on alder, 282.
 Working the ground for insect attack, 259.

X.

- xanthomelæna, *Galeruca*, 234-242, 303, 319, 322, 325.
 X. O. dust for repelling cow-horn fly, 227.
 Xyleborus pyri, 300, 318, 325.

Y.

- Yellow-striped oak caterpillar, 192.

Z.

- Zebra cabbage caterpillar, 206.
 Zeller [Prof. P. C.], cited, 213, 215.
Zygæna s maculata, 179.
Zygænidæ, 179.

PLANT INDEX.

A.

Acaela, 326.
 Acer dasycarpum, 200.
 saccharinum, 187, 200.
 Adlumia, 288.
 alba, Botula, 187, 197.
 Carya, 304.
 album, Chenopodium, 209.
 Alder, 243, 282.
 Alnus serrulata, 243.
 Alnus sp., 282.
 Alsike clover, 263.
 Althaea, 265.
 Americana, Corylus, 187.
 Larix, 155.
 Ulmus, 303.
 Ampelopsis, 306.
 quinquefolia, 179, 180.
 Apple, 151, 152, 160-162, 167, 187, 192, 201-205,
 253, 260, 265, 269, 277, 299, 302, 306, 307, 309,
 316-318, 320, 321, 324, 325.
 Apple, early harvest, 305.
 Asclepias cornuti, 282.
 Ash, 187, 230, 321.
 asparagoides, Myrsiphyllum, 205.
 Asparagus, 209.
 Aster, 209.
 aurantiaca, Ræstelia, 321.
 Austrian plne, 266.
 Avena fatua, 252.
 sativa, 250.

B.

Balsam, 260.
 Barley, 247, 251.
 Beans, 159, 288.
 Bear oak, 197.
 Beech, 218.
 Beet, 209, 314.
 Betula alba, 187, 197.
 Birch, white, 187, 197.
 Black alder, 243.
 Blackberry, 245.
 Black currant, 256, 274.
 Black-knot, 280.
 Black oak, 197.
 Black scrub oak, 197.
 blanda, Rosa, 214.
 Blueberry, 245.
 Blue grass, 251.
 Brinckle's orange raspberry, 232.
 Bromus mollis, 252.
 Buckwheat, 209, 285.
 Bush-honeysuckle, 182.

C.

Cabbage, 157, 158, 205, 209.
 Calla, 287.
 canariensis, Phalaris, 252.
 Canary grass, 252.
 Carduus, 205.
 Carrot, 205.
 Carya alba, 304.
 porcina, 304.
 Castanea, 187.
 Cauliflower, 158, 265.
 Centrauthus ruber, 205.
 Cerasus vulgaris, 254.
 Cercis Japonica, 326.
 cereale, Secale, 252.
 Chenopodium album, 209.
 Cherry, 154, 186, 187, 230, 241, 254, 279, 282, 306,
 317, 319, 320, 323, 325.
 Chees, 252.
 Chestnut, 187.
 Spanish, 308.
 Chickasaw plum, 281.
 Chickweed, 205.
 Choke-cherry, 281.
 Chrysanthemum, 162.
 Clover, 205, 262, 272, 312, 316.
 Alsike, 263.
 medium, 263.
 pea-vine, 263.

Concord grape, 302.
 cordata, Salix, 173.
 Corn, 304, 312, 324.
 cornuti, Asclepias, 282.
 Corylus Americana, 187.
 Cotton-wood, 233.
 cotula, Maruta, 257.
 Crab-apple, 187, 192.
 Cranberry, 245.
 Cratægus, 282.
 Crocus, 267.
 Cucumber, 157, 159, 320.
 Currant, 209, 279, 317, 326.
 black, 256.

D.

Dactylis glomerata, 252.
 Daucus, 205.
 Deutzia gracilis, 182.
 Diervilla Japonica, 182.
 Diospyros Virginiana, 187, 233.
 Dock, 205.
 Dwarf chestnut oak, 197.

E.

- Early harvest apple, 305.
 Egg-plant, 320, 322.
 Elm, 236-242, 268, 300, 301, 305, 314, 317, 319, 322, 326.
 slippery, 303, 326.
 white, 303.
 Empusa muscæ, 272.
 English ivy, 279.
 violet, 287.
 Entomophthora Phytonomi, 272.
 Eupatorium, 205.
 purpureum, 285.
 Euphorbia, 315.
 Europæa, Larix, 164, 165.

F.

- fatua, Avena, 252.
 ferax, Saprolegnia, 272.
 Field pea, 209.
 Fig, 319.
 Filbert, 162.
 fluitans, Glyceria, 252.

G.

- Geranium, 307, 326.
 glomerata, Dactylis, 252.
 Glyceria fluitans, 252.
 Golden-rod, 284, 286.
 Gooseberry, 274.
 gracilis, Deutzia, 182.
 Gramineæ, 247.
 Grape, 154, 162, 175, 180, 205, 245, 300, 302-306,
 310, 311, 326.
 Concord, 326.
 Muscadine, 303.
 Rogers' Seedling, 304.
 Grass, 164, 202, 243, 246, 247, 304, 306, 320.
 blue, 261.
 Canary, 262.
 June, 163, 304.
 orchard, 252.
 red-top, 251.
 Timothy, 163, 261, 304.

H.

- Hamamelis Virginica, 187.
 Hard-hack, 284.
 Hard maple, 216.
 Hawthorn, 282, 320.
 Hazel, 187, 192.
 Hedera helix, 317.
 helix, Hedera, 317.
 Hickory, 304.
 Holcus, 262.
 Honeysuckle, 209, 244.
 Hop, 153, 307.
 Hordeum murinum, 252.
 Horseradish, 321.

I.

- Ivy, 278, 300, 317.
 English, 279.

J.

- Japonica, Cercis, 326.
 Diervilla, 182.
 June grass, 304.

K.

- Knot grass, 205.

L.

- Lambs' quarters, 209.
 lantanoides, Viburnum, 260.
 Larch, 164-172.
 Larix Americana, 165.
 Europæa, 164-165.
 Lemon, 279.
 Lettuce, 205.
 Linden, 265.
 Litorella, 205.
 Lucern, 205.

M.

- major, Plantago, 203.
 Malva, 265.
 Mangold, 209.
 Maple, 163, 167, 168, 197, 200, 215, 279, 303, 305,
 313, 317.
 soft, 325.
 Maruta cotula, 267.
 Mayweed, 267.
 Medium clover, 263.
 Melon, 159, 306, 320, 326.
 Mignonette, 209.
 Milkweed, 282.
 Miner plum, 280.
 Mitella, 288.
 mollis, Bromus, 262.
 monilifera, Populus, 171, 233.
 morbosa, Plowrightia, 280.
 Sphæria, 280.
 murinum, Hordeum, 252.
 muscæ, Empusa, 272.
 Mushrooms, 255.
 Myrsiphyllum asparagoides, 205.

N.

- Nasturtium, 289, 322.
 nigrum, Ribes, 274.

O.

- Oak, 163, 187, 195, 200, 230, 268, 308, 325.
 bear, 197.
 black, 197.
 dwarf chestnut, 197.
 red, 187.
 scarlet, 197.
 scrub, 197.
 white, 187.

- Oats, 247, 249.
 officinalis, Salvia, 273.
 Oleander, 279, 317.
 Orange, 187.
 Orchard grass, 252.

P.

- Pastinaca sativa, 282.
 Pea, 300.
 Peach, 205, 241, 266, 299, 316, 319, 326.
 Pear, 161, 162, 187, 192, 266, 276, 299, 323-326.
 Buerre d'Anjou, 276.
 Duchesse d'Angouleme, 276.
 Pea-vine clover, 263.
 persicaria, Polygonum, 262.
 Persimmon, 187, 233.

Phalaris canariensis, 252.
Phleum pratense, 153.
 Phytoumi, *Entomophthora*, 372.
 Pig-nut, 304.
 Pine, 168, 245.
 Austrian, 266.
 white, 245.
Pinus strobus, 267.
Plantago, 205.
 major, 203.
 Plautain, 203.
Plowrightia morbosa, 280.
 Plum, 152, 151, 256, 279, 280, 305, 306, 317,
 323-326.
 Chickasaw, 281.
 sand, 281.
 wild, 281.
Poa annua, 252.
 pratensis, 153.
Polygonum persicaria, 252.
 Poplar, 171, 210, 283.
Populus monilifera, 171, 233.
 tremuloides, 210, 283.
 porcelain, *Carya*, 304.
 Potato, 265, 291, 296, 321, 322.
 pratense, *Phleum*, 153.
 pratensis, *Poa*, 153.
 purpureum, *Eupatorium*, 285.

Q.

Quercus alba, 197.
 coccinea, 197.
 ilicifolia, 197.
 prinoides, 193, 197.
 rubra, 197.
 sp.? 308, 324.
 tinctoria, 197.
 Quince, 151, 288, 316, 321, 322.
 quinquefolia, *Ampelopsis*, 179, 180.

R.

Radish, 157, 321.
 Raspberry, 197, 232, 321.
 Red oak, 187, 197.
 Red-top grass, 251.
Rhus typhina, 271.
Ribes nigrum, 274.
Ræstelia aurantiaca, 321.
Rosa blanda, 214.
 Rose, 162, 214, 315.
 ruber, *Centranthus*, 205.
Rumex, 205.
 Rye, 247, 252.

S.

 saccharinum, *Acer*, 187.
 Sorghum, 252.
 Sage, 273, 274.
Salix cordata, 173.
Salvia officinalis, 273.
 Sand-plum, 281.
Saprolegnia ferax, 272.
Sassafras, 233.
 sativa, *Avena*, 250.
 Pastinaca, 282.

 sativum, *Triticum*, 252.
 Scarlet oak, 197.
 Scrub-oak, 197.
 Secale cereale, 252.
 serrulata, *Alnus*, 243.
 Slippery elm, 303, 326.
 Smilax, 205.
 Solidago, 284, 285, 286.
 Sorghum saccharinum, 252.
 Sorrel, 205.
 Sphaeria morbosa, 280.
 Spinach, 209.
 Spiraea, 287.
 tomentosa, 284.
 Spruce, 171, 260.
 Squash, 155, 157, 312.
 Hubbard, 155, 313.
 Stellaria, 205.
 Strawberry, 156, 159, 205, 209, 275, 319, 321.
 strobis, *Pinus*, 267.
 Sugar maple, 187, 216.
 Sumach, 270.
 Sweet pea, 209.
 Sycamore, 308.

T.

Tamarack, 166-7-8.
Thunbergia, 287.
 Timothy grass, 205, 261, 304.
 Tobacco, 159, 200, 230, 321.
 Tomato, 322.
 tomentosa, *Spiraea*, 284.
 Trefoil, 205.
 tremuloides, *Populus*, 210.
 Triticum sativum, 252.
 Tropæolum, 288.
 Turnip, 209, 265, 321.
 typhina, *Rhus*, 271.

U.

Ulmus Americana, 303.

V.

Viburnum lantanoides, 260.
 Violet, English, 287.
 Virginia creeper, 179, 180.
Virginiana, *Diospyros*, 187, 233.
Virginica, *Hamamelis*, 187.
 vulgaris, *Cerasus*, 254.)

W.

Walnut, 324.
 Weeds, 205.
 Wheat, 247, 249, 251, 263, 264, 265, 325.
 White birch, 187, 197.
 White elm, 303.
 White oak, 187, 197.
 White pine, 245.
 Wild cherry, 152, 187, 256.
 Wild parsnip, 282.
 Wild plum, 281.
 Willow, 173, 205, 230, 245.
 Witch-hazel, 187.
 Witch-hobble, 260.
 Woodbine, 306.

ERRATA IN FIFTH REPORT.

- Page 148, line 4, for zanthomelæna read xanthomelæna.
Page 170, line 7, for Dallas read (Dallas).
Page 174, line 17, transfer first comma from after chærocampa to before.
Page 213, line 3, for Boisdaval read Boisdaval.
Page 219, line 19, for ac ss read across.
Page 224, line 3 from bottom, and p. 225, line 12, for Boder read Bodee.
Page 224, line 9 from bottom, for L. A. Howard read L. O. Howard.
Page 231, *dele* first and third paragraphs, relating to tobacco feeding.
Page 257, line 15, for Guer read Guér.
Page 268, line 14, for subjee read subject.
Page 282, line 1, for *Trypetidæ* read *Trypetidæ*.
Page 283, line 22, for Thirth read Thirty.
Page 283, line 3 from bottom, in foot-note, for more read less.
Page 295, line 17, for Raf. read (Raf.).
Page 313, bottom line, for he read the.
Page 330, line 24, for Prionatus read Prionotus.
Page 331, line 20, col. 1, transfer 321 to line 21.
Page 332, line 12 from bottom, for 179 read 177.
Page 335, read *Julus cæruleocinctus*, 307, 326.
Page 338, line 21, for Ormerod read Ormerod.
Page 343, line 16, for 323 read 324.

