University of the State of New York

EIGHTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

FOR THE YEAR 1891

[From the Forty-fifth Report on the New York State Museum]

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ALBANY
UNIVERSITY OF THE STATE OF NEW YORK
1893

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REPORT.

OFFICE OF THE STATE ENTOMOLOGIST,
ALBANY, *November* 25, 1891.

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

GENTLEMEN. — I have the honor of presenting to your board my Eighth Report on the Injurious and Other Insects of the State of New York, containing the results of observations and studies made by me during the present year.

The year has not been prolific in insect life, either in the multiplication of individuals of a species, or in the number of special pests. The abundance of insects varies greatly in different years. While this may be, and often is, controlled to a large extent by the beneficent provision in nature of parasitism, through which certain classes of insects live wholly at the expense of others, it is still more largely due to meteorological conditions, varied in their nature and complex in their influences. Among these may be named drouth, excessive moisture, high temperature, severe cold, late and early frosts, depth of frost, winds, cold rains, continued rain, and absence or abundance of snow. Under such diverse and conflicting conditions, the aggregate of insect injury for any year can never be foretold for months in advance, although in individual cases, as in the chinch-bug and the western locust, predictions for the succeeding season have been made and verified. An excessive abundance of an insect pest in one year may be followed by its almost entire absence in the next, while a disastrous attack may suddenly be made upon a valuable crop by an insect long known but never before recognized as of the slightest economic importance.

When to these fluctuations in insect life there is added continually changing habits, wild food-plants deserted for cultivated ones, gradual extension of geographic range, introduction by commerce from abroad, etc., etc., it is not surprising that each year should bring to the economic entomologist new subjects for

study, and in such rapid succession that hardly a tithe can be given proper investigation.

The present year, even more markedly than the preceding, has been exempt from severe insect attacks upon the grain crops of the State. These agricultural staples have been almost entirely free from the destructive midges — the wheat-midge and the Hessian-fly, that in former years have often occasioned such serious losses; and but little harm has been inflicted by the grain-aphis. The hop crop was not greatly injured by the hop-vine aphis, *Phorodon humuli*. The potato beetle has been less abundant than usual, and in most localities where mention has been made of its presence, it was so late in making its appearance that less than ordinary effort was required for keeping it within control. In some of the Hudson river counties, injuries from it were first reported in the early part of July. In portions of Cattaraugus county it is said to have been unusually abundant during the month of July.

With the large acreage devoted to fruit-growing in the State of New York, its annual extension, and the increasing care which is required in order to insure a good degree of protection from insect and fungus attack—it might naturally be expected that fruit insects should claim the foremost place among our insect foes. They have certainly taken such rank the present year, for among the hundreds of inquiries received of name, habits, remedies, etc., through personal application and a correspondence largely in excess of any former year, more than three-fourths have been of the insect depredators of orchards and of the smaller fruits. And to no inquiries have a more cordial welcome been given by your entomologist than to these, for, thanks to progress made in applied entomology, and the earnestness with which this useful science is being studied—in almost every instance there has been the ability of returning answer that could hardly fail of substantial benefit to the inquirer.

Referring to a few of these fruit insect attacks: The apple-tree tent caterpillar, *Clisiocampa Americana* Harris, which has been unusually destructive for several years past, has not been the cause of as frequent complaint as in the preceding year. This may have resulted from the more general care that has been given to the collecting and burning of the eggs during the winter,

and to destroying the nests or tents of the young caterpillars when they are first to be seen in the forks of the branches. Reports of the abundance of this caterpillar have been received from Westchester, Dutchess, Chemung, and Oswego counties.

The apple-tree aphis, *Aphis mali* Fabr., while not very generally distributed, appeared in remarkable numbers in a few localities—in Oswego, Monroe, and Essex counties, and elsewhere. The season, however, was not propitious for its increase, and the aggregate amount of injury caused by it was not large. This insect may so easily be killed by kerosene emulsion spraying—either while in the egg or at the time of its hatching, that losses from it in the orchard deserve to be charged, in the profit and loss account, to the item of carelessness.

The apple-leaf Bucculatrix, *Bucculatrix pomifoliella* Clemens, is extending its range, and is now to be found in nearly every county of the State. In Oswego, Wayne, Orleans, Monroe, Niagara, Livingston, and Ontario counties, its peculiar, white ribbed cocoons are so numerous as to readily attract the eye. Yet, little complaint has been made during the year of injury from it. Many of the cocoons seen upon the twigs are those of former years, and therefore tenantless. An effective parasitic attack has fortunately been made upon it which is largely reducing its numbers. Mr. Powell, Director of the Farmers' Institutes, reports that at a recent institute held at Sodus, Wayne county, on a small piece of apple-twig brought in, containing thirty of the cocoons, twenty-five had been destroyed by the parasite, as shown by a small hole eaten through one end of the cocoon.

Another Tineid apple-tree depredator, *Coleophora malivorella* Riley, rare to the State (see 1st Report Ins. N. Y., page 163), was received in the early spring from Oswego and Wayne counties. While not yet abundant in New York, it would not be a difficult task to prevent its becoming a serious pest.

Although of slight economic importance, yet of considerable interest from its rarity and limited extent, is the occurrence during the autumn of the apple leaf-sewer, *Phoxopteris nubeculana* (Clemens), in an orchard at Palmyra, Wayne county, N. Y. While in this orchard nearly one-half of the leaves have been neatly folded over near the midrib and the two edges fastened together to form the shelter for the hibernating larva, none of the other orchards in the vicinity show the presence of the insect.

Reference was made, and a brief notice given, in the Report for last year, to injuries to apple buds, blossoms, and leaves by the caterpillar of another Tortricid moth, *Tmetocera ocellana* (Schiff.), or the eye-spotted bud-moth — so named from an eye-like spot on its wings. The present year it has greatly multiplied in the "apple-belt" of Western New York; and its pernicious work in eating into the buds, and destroying the blossoms, and feeding on the tender foliage, has materially lessened the production of fruit in many localities. A large orchardist in Wayne county has written me that he has found it almost impossible to check, in the slightest degree, its ravages, and that it has done him more harm than all other apple pests combined. A full knowledge of its life-history, which we do not yet possess, will, it is hoped, reveal some simple and effective means by which it may be controlled.

Of the comparatively small number of insects attacking the pear, and none of which have seriously interfered with its cultivation, two insects have emerged from their obscurity during the present year, and have been the occasion of no little alarm in localities where they have abounded. Of these, the pear-tree *Psylla pyricola* Foerst.,— an aphis-like creature, has been quite destructive in orchards in Greene and Columbia counties on the Hudson river, through sucking the sap from the buds, leaves, and stems of the young fruit, and covering them and the twigs with an impervious coating of honey-dew. Later in the season a fungus develops upon this viscid excretion and blackens the twigs and terminal branches of the infested trees as if they had been painted. From an orchard in Columbia county where the crop gave promise of yielding 1,200 bushels of pears — as the result of the operations of this insect, only 400 bushels of indifferent fruit was gathered.

The other of the two is the pear-midge, *Diplosis pyrivora* Riley, which had not, hitherto, been reported in the State of New York — its only known locality in the United States being Meriden, Conn., where it is believed to have been introduced from France about fifteen years ago. The eggs of the parent midge are deposited in the blossom before they open, and the larvæ therefrom, to the number of twenty or more, burrow and feed within the young fruit wholly withdrawn from the reach of insecticidal applications. At maturity they escape from the fruit and drop

to the ground, where they bury for their transformation, to reappear the following spring as the winged midge. The infested fruit, with its interior eaten away, soon falls from the tree. The insect, wherever observed—in France, England, and in this country, has shown a decided preference for some particular variety of pear, while attacking most of the others. With us, the Lawrence has been the attractive one, to the extent of its crop proving almost an entire failure — at least nine-tenths of it having been destroyed both in Meriden, Conn., and at Catskill, N. Y. Notice of both of these insects will be found in the following pages, where the results of the studies made upon them are detailed.

In my fifth report account is given of an attack on young pears at Rochester, N. Y., in which the fruit was completely ruined by the gnarling, knotting, and deformation caused by the punctures and feeding of one of the plant-bugs, *Lygus pratensis* (Linn.). A similar attack was brought to my notice during the early summer, occurring at South Byron, Genesee county, of a closely resembling species, *Lygus invitus* (Say). The operation of the insect was carefully watched, and interesting observations made upon it. Fortunately, these injuries, while quite general, are not often severe. In only one other instance were they deemed of sufficient importance to merit report — in Monroe county, where a crop of Seckels was badly gnarled in August from a second brood of the *Lygus*.

Of other fruit insects of which complaint has been made, these may be noticed: The cherry aphis, *Myzus cerasi* (Fabr.), caused considerable injury in St. Lawrence county in the early part of July. The plum aphis, *Aphis pruni* Fabr., abounded in some plum orchards at Schoharie, N. Y., affecting the foliage quite severely. The plum curculio was unusually harmful in parts of Albany county. It is rarely so injurious in the eastern part of the State that it is necessary to resort to "jarring" for its destruction. At North Salem, Westchester county, the rose-bug, in the latter part of June, is said to have almost ruined grapes and peaches, and somewhat later, vineyards in Jefferson and Oswego counties were reported as nearly destroyed by immense swarms of the same insect. According to an account received, the currant-worm, *Nematus ribesii* Scop., when threatening the destruction of the currant crop, at Millbrook, Dutchess county, early in June, was killed by heavy rains occurring at that time.

The cow-horn fly, *Hæmatobia serrata* R. Desv., which has been noticed in a former report, has made its appearance in a few, but widely separated, localities in the State, and its speedy general distribution may therefore be looked for, unless the measures recommended for the prevention of its increase shall be generally adopted.

A new onion pest attacked the onion crop at Canastota, in Central New York, during the month of June. It was a dark-colored caterpillar of over an inch in length, which fed on the plants above ground, and overran the large fields of onions in the muck lands about Canastota, feeding also on weeds and other vegetation. It was at first thought to be the same cut-worm that in the year 1885 was so exceedingly destructive in the extensive onion fields in Goshen and vicinity in Orange county. But its critical examination indicated it to be a different species, viz., *Agrotis ypsilon* (Rott.), and the subsequent rearing of the moth proved it to be that common insect, which had not been recognized before as an onion feeder.

From Chenango county an estimate was received of twenty per cent injury to corn from cut-worms — the species not identified.

Epilachna borealis (Fabr.), the northern lady-bug — quite exceptional in its family for its injurious habits, has again been destructive this year in its extraordinary numbers, to melon and squash vines upon Long Island.

Most of the above, together with others not here referred to, are noticed in the body of the report.

It gives me pleasure to report an increasing interest each year shown by the people of the State in the work of this Department. This is particularly marked on the part of the agricultural community, who are thoroughly awakened to the importance of protecting their crops from the steadily increasing hosts of their insect enemies. So frequent are the requests from farmers and fruit-growers for information and for aid, that almost my entire time during the year has been occupied in the study of these successive attacks, and of the best methods for their control. While service rendered in this direction is beyond question quite as valuable as any other that may be given, still it is necessary that a certain amount of purely scientific work should accompany economic

studies, if their published results are to be accepted as valuable scientific contributions.

The collections made during the year were not as large as in some preceding years, owing to the shorter time that could be spared from office duties, and from a lesser abundance than usual of insect life. Particular attention was again given to the insects occurring in high altitudes in the Adirondack region, the fauna of which has been so imperfectly explored. Several new and many valuable forms were obtained in Essex county, in the towns of North Elba, Wilmington, and Keene, and life-histories, more or less complete, worked out.

Contributions to the collections have been received from a larger number of donors, but aggregating less in the number of specimens than reported in 1890. As of special value may be particularized a package of alcoholic specimens of Lepidoptera from Mr. H. G. Dyar, of New York city, mainly of rare larval forms, collected by him in the Yosemite valley, Cal., and described in scientific journals.

The report herewith submitted contains, under the division of Injurious Insects, a somewhat full notice of the several species, after the manner in which I would be glad to present most of the insects embraced in these reports, i. e., in so general and full an account, drawn from their literature and combined with new observations as may afford ample means for the arrest of their depredations, or their protection if desirable. But this, under the requirement for the completion of the report in readiness for printing on the first of October, is impracticable. I have, therefore, embodied under Notes on Various Insects, such briefer notices as seemed worthy of placing on record at the present time; and under Insect Attacks: Their Remedies and Preventives, notices of several of the more interesting attacks of the year, together with approved remedies for some of the long and well known insect pests.

The Appendix contains two addresses made before State boards of agriculture by the Entomologist, and a list of the principal publications of the Entomologist during the year, of which fifty-seven are named and brief summaries given; also the usual list of the contributions to the collections of the department.

The additional room and cases for which arrangements are being made by your board for the use of the Entomologist, will remove the discomfort and hindrance of an overcrowded office, and permit of a more convenient and systematic arrangement of the library and the collections.

With grateful acknowledgment of aid and courtesies extended.

Respectfully submitted.

J. A. LINTNER.

INJURIOUS INSECTS.

Synchlora glaucaria (Guenée).

The Raspberry Geometer.

(Ord. Lepidoptera: Fam. Geometridæ.)

Aplodes glaucaria Guenée: Hist. Nat. Ins.–Lepidop., ix, 1857, p. 377.
Aplodes rubivora Riley: 1st Rept. Ins. Mo., 1869, p. 139, pl. 2, fig. 25.
Aplodes rubivora. Walsh–Riley: in Amer. Ent., i, 1869, p. 247 (ident. from, New Jersey).
Aplodes rubivora. Treat: in Amer. Ent.–Bot., ii, 1870, pp. 203–205, fig. 125.
Eunemoria gracilaria Packard: in 5th Rept. Peab. Acad. Sci., 1873, p. 77.
Synchlora albolineata Packard: in *id.* p. 75.
Aplodes rubivora. Saunders: in Rept. Ent. Soc. Ont. for 1873, 1874, pp. 15, 16, fig. 10 (habits, etc.).
Synchlora rubiroraria Packard: Mon. Geomet. Moths, 1876, p. 382, pl. 10, fig. 85.
Synchlora rubiroraria. French: in Trans. Ill. Dept. Agr., xv, 1877, App., p. 288; in 7th Rept. Ins. Ill., 1878, p. 238 (brief description of larva and its habits); in Trans. Ill. St. Horticul. Soc. for 1881, n. s., xv, p. 198 (brief description).
Synchlora glaucaria (Guen.), Hulst: in Entomolog. Amer., ii, 1886, p. 141.
Synchlora rubiroraria. Saunders: Ins. Inj. Fruits, 1889, p. 316, fig. 330 (brief account).
Synchlora rubivora. Edwards (H.): Bull. 35, U. S. Nat. Mus., 1889, p. 102 (ref. to descr. early stages).
Synchlora rubivora. Lintner: in Rural N. Yorker, L, 1891, p. 577 (larva and habits).
Synchlora rubivora. Riley–Howard: in Insect Life, iv, 1891, p. 157 (in Jamaica).
Synchlora glaucaria. Smith: List Lepidop. N. A., 1891, p. 57, no. 3460.

A Strange-looking Caterpillar.

That the two strange-looking caterpillars of this insect, received from New Haven, Conn., on the 27th of July, were the first of the kind that had come under my notice, would indicate not very acute powers of observation — unusual mimetic concealment in the larva — or that the insect is not of frequent occurrence in the State of New York.

The caterpillar and the moth that it produces are represented in the accompanying figure, but the reader, if not an entomologist may need to be told that the former is intended to be shown in the little irregular bunch adhering to the berry at *a*, and looking as if it were merely a roll of vegetable material that had been carried about in the winds before finding a temporary resting-place. Only upon examining carefully could the outline of a larval form be made out within it, nor would it then be accepted as a living being, unless it could be seen to unbend and commence to travel over the berry or to feed upon it.

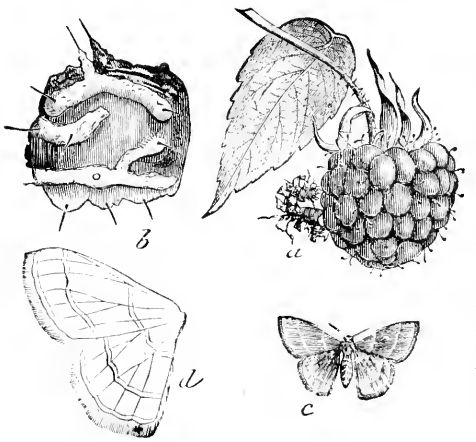

FIG 1.—The raspberry geometer, SYNCHLORA GLAUCARIA: *a*, the caterpillar; *b*, one of its segments enlarged to show the spines; *c*, the moth; *d*, wings enlarged. (After Riley.)

The raspberry geometer, as it is popularly called, is a small "measuring-worm," "inch-worm," or "looper"—names that are borrowed from the peculiar mode of progression in the family of *Geometridæ* to which it belongs, the caterpillars of which travel in a series of loops, as if surveying or measuring land. Supported on the terminal legs and extending the body to the utmost, they grasp the twig or leaf, and bring forward the hinder legs in contact with the front. The intermediate portions of the body which are unprovided with the legs that are present in most other families, are curved upward by the movement in the form of the capital letter omega in the Greek alphabet.

Concealment or Mimicry.

While many of the geometers when at rest extend their body upward from the branch in a straight line, counterfeiting almost exactly a twig, this one rests upon the berry in a close loop. When motionless in this position, no one would suspect it of being a living animal form. Its concealment is made almost perfect by the bits of vegetable material within which it hides itself. From its body a number of spines project, as shown in one of its enlarged segments at *b* in the figure. To these and at other points, it fastens the anthers of the raspberry blossoms and other bits of vegetation so thickly as to almost conceal its true form. It is strange that the anthers should be

specially chosen for this purpose, but the fact has been stated by several writers, and the entire covering of the two received by me, consisted of these organs.

So perfect is the concealment of the caterpillar or its miniery of a blighted blossom, that it might be supposed that the immunity from its natural enemies which it must secure in this manner would promote its multiplication and make it a quite common insect; but on the other hand, its disguise might easily, before it had attained a conspicuous size, permit of its being swallowed unsuspectingly with the berry. Indeed, a writer has remarked:* "The lovers of these most exquisite fruits, the raspberry and the blackberry, are often greatly disgusted by the discovery of the fact that instead of the delicious berry which they expected to enjoy, they are munching the small caterpillar under consideration."

The Caterpillar Described.

The caterpillar has been described by Professor Riley as follows:

Average length, 0.80 inch. Color light yellowish-gray, darker just behind each joint, and very minutely shagreened all over. On each segment a prominent pointed straight projection on each side of the dorsum, and several minor warts and prickles below. Two very slightly raised longitudinal lighter lines along the dorsum between the prominent prickles. Ten legs.

The above description, although brief, is probably all that will be needed for its identification, in consideration of its peculiar appearance and habits above given and illustrated.

The Moth.

The moth is a delicate creature, of about a half inch expanse of wings, of a pale green color, having both pairs of wings traversed by two whitish cross bands. More minutely described, to distinguish it from allied species:

Pea-green; a white stripe between the antennæ, which are also white, and beneath pale testaceous; palpi and legs white; front and pectus green; a green stripe on the fore trochanters. Palpi very long, extending out nearly twice the length of the head, greenish or reddish at the tip. Fore-wings with the costal edge white; a basal curved line, slightly dentate on the venules. Discal dot very linear, pale, obscure. Outer white line parallel with the outer edge, dentate on the venules; edge with white dots on the venules; fringe pale green. Secondaries with a much curved basal white line, a linear, small, white discal dot; outer line very dentate on the venules, much more so than the same line on fore wings; fringe pale, edge with white dots on ends of venules. Beneath, fore-wings testaceous, whitish on costal edge; fringe white;

* 1st Report on the Insects of Missouri, 1869, p. 139.

anterior half of wings greenish, posterior [half] whitish. Secondaries whitish; the line appears, though very faintly. Abdomen green, streaked mesially with whitish. Length of body, ♂, 0.33; ♀, 0.43. Expanse of wings, 0.65—1.08. (*Packard.*)

Its Natural History.

The early life-history of the raspberry geometer is not known. Its eggs are probably deposited on the leaves of the raspberry and the blackberry near the blossom buds in May or June, according to the latitude, and the caterpillar feeds at first upon the tender leaves, but as soon as the berries begin to ripen they constitute its entire food. At or about the time of the ripening of the berries the caterpillar having reached maturity, it selects a suitable spot upon a leaf or twig where it forms a slight cocoon for its pupation. A few days only are passed in this stage when the moth makes its appearance — in the latter part of June in Texas, in July in Illinois, in August and September in New York and New England.

One of the two caterpillars received from New Haven either escaped from its box or was devoured by its associate; the other, after having fed for nearly two weeks upon raspberries, commenced making its cocoon on August 8th, and had completed it on the following day. Two days later (11th) the pupa could be seen through the thin meshes of the cocoon, of a pale brown color, with darker spots and lines, and about one-third of an inch in length. After a two weeks' pupation the moth was found in the box on the 23d of August.

A specimen in my collection bears date of August 3, 1873, taken at Schoharie, N. Y., and another from the collection of the late W. W. Hill, "July, 1871, Lewis Co., N. Y."

The Cocoon.

The inclosure for its pupation hardly deserves the name of a cocoon as it consisted only of about a dozen pieces of varying sizes taken from the sepals of the calyx of the berry, and arranged over its body and connected by some coarse threads, so few in number that they barely sufficed to hold the pieces together. The pupa was fastened within by its terminal tip caught in some silken threads.

Abundance and Distribution.

The principal interest pertaining to this insect lies in the possibility of its not being detected when the berries to which it is attached are eaten; but, in that event, no harm will ensue, or even a nauseous taste

be experienced, such as attends the presence of one or two of the minute plant-bugs that so frequently infest the raspberry. It has never been known to occur in such numbers as to mar the fruit, although, according to Professor Riley, it has been somewhat numerous in Illinois. It has a large distribution over the United States, being reported by Dr. Packard from Maine, Massachusetts, New York, New Jersey, Missouri, Kansas, Texas, and Alabama. An example of apparently this species occurred among collections made by Mr. T. D. A. Cockerell, in Jamaica, West Indies.

Bucculatrix Canadensisella (Chamb.).

The Birch-leaf Bucculatrix.

(Ord. Lepidoptera: Fam. Tineidæ.)

Chambers: in Canad. Entomol., vii, 1875, p. 146 (imago); in U. S. Geolog.-Geograph. Surv., iv, 1875, p. 133 (citation).

Lintner: "3d Rept. Ins. N. Y.," in 40th Rept. N. Y. St. Mus. N. H., 1887, p. 135.

Packard: 5th Rept. U. S. Entomolog. Commis., 1890, p. 507 (larva and moth), p. 508 (Tineid larva); in Insect Life, v, 1892, pp. 14–16, fig. 3 (occurrence in Rhode Island).

Riley–Howard: in Insect Life, v, 1892, p. 16, fig. 3 (in New York, Mass., and parasitic attack).

Fletcher: in Rept. Min. Agr. on Exper. Farms for 1892, pp. 156–158, fig. 14; same in Rept. Ent.-Bot., 1892, pp. 14–16, fig. 14 (general account).

Mrs. H. D. Graves, of Ausable Forks, N. Y., to whom many obligations are due for interesting and valuable observations made upon the insect pests of Northern New York, has kindly communicated the following notes upon recent operations of the above-named insect, under date of September 8, 1894:

The Insect at Ausable Forks.

I send herewith some birch leaves and worms, illustrating the condition of all the birches in this vicinity. The leaves sent are from a cut-leaf birch on my lawn. Lindens, maples, and dogwood standing near are entirely free from attack. In a ride of thirteen miles that I took through the country yesterday, all the birches could be distinguished at a long distance by their burned looking foliage, while all other trees were green and fresh. About three weeks ago I first noticed the falling of the leaves from my tree, but being busily occupied at the time I did not examine into the cause, and now the tree is spoiled for this year. I do not believe that there is a perfect leaf upon it.

The Insect at Scottsville.

The attack was recognized as identical with one that had come under my notice in the summer of 1886, through a letter and examples of the eaten foliage of a yellow birch, *Betula lutea*, and the infesting insect, received from Mr. Shelby Reed, of Scottsville, Monroe county, N. Y., as was briefly noticed in my "Third Report," as above cited. Mr. Reed, writing September 14th, stated: "Trees infested with the insect have a brown and scorched appearance, and light comes down through the thickest of the foliage as through a softened skylight."

The leaves sent for showing the injury to the foliage caused by the insect, had very nearly all of the green parenchymal matter eaten away, leaving only the transparent epidermis of one side as a thin transparent film. In a few instances only, had this film been broken or pierced into holes of microscopic size. It was interesting to see how thorough had been the work of dissecting out the parenchyma from between the epidermal reticulations. Only here and there had a cell escaped — all of them united, over the entire surface of some of the leaves, not exceeding a square quarter-inch. It was the most remarkable and beautiful leaf dissection that had ever come under my observation, far exceeding in delicacy any of the "skeletonizing" which we are often called upon to admire. That it could have been executed by so small a larva, seemed surprising, until it was learned from Mr. Reed that it was the concerted work of large numbers — forty-eight of the little caterpillars having been counted by him on a single leaf.

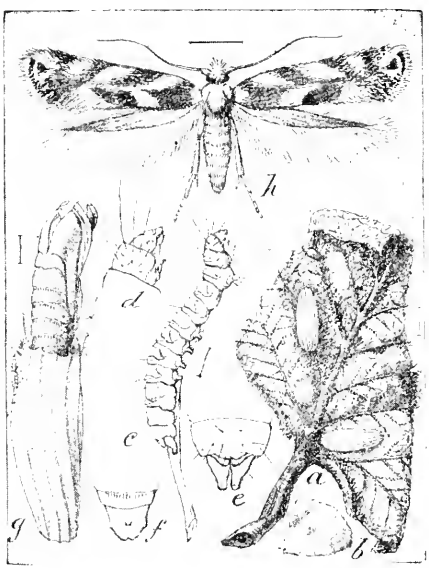

Fig. 2.— Bucculatrix Canadensisella: *a*, skeletonized leaf; *b*, molting cocoon; *c*, larva; *d*, head of larva; *e*, anal segments of larva; *f*, same of pupa; *g*, cocoon with extruded pupa skin; *h*, moth — all enlarged. (From *Insect Life*.)

The leaves of the cut-leaf birch received from Ausable Forks, were less eaten than the above — only about one-half, on an average, of the parenchymal matter having been removed. It is probable that the native birches, in their "burned looking" foliage, had been more seriously affected. At *a*, in Figure 2, a partly skeletonized leaf is shown.

The Caterpillar.

The full-grown caterpillar measures less than a quarter of an inch in length — more exactly, from 0.18 to 0.22 of an inch. It is of a slender form, tapering considerably at each extremity, and with deep incisures between the rounded segments. The head is long, projecting, slightly bilobed, of a pale brown color, with the ocelli and mandibles black; width of head about half that of the first segment, and one-fourth or less, of the central segments. The body is dull pale green, sometimes of a yellowish cast, having short hairs on the setiferous spots, and some longer ones elsewhere, particularly at the extremities, as shown at *c* in Figure 2, but omitted by the engraver in Figure 3. The terminal pair of prolegs are projected behind: the other prolegs are so short that the apodal segments also have the appearance of being employed for locomotion.

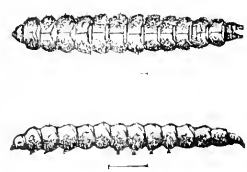

FIG. 3—Caterpillar of the birch-leaf Bucculatrix, BUCCULATRIX CANADENSISELLA, side view and dorsal view (original.)

The caterpillar walks slowly, and when disturbed, drops from the leaf and hangs suspended by its thread. If brushed from the leaf to the table or a smooth surface, it twists vigorously about, in violent contortions, as if to frighten away, or to escape from, its enemies.

Its Molting Cocoon.

In addition to the two New York localities mentioned, the insect is also known to occur in Albany. After its reception from Ausable Forks, in Essex county, the birches in Washington Park were examined for it. Leaves eaten after the peculiar manner of the larvæ, to a moderate extent, were found, but none of the ribbed cocoons. On a number of the leaves were small rounded silken patches, which were identified as the retreats made by the larvæ during their molting periods—apparently in two sizes. They had been described by Dr. Packard, in the 5th Report of the U. S. Entomological Commission, as "Orbicular, 2 to 3 mm. in diameter, of white silk, inclosing the larva curled up within," and referred to an "unknown Tineid." Different names have been given to these interesting objects by recent writers, as cocoonets, cocoons, and pseudo-cocoons. They are, strictly speaking, cocoons, but as it might be confusing to refer to them by this name, any misapprehension would be prevented by calling them "molting cocoons," as suggested by Mr. Brunn in the first description of the structure. Their manner of construction, entrance into them, and occupancy will probably be found to agree with that of the larva of *Bucculatrix pomifoliella*, minutely given by Mr. A. E. Brunn, in the Second Report of the Department of Entomology of the Cornell

University Experiment Station, 1883, p. 158. As the publication is not accessible to many, the description is quoted:

When the larva has made a mine from one-half to three-fourths inch long, which it does in from four to five days, it eats its way out through the upper surface; then somewhere on the upper surface of the leaf it weaves a circular silken covering about one-twelfth inch in diameter. Stretched out on this network, the larva, which is now 2.6 mm. long, makes a small hole in it near its edge, then, as one would turn a somersault, the larva puts its head into this hole and draws its body after. Arriving inside the "molting cocoon," as it may be termed, on its back and doubled in the shape of a horseshoe, the larva is then ready to strengthen the cocoon and close the opening which it made in entering. The larvæ make these cocoons in from fifteen to thirty minutes, and usually within two hours after leaving the mine. * * * Having molted, the larvæ leave their cast-off skins in the molting cocoons and cut their way out; they remain in these cocoons in most cases less than twenty-four hours.

The molting cocoon is represented at *b*, Figure 2, showing its peculiar central spot, or depression, or both.

The Cocoon.

The cocoon is a pretty little object with its five, or sometimes six, sharp ridges,* of which four are seen in a dorsal view, crossing over its entire length from one end to the other in parallel lines and uninterrupted except as they may be broken near one end where the cocoon is joined in its construction. The base is flat; the ends rounded; color, yellow-green. Length, 0.15 to 0.19 inch; breadth, 0.05 inch.

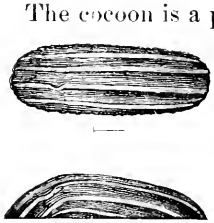

Fig. 4—Cocoon of the birch-leaf Bucculatrix, Bucculatrix canadensisella: side view and from above (original).

It is quite different in appearance from that of *Bucculatrix pomifoliella* Clem., in several particulars, viz.: in its yellow-green color, instead of white; its sharper and more distinct ribs; its rounded instead of pointed ends; its base flattened to nearly its broadest diameter in place of being strongly contracted at the sides; its ridges distinct to the extreme tips instead of uniting near them; and the more conspicuous joining of the cocoon near one end. Cocoons are represented in

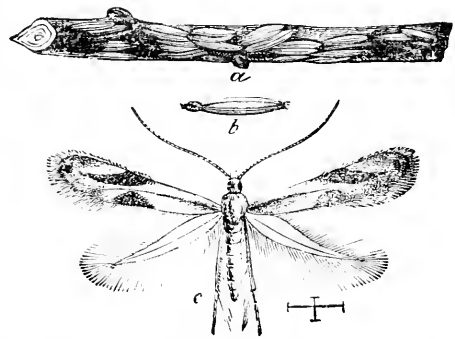

Fig. 5.—Apple-leaf Bucculatrix, Bucculatrix pomifoliella; *a*, piece of twig covered with cocoons; *b*, cocoon enlarged; *c*, the moth, enlarged.

*Mr. Fletcher (*loc. cit.*) gives "about eight prominent ridges," and Dr. Packard, "eight sharp, high ridges." I never saw them with so many.

Figures 2*g* and 4. Those of *Bucculatrix pomifoliella* are shown, for comparison at *a* and *b* in Figure 5.

The cocoons have only been observed upon the leaves, but as they are seemingly too few for such an abundant larval presence, it is probable that many of them are made on leaves that have fallen to the ground, or possibly, on or beneath the bark of the trunk, or even on adjoining trees and shrubs, as some of the species of Bucculatrix are known to have a fondness for traveling. None were found on the small twigs that have been sent me with the leaves.

The construction of the cocoon is an interesting operation to watch. It differs in method from that with which we are familiar in many of the Bombycid and other moths where the caterpillar spins its thread around it, and gradually hides itself from view. In its early life the birch-leaf caterpillar had been an outside builder, as will be noticed hereafter, and its habit is not abandoned in this its mature stage.

The cocoon is apparently commenced by the caterpillar marking out with a few threads laid upon the surface of the leaf the outline of one end. From this, as the base of operations, the ribbed walls are built up in the following manner: Its thread is fastened at one end of the basal line, and then carried over in the required curve and at a slight elevation to the other side where it is fastened to the base. The thread continues to be carried from one side to the other, but not in single curves made by one sweep of the larval head. If closely noticed through a lens (as these observations were made), the head will be seen moving in a series of concave curves, resting momentarily at the four or five points where the ribs are being formed. Thread after thread is thus rapidly carried over; the base is gradually widened as it approaches the middle part; the short curved sweeps of the larval head build in the ribs and the depressed portion between them, while each thread is applied, and apparently adheres closely, to the preceding. This is continued without cessation, and as the building progresses the caterpillar gradually moves backward before its advance. Whether its eyes or the length of its head serves as the only measure for the diameter of the cocoon is not known. Possibly its body may be used as a guide after the manner of the caterpillar of a Limenitis butterfly, which repeatedly during the construction of its hibernaculum creeps within it as if to test the dimensions of the silken-lined leaf-tube within which, with entrance left unclosed, it is destined to pass the winter.

When the cocoon is about three-fourths completed, a new procedure ensues: the caterpillar arrests its work, turns itself about, and moves

backward within its walls — its head and two or three of its segments projecting. The other end is now commenced, and is extended backward on the same plan and in the same manner as before, until the two portions are united. Sometimes the joining is so accurately made that it can hardly be detected; the ridges are in exact line and only a slight elevation or other irregularity is visible. In others the ridges, instead of aligning, are interposed at the suture, and a perceptible hump marks the place. For a short time longer the caterpillar may be seen through the translucent walls, actively twisting its front segments backward and forward, as additional threads are being thrown over the joining to unite the two portions, and the strikingly ingenious piece of insect architecture is finished.

Since the above was written my attention has been drawn to the detailed account given by Mr. Chambers in the *Canadian Entomologist*, vol. xiv, 1882, pp. 157–160, of the building of the cocoon of another species of *Bucculatrix*, viz., *B. ambrosiæfoliella*. It differs materially from that above described, in that "a reticulated framework" is at first constructed (of which a diagram is given by Mr. Chambers), and "the cocoon proper" afterward spun within it.

No specimens of the cocoons of *B. Canadensisella* are at hand which would serve to show if they also are double, but I would expect to find them single — simply reinforced with additional threads within.

I am unable to reconcile what I saw, or at least thought that I saw, in the construction of the cocoon of *B. Canadensisella* as above described, with Mr. Fletcher's account of the same operation, given in his Annual Report for 1892 (*loc. cit.*): "A mat was first spun on the surface of the leaf, then the foundations of the ribs were begun. Little by little they were continued, and the meshes of an open network stretched between them, the caterpillar all the while retreating backwards as the structure advanced."

There was certainly no "open network" in the cocoons that my caterpillars built before my eyes. Strange that they should have done so differently from what they ought to have done "according to the books." Mr. Chambers, who was a close student of the habits of Bucculatrix larvæ, has stated: "All other known species of the genus, save one, make these ribbed cocoons, and to do so, they must work much as this [*ambrosiæfoliella*] does."

The building of the cocoon of the common *B. pomifoliella* has probably never been observed, as no account of it has been given to us.

The Moth.

The moth is so well shown in Figure 2, that it can hardly fail of recognition when the comparison is made, but, as of possible service to the student, the original description by Mr. Chambers is transcribed:

Head white; tuft tipped with dark reddish-brown, and the face faintly tinged with purplish fuscous. Upper surface of the thorax brown margined by white. Base of the fore-wings white, followed by an oblique brown fascia, which is nearest the base on the costal margin, and is followed by an oblique parallel white fascia; all of these are placed before the middle, and are followed by a large brown patch which occupies the entire wing to the ciliæ [cilia], except that it contains a white spot on the middle of the costal margin; the brown patch is margined before on the dorsal margin of the wing by a small tuft of raised brown scales; at the beginning of the dorsal ciliæ is a white spot placed a little before, but becomes almost confluent with a longer white costal streak; behind these streaks to the apex of the wing is pale brown, with a darker velvety brown apical spot; ciliæ pale yellowish, with a dark brown hinder marginal line before their middle, not extending to the costal ciliæ. Expanse of wings, three-eighths of an inch.— From Canada.

Mr. Fletcher's description of the fore-wings will give a better idea of their general appearance:

Wings crossed with silvery white bars; three of these run from the outer edge about half way across the wings obliquely toward the apex, and there are two shorter subtriangular blotches on the inner margin of each fore-wing. These latter, when the wings are closed, form two white dorsal saddles, the anterior of which is slightly the larger and is followed closely by a tuft of raised black scales. At the extremity of the fore-wings are also several raised black scales, a few of which are separated into an apical spot by an irregular narrow white band. The cilia of the fringes are pale brown.

Life-history and Habits.

The life-history of this insect is as yet unknown. Neither the eggs of the moth or the mining operations of the larvæ have been observed. The following seems to be about all that is known of the insect:

Larvæ had built their cocoons at Ausable Forks, N. Y., on September 8, 1886. Of examples received from Monroe county, N. Y., on September fourteenth, a few had already made their cocoons, and the following day nearly all had completed or commenced their construction. The larva eats the parenchyma out of both sides of the leaf. In confinement it walks slowly, often dropping down and hanging by a thread. The first week in September larvæ were seen within their molting cocoons, and previous to that had been noticed feeding exposed and eating little holes in the upper surface of the leaves, at Brunswick, Me.

They were abundant in Massachusetts during the second week in September, 1892, on *Betula populifera*. (Packard.)

Larvæ received September 13 and 15, 1890, from Massachusetts, gave cocoons later, moths from which emerged from January until March. (Riley–Howard.)

The injuries of the larvæ become noticeable in August, when the leaves assume a rusty or burned appearance and fall prematurely. Since 1890, all varieties of birches in the vicinity of Ottawa have been attacked, but *Betula alba* most severely; *B. papyrifera* and *B. lutea* almost as severely. They are particularly partial to the European cut-leaf weeping-birch. A few cocoons have been found on twigs, but the main body must spin elsewhere. They are not spun on the leaves except in confinement. (Fletcher.)

Distribution.

Thus far, the insect has only been reported from Canada, New England States, and New York, but it will undoubtedly be found to have a wider distribution. It was originally described from specimens received from Mr. F. H. Belenger of the Université Laval, Quebec. The recorded localities are Ottawa and vicinity (Fletcher). Brunswick, Me.; Bristol county, Mass.; Providence, R. I. (Packard). East Norton and West Bridgewater, Mass. (Riley–Howard). Scottsville, Plattsburg, and Albany (Lintner).

Remedy.

Whenever it shall be found necessary to check the attacks of this insect, on ornamental or shade trees, it can be done by spraying the foliage of the infested tree during the latter part of August or the first of September with a weak mixture of Paris green or London purple—one pound to 300 gallons of water.

Diplosis pyrivora Riley.

The Pear Midge.

(Ord. DIPTERA: Fam. CECIDOMYIDÆ.)

? *Cecidomyia nigra* MEIGEN: Syst. Beschr. bek. europ Zweifl. Insek., 1818, pl. iii, fig. 11; cited in Macquart's Hist. Nat. Ins.–Dipt., i, 1834, p. 161.

? *Cecidomyia nigra* Meig.: SCHMIDBERGER, in Kollar's Ins. Inj. Gard.-For.-Farm., 1840, pp. 292–295 (general account).

? *Cecidomyia pyricola* NÖRDLINGER: Die Kleinen Feinde, 1869, p. 622.

Cecidomyia nigra: ORMEROD: [7th] Rept. Obs. Inj. Ins., 1884, pp. 52–54 (operations, habits, remedies).

Cecidomyid larva SMITH: in Ann. Rept. Dept. Agricul. for 1884. 1885, pp. 396–398, pl. 9, fig. 6 (at Meriden, Conn., larva figured).

Diplosis nigra [?]. RILEY: in Ann. Rept. Dept. Agricul. for 1885. 1886, pp. 283–289, pl. 7, figs. 2, 3, 4 (history, habits, description, remedies, etc.); in Wien. Entomolog. Zeit., vi, 1887, p. 201.

Diplosis pyrivora RILEY–HOWARD: in Insect Life, i, 1888, p. 120 (in England); in *id.*, ii, 1889 (in England); in *id.*, iv, 1891, p. 161 (in New York).

Diplosis pyrivora. MEADE: in Entomologist, xxi, 1888, pp. 123–131.

Cecidomyia nigra. BLOOMFIELD: in Ent. Month. Mag., xxiv, 1888, p. 273 (operations in England); in *id.*, xxv, 1889, p. 323.

Diplosis pyrivora. LINTNER: in Albany Eve. Journ., May 30, 1891, p. 8, c. 1; in The [New York] Sun, June 1, 1891, p. 3, c. 5; in Oswego Daily Times, June 3, 1891, p. 5, c. 2, 3; in Garden and Forest, June 10, iv, 1891, p. 276; in New Engl. Homestead, June 13, 1891, xxv, p. 249, c. 4; in Canad. Entomol. xxiii, 1891, p. 223.

Pear midge. COE: in Count. Gent., lvi, 1891, p. 896 (injuries lessening).

Diplosis pyrivora. SMITH: in Insect Life, iv, 1891, p. 45 (in New Jersey); in Ann. Rept. N. J. Agr. Exp. St. for 1891, pp. 397–402, figs. 18, 19 (life-history, spread, remedies); in Insect Life, v, 1892, p. 94 (in New Jersey).

Cecidomyia nigra Meig. RITZEMA BOS.: Tierische Schädlinge und Nützlinge, 1891, p. 587.

Cecidomyia nigra Meig. THEOBALD: British Flies, 1892, p. 64 (in England).

The Pear-tree Seriously Attacked.

It is quite remarkable that while the apple tree has drawn to it, in this country, 280 known species of attacking insects, and a large number of them quite injurious ones, the pear tree should have so long escaped with but a moderate amount of insect injury, either to its trunk, its foliage or to the fruit. Its worst enemies have never been very destructive, and nearly all of them are only of occasional occurrence and local in their operations. Mr. E. P. Powell, a successful pear grower in central New York, has recently written: "The apple has four serious enemies [referring to the codling-moth, the tent-caterpillar, the apple-tree aphis and the fall web-worm], while apart from blight, the pear has none."

At the present time, this favorable condition of the pear seems to be seriously threatened, and pear growers in the Hudson river valley are confronted with two small insect pests, either of which, should it continue to multiply and extend, as it gives promise of doing, would prove a greater obstacle to successful pear culture than all of our other pear insects combined. While the pear midge confines its operations to the fruit, the pear Psylla not only blights the fruit but may so impair the vitality of the tree as eventually to kill it. This last-named insect will be noticed hereafter.

What the Pear Midge Is.

The perfect insect is a small, grayish-colored, delicate-winged, slender-bodied, long-legged fly, of the general appearance of the minute flies which are commonly known as gnats or midges. With its wings expanded, its spread would be about one-fifth of an inch. It is represented in Figure 6, at *a*. The larva of the fly, found feeding within the young fruit, when full-grown, about the first of June, is a thick-bodied, pale-yellow, footless "maggot" (as the larva of flies is usually called), somewhat pointed at the ends, and of about one-tenth of an inch in length. Those familiar with the appearance of the wheat-midge (*Diplosis tritici*), commonly known as the "weevil," would at once recognize the resemblance of the two forms, as they belong to the same genus, and are not much unlike.

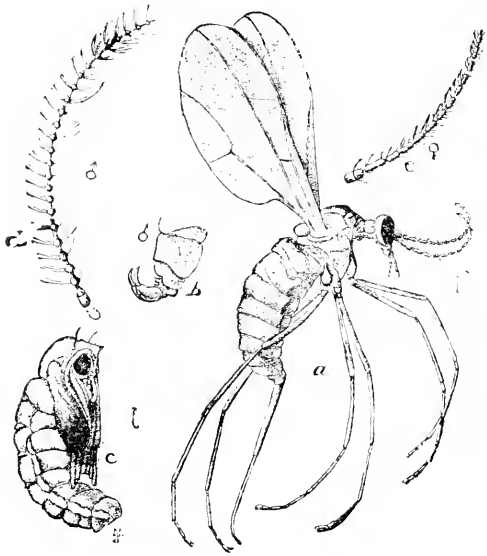

FIG. 6.—The Pear Midge, DIPLOSIS PYRIVORA: *a*, the female, side view; *b*, genitalia of male, from side; *c*, pupa—all much enlarged; *d*, antenna of male; *e*, antenna of female, still more enlarged.

Its First Notice in the United States.

It is believed that this insect is an European species, and that it was introduced in this country in the year 1877, in an importation by Messrs. Coe Brothers, of Meriden, Conn., of pear stocks from France—the pupæ being contained in the soil adhering to the roots. Two years after this importation (1879) the deformation of the fruit caused by the insect was noticed in the Coe orchards—at first in the Lawrence pear, and afterwards extending to other varieties. Each following year showed a marked increase, and in 1883 it had multiplied to such an extent as to destroy nearly the entire crop of the extensive pear orchards of 600 trees. At this time the attention of the Division of Entomology of the United States Department of Agriculture was called to the new and unknown pest, and in response the locality was

visited by Mr. John B. Smith of the Entomological Division, who made report upon it, as published in the Annual Report of the Department for that year. A more extended report was made by Dr. Riley in the year following, embracing figures of the insect, its life-history and habits, and detailed descriptions, under the name of *Diplosis nigra* Meigen. From this report the figures of the insect herewith presented, are drawn, as also the facts relating to its introduction as above given.

Identity with the European Species.

Although there seems to be but little question of its identity with the species described by Meigen as *Cecidomyia nigra*, yet as not a single specimen of Meigen's *nigra* can be found for comparison in any of the European collections, and as the original description is quite imperfect, Dr. Riley was advised by the European authorities to redescribe and rename it, which he has accordingly done, designating it as *Diplosis pyrivora*. The name was subsequently accepted by R. H. Meade and other eminent dipterologists in Europe.

Efforts for Its Extermination at Meriden.

Realizing the importance of suppressing so destructive a fruit pest while confined in its limited locality, the Messrs. Coe resorted to the heroic treatment of picking off their entire crop of pears in 1883, it being an "off year" when the yield was comparatively light, and burning it with the contained larvæ. But before the entire completion of the task a heavy rain set in, which caused the infested fruit to break open and release the inmates. When the work was resumed it proved to be too late, as all of the larvæ had deserted the fruit and entered the ground. It was also discovered that a neighboring orchard had become infested. But for these two unfortunate circumstances — or if the effort had been made a little more timely, there is every probability that the insect might have been exterminated, and losses to our fruit growers which may run into the millions of dollars might have been prevented.

It was hoped that the spread of the insect had been largely arrested by the above means, as nothing had been heard of its presence in other localities for the ensuing six years.

Discovered at Catskill, N. Y.

During the last week in May of the present year (1891), some young pears were sent to me from Catskill, N. Y., with the inquiry of the name of the attacking insect. The nature of the inquiry was not evident at the first inspection, as the fruit was fair, unbroken, and showed no external injury — its peculiar deformation being unnoticed. But upon cutting into one the interior was found to be occupied by a large company of active little bodies which, wriggling out and dropping to the table, commenced to give evidence of their sharing in the saltatory powers belonging to many of the Cecidomyids and particularly to the genus *Diplosis*, by throwing themselves from a small box in which some had been placed to a distance of two inches and more in a single bound. The attack upon the fruit was at once recognized as that of the pear midge, *Diplosis pyrivora*.

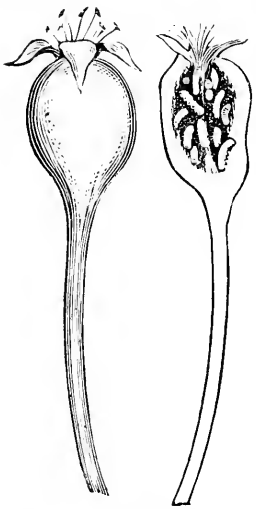

FIG. 7 — Section of a pear containing the larvæ, and an uninfested one for comparison of forms (original).

In a visit to Catskill immediately following this discovery, all the orchards that could be examined during the day, within a radius of two miles, were found badly infested with the insect, and its presence in other orchards more distant was reported. In those of Mr. Theodore A. Cole, where it was first detected, the attack was the most severe. There were here many old and quite large Lawrence pear-trees, heavily laden with fruit, but an examination showed that at the least ninety per cent of the fruit was filled with the full-grown midge larvæ. Other varieties were infested in a less degree, among which were the Vicar, Anjou, Seckel, Bartlett, and Buerre Bosc. Mr. Cole had observed the attack in his orchards four years previous (in 1887); in 1889 the Lawrences were almost entirely destroyed by it. He had neglected calling attention to it until the present season, thinking that it was a well-known trouble which could not be prevented.

In passing over the orchards and observing so large a proportion of the fruit infested, Mr. Cole asked—"how can this condition follow a year (1890) in which I had no pears: where did the midge breed?" This could not be answered until, upon coming to some Buerre Bosc trees which were now for the first time found to contain the larvæ, Mr. Cole recalled the fact that this variety had borne some fruit the preceding year and was the only one that had done so. How the midge had been carried over "a no pear year" was at once satisfac-

torily explained. Had there been absolutely *no* fruit in which the larvæ could have fed within reach of the flight of the parent midge at the time for its oviposition, the species would probably have been exterminated within that locality, for it is not known to occur in any other fruit than the pear. It is possible, however, that if there should be in any year no pear-blossoms to receive the eggs, that the midge might resort to apple trees for oviposition, and thus originate a new food-plant for its perpetuation. This consideration may have a bearing in the direction of methods for the extermination of the pest.

Deformation of the Infested Fruit.

The presence of the larvæ within the fruit causes it to enlarge and swell out irregularly, assuming various forms, — the most marked and striking of which are represented in the accompanying illustration.

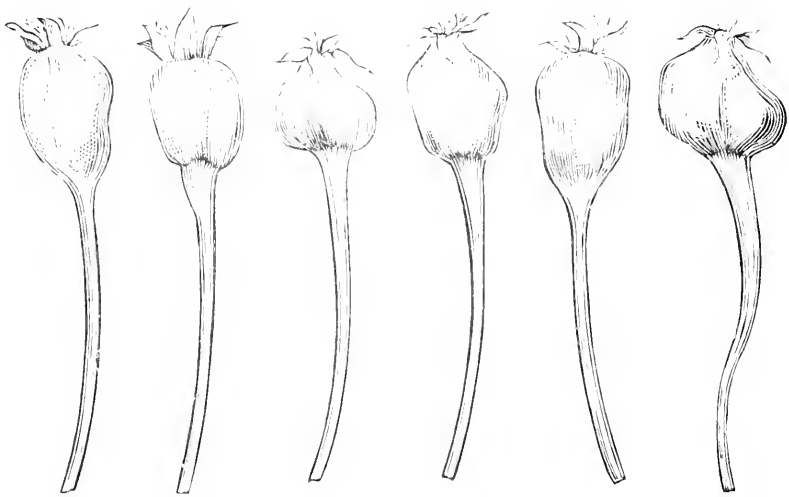

Fig. 8 — Young pears deformed by the pear-midge larvæ — natural size. (Original.)

The more usual form observed about the 1st of June when the larvæ have attained maturity, is that in which the upper three-fourths of the pear has become enlarged and swollen out into irregular protuberances, and showing an abnormal color, quite in contrast with that of the seemingly contracted base.

So conspicuous are these features that every infested pear on a tree can be recognized without difficulty. Any that are without distortion and of normal shape, if cut open, would be found entirely free from attack.

Much earlier than this, according to Mr. Cole, the midged fruit can be readily detected — more easily, if possible, than at a later period; for soon after the falling of the blossoms, the operations of the larvæ cause a marked enlargement of the forming fruit, which is presumably (although it was not so stated) accompanied with more or less distortion.

On cutting open the fruit, a large central cavity is seen within it, occupying most of its interior, quite irregular in form and often made up of smaller cavities separated by thin walls or by the remains of the core. Among these the larvæ are distributed, instead of being collected in one mass. Repeatedly, when all had been removed that were at first visible, sometimes as many more could be extracted or would creep out from side cavities. The average number of larvæ occurring in the Catskill fruit may be stated at twenty. In one pear thirty-four were counted.

How the Larvæ Leave the Fruit.

The infested fruit does not fall from the tree. The first rain of several hours' duration that may occur about the 1st of June causes the fruit to crack open, sometimes at different points, but often in an interrupted line around the enlarged portion near the base. Through these gaping openings the larvæ, now mature, find easy egress, when they at once emerge and drop to the ground. Or the rain, under different conditions of the fruit, may cause it to soften, blacken and decay in spots, and these would serve as outlets for the larvæ. So eager do they seem to be for their escape that a rain of twenty-four hours' duration would be followed by the emergence of considerably the greater part of them within a day thereafter.

Wet, and its attendant breaking down of the structure of the pear, seems indispensible for freeing the larvæ and their subsequent development. I have not known them to emerge through the calyx end, and do not believe that they ever do so. Some infested fruit picked on the 25th of May before rain had fallen and brought to my office, gradually dried up unbroken and blackened, without releasing a single one of its occupants. On the 15th of June living larvæ only were contained in the dried fruit. On the 25th of August a few of the larvæ were still alive, but most had died; at the present date, October 10th, all that I examine are dead and hardened. The fruit, having given out its larvæ as above described, continues to hang upon the tree for a while thereafter, but in a few days shrinks, blackens, and falls to the ground. Under date of June 10th Mr. Cole reported that nearly all of the midged pears had, at that time, fallen.

The Larva Described.

The following description is extracted from Dr. Riley's Entomological Report for the year 1885, together with the accompanying figures:

Length 4mm to 4.5mm. Color, pale yellow. Surface polished and very faintly reticulated. Breastbone pale brownish, its apex broadly bilobed. (In the figure it is represented as rather too long for its width.) Body (thirteen joints and subjoint) fourteen-jointed, exclusive of the head. Antenna two-jointed. Anal subjoint much narrower laterally than the penultimate, slightly concave, the concavity beset with six (three each side) small, fleshy tubercles (the two middle ones are not shown in the figure), of which the second one on each side is stoutest, those on the external angles bearing each a short spine. Spiracles normally placed and mounted on tubercles.

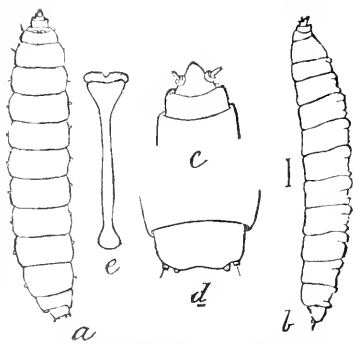

Fig. 9.—The pear-midge: *a*, dorsal view of the larva; *b*, side view; *c*, head and front segments; *d*, last segment; *e*, "breastbone"—all much enlarged.

Entering the Ground for Pupation.

Pears received from Catskill, through the kindness of Mr. Cole, on the 30th of May, after they had been exposed to a heavy rain and were cracking open freely, were already giving out their larvæ very abundantly. About five hundred of these were given common earth in a flower pot, which they speedily entered. The pot was buried in my garden, with its top at the surface of the ground, where it will be left until the coming spring under conditions natural to the insect. A still larger number were given, on June 8th, damp molding sand for burial, as offering facilities for their occasional observation. A jar of these containing two hundred was carefully examined a week thereafter (June 15th), when a single cocoon was found at the depth of a half-inch, several at one inch, a number at one inch and a half, thence to two inches a large number, and to two and one-half inches quite as many; below this none were found. All but four of the larvæ had made cocoons, and these had evidently received some harm. It may be inferred from the above that in ordinary soil, not as penetrable as the molding sand, the larvæ ordinarily bury at a depth of between one and two inches. A cocoon opened July 6th contained the larva with a thin pellicle attached to its terminal end which had apparently been cast off by it.

Pupation.

The pupation is within an oval cocoon, composed (in the above) of grains of the sand united and lined with yellowish silk, somewhat flat-

tened, with its longest diameter exceeding its transverse by about one-half. The cocoons differ perceptibly in size, but average one-tenth of an inch in length,—ten taken at random measuring just one inch.

Opening a few of the cocoons on October 12th, somewhat more than half had changed to pupæ. These agreed with the description given of this stage by Dr. Riley in his Report for 1885 (*loc. cit.*), but differed in the examples examined from his figure (see *c* in figure) in that the leg-cases reached quite to the tip of the abdomen, even when straightly extended, instead of only to its sixth segment.

The larvæ that were planted out of doors have not been examined, but it is probable that they will hibernate in the larval stage.

At Washington, the winged midge was obtained from examples bred in the warmer temperature of the vivarium during the months of January and February,* while others, presumably under natural exposure, emerged from April 10th to 13th. Their usual time of appearance is probably coincident with the putting out of the blossom buds of the pear.

The Winged Insect.

The general appearance of the midge is represented in Figure 6. Its more conspicuous features, borrowed from Dr. Riley's detailed description, are these: The male. Average length, one-tenth inch; general color, dark gray or black; eyes, deep velvety black; antennæ, one-fifth longer than the body, black, with twenty-six globose joints; thorax, dark dull gray or black, with two diverging rather indistinct gray stripes, and beset with long yellowish hairs; wings, slightly smoky, darker veined and covered with a sparse black pubescence, and having a black fringe; halteres, or balancers, pale yellow; legs, dusky with a yellowish tinge; abdomen, dark gray, almost black dorsally, terminating in a pair of two-jointed claspers, shown in enlargement in Figure 10, in which *b* are the claspers and *c* the intromittent organ.

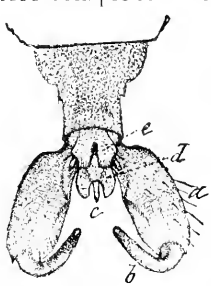

FIG. 10.—Genitalia of the male pear midge, DIPLOSIS PYRIVORA. (After Riley.)

Female, 0.13 in. long, exclusive of ovipositor, which extended is as long as the abdomen. Antennæ, fourteen-jointed, slightly longer than the head and thorax together. General color somewhat lighter than the male.

The Egg-laying.

I know nothing, personally, of the oviposition of the midge, nor have I knowledge of any other record of it than what is based on Schmid-

*Schmidberger had it emerge as early as the 28th of December.

berger's observations as recorded of *Diplosis nigra* in *loc. cit.* This is so circumstantial, that it seems deserving of acceptance as having been carefully observed by him, and conclusive as to the time and manner of the egg-deposit. That the eggs are deposited in the blossom, rather than in the young fruit as believed by some, * finds seeming confirmation in the fact stated by Mr. Cole, that upon the falling of the blossom petals and the first forming of the fruit, the presence of the larvæ may be already detected in the abnormal growth.

Schmidberger's account is as follows:

When the blossom-buds of the pear-tree were so far developed that in the single blossoms a petal showed itself between the segments of the calyx, I found the first gall-midge in the act of laying its eggs in the blossom; this was on the 12th of April. It had fixed itself almost perpendicularly in the middle of a single blossom, and having pierced the petal through with its long ovipositor, it laid its eggs on the anthers of the still closed blossom. The female was about seven and a half minutes in laying her eggs. When she had flown away, I cut the pierced bud in two, and found the eggs lying in a heap one upon another on the anthers. They were white, longish, on one side pointed and transparent, and from ten to twelve in number. I afterwards found several midges engaged in laying their eggs, as late as the 18th of April, from which day they ceased to appear in the garden. I also saw a gall-midge on the side of a blossom with its ovipositor inserted in it, so that they do not merely pierce the petals but the calyx also. I even saw one, which having been somewhat long in laying its eggs, could not draw out the ovipositor from the blossom; the cause of which I conceived to be, that the wound had begun to close during the operation, and the ovipositor was thereby held.

Schmidberger further states that the eggs are quickly hatched in warm weather, for on the fourth day after the deposit he had found the small larvæ on the embryo blossom. They bore into it near the calyx, and before the blossom is expanded, they descend to the core, so as not to be exposed to the rays of the sun. They separate at the core and begin to devour on all sides.

Distribution of the Midge.

The midge still continues its work at Meriden, Conn., where it was first detected, but with less severity than at first. Mr. Coe has written to me recently that it has this year taken one-half of his Lawrence and Dana pears on about three hundred trees.

When first discovered at Catskill, I thought it probable that it had been brought in trees purchased in Meriden, but was assured that none had been introduced from that locality or imported from abroad.

* See Professor J. B. Smith, in *Insect Life*, iv, 1891, p. 45.

In a visit made to the pear-orchards of Mr. George T. Powell at Ghent, N. Y., on June 8th, the work of the midge was seen, although less severe than at Catskill, but occurring in a larger number of varieties of the fruit.

At this date, all the fruit attacked had passed its knobby, swollen, gall-like stage, and had become shriveled and black and more or less cracked or broken about the base, while still fast on the trees. Upon cutting them open the irregular cavity within showed the work of the larvæ. In a few instances some of the larvæ still remained within the fruit.

Ghent is fifteen miles in direct line from Catskill, and each locality is about ninety miles from Meriden. It is probable that the attack has been gradually extending westerly (presumably in other directions also) until it has reached the fruit region of the Hudson river valley, where, unless efficient means can be found for its control, it will continue to extend its range. It is reported as quite bad at Athens, six miles to the north of Catskill. It has not yet reached as far north as Albany, in force, although it is actually present in this locality, for examination of pear trees in gardens in the city, gave me a single pear hanging on a tree, June 6th, which had unmistakably harbored and given out the midge larvæ.

Remedies.

From the peculiar concealment of this insect within the fruit during its egg and larval growth to maturity, where it is effectually beyond the reach of the sprayed insecticides, the question of how it can be reached and destroyed, finds no ready answer. At first sight, it would seem, that since every infested pear can be readily and unerringly recognized, the method adopted at Meriden of picking and burning the infested fruit while containing the larvæ, would be all that could be desired. This would not be a difficult task in a young orchard, but when trees have attained the size of the Lawrences growing in the orchard of Mr. Cole at Catskill, viz., twenty-five feet in height with a spread of about twenty feet, it is virtually impracticable.

Mr. Cole at first thought of meeting the difficulty by cutting down and burning in the following month of May, after the oviposition of the midge, all of the old and large Lawrence trees which were yielding him scarcely any fruit. On reflection, he concluded that they might serve a more valuable purpose by allowing them to stand as lures for the reception of much the larger proportion of the eggs that would be deposited by the midges in an orchard of different varieties. As soon

as the time of oviposition had passed, which would be before the blossoms had fallen, the blossoms could be sprayed with some substance that would blight them, when the larvæ, being left without their food, would die. In the discussion of this proposed remedy by the Entomological Club of the A. A. A. S. at its recent Washington meeting, Mr. Fletcher, Entomologist and Botanist of the Government Experimental Farms of the Dominion of Canada, suggested that the blighting might be done by the arsenites, and preferably, by London purple on account of its causticity: but if there was possibility that honey bees visiting the blossoms might be injured thereby, sulphate of copper might be used instead.*

A few years' sacrifice of the Lawrence pear crop, in the above manner, should tend largely toward the reduction in numbers of the midge. It is probable that the other pears do not offer as favorable conditions for its multiplication. Should the Dana's Hovey, or some other variety hereafter be found almost as attractive as the Lawrence, it also, in turn, might be given the same treatment. When by this means the insects have been largely reduced, it would not be difficult to control the attack by hand-picking and burning.

Another means of destroying the insect after it has left the tree is this: The larvæ, upon dropping to the ground, enter it to the moderate depth of an inch or two, where they remain in their larval stage for two or three weeks before they inclose themselves within their cocoons. At this time they could be reached and killed by spraying over the ground directly beneath the trees a strong kerosene emulsion. Experiment and examination would show the maximum amount of the liquid required. The cost of this would be very slight in comparison with the value of the pears saved. Or the same end would probably be attained by spreading lime or ashes on the ground, to be carried into it either by the rain or by sprinkling with water. Of course, if these measures were delayed until after the larvæ were sheltered within their cocoons, their efficacy would be impaired. It must also be evident that if this destructive pest is to be controlled, that just so far as it is found to have extended, all pear growers should unite in an earnest effort for its extermination. A golden opportunity was lost while it was limited to the Coe Brothers' orchard at Meriden, but it seems to be quite practicable to prevent its spread much beyond its present range.

Canadian Entomologist, xxiii, 1891, p. 224.

Clastoptera obtusa (Say).

The Ob use Clastoptera.

(Order HEMIPTERA: Subord. HOMOPTERA: Fam. CERCOPIDÆ.)

SAY: Descr. New Hemip. Ins. in Exp. Rocky Mts., Journ. Acad. Nat. Sci. Phila. iv, 1825, p. 339; Compl. Writings, ii, 1886, p. 256 (as *Cercopis*).

FITCH: in 4th Ann. Rept. [N. Y.] St. Cab. N. H., 1851, p. 73 (*C. achatina* Germ.); in Trans. N. Y. Agr. Soc. for 1856, xvi, p. 466; 3d Rept. Ins. N. Y. (in 3d–5th Repts.), 1859, p. 148, no. 192 (characterized).

GLOVER: in Rept. Commis. Agricul. for 1876, 1877, p. 31, f. 29 (brief notice).

UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 244 (its features).

COMSTOCK: Introduc. Entomol., 1888, p. 178 (from Uhler).

PROVANCHER: Pet. Faun. Ent. Can.—Hemipt., 1889, p. 259 (description).

LINTNER: 5th Rept. Ins. N. Y., 1889, p. [100] 242; in 42d Rept. St. Mus., 1889, pp. 242–246 (general notice).

PACKARD: Bull. No. 7, U. S. Ent. Commis., 1881, p. 88 (quotes Fitch); 5th Rept. U. S. Ent. Comm., 1890, p. 342 (on butternut).

VAN DUZEE: in Canad. Entomol., xxi, 1889, p. 8 (on blueberry in Canada).

OSBORN: in Proc. Iowa Acad. Sci., i, 1892, p. 127 (in Iowa).

SOUTHWICK: in Science, xix, 1892, p. 318 (mention).

The Insect on Linden.

Leaves of the linden tree, *Tilia Americana*, were received June 22d, 1891, from Mr. D. J. Garth, of Scarsdale, N. Y., having on their stems large masses of the "cuckoo-spit," from which the small ivory-white larvæ which had produced it, had crept out and were actively traveling over the leaves and the box in which they were inclosed. Mr. Garth wrote:

I have a large Linden growing on my lawn, which has on the stems of the leaves where they join the branches, a substance that looks like the white of an egg beaten to a froth, and small insects within it like those that I send you for examination and report. I have never seen this before, and as it appears to cover the entire tree, I fear that damage may result from it.

Its Habits and Injuries.

Mr. Garth was informed that the examples sent were the larvæ of one of the tree-hoppers, or "spittle insects" as commonly known, which feed on the juices of the trees that they infest, sometimes injuriously, and that the froth-like substance in which they were hidden, was a protective excretion from them, thrown out after the manner, and for the purpose stated in the *Fifth Report Insects New York*, 1889, in the account of the "Alder Spittle-Insect," p. 242. As they were apparently nearly full-grown, and, probably, not excessively abundant, the injury that they would inflict upon the tree through sucking its sap, would not be sufficiently severe to render necessary a resort to means for their destruction.

Change to the Perfect Stage.

A few days thereafter, on June 26th, the perfect winged forms were disclosed, showing them to be *Clastoptera obtusa* (Say), and therefore identical with the Alder insect, to the history of which reference is above made. Its development was unexpectedly rapid, for when received on the 23d, no pupæ were observed, and only four days thereafter the perfect insect was found in the box, so fully colored that it must have emerged from the pupal case the previous day. The insect is shown in Figure 11.

Fig. 11 – The obtuse Clastoptera, C. obtusa. (Original.)

Food-plants.

Those that were observed in 1889 (see *loc. cit.*) occurred on the alder, *Alnus serrulata*, upon which it had been reported as common by Mr. Uhler.

Dr. Fitch includes it, in his 3d Report, among the Insects of the Butternut, adding, that it may frequently be met with on quite a number of different trees and shrubs, from the middle of July till the end of the season.

Dr. Packard, in his *Insects Injurious to Forest and Shade Trees*, names it, on the authority of Dr. Fitch, among the Insects of the Butternut, but without mentioning its occurrence on any other tree.

Mr. E. P. Van Duzee, in his *Hemiptera from Muskoka Lake District*, Canada, gives it as very common on the blueberry, in company with *Clastoptera Proteus*, during the latter part of July, 1888.

There seems to be no previous record of its observation on the linden.

Distribution.

It apparently extends over a large portion of the United States and Canada. Say, in his original description, gives it as inhabiting "the United States." It was found by him in the Northwest near Council Bluffs. Provancher gives it as very common in Canada. Uhler states that it is found in many parts of the Eastern United States and in Texas, and extends also to Tamaulipas, Mexico.

Clastoptera pini Fitch.

The Pine Clastoptera.

(Ord. Hemiptera: Subord. Homoptera: Fam. Cercopidæ.)

Fitch: in 4th Ann. Rept. [N. Y.] St. Cab. N. H., 1851, p. 53: in Trans. N. Y. St. Agricul. Soc. for 1857, xvii, p. 738: 4th Rept. Ins. N. Y. (in 3d-5th Repts.), 1859, p. 52, No. 259.

Packard: Full. No. 7, U. S. Ent. Commis., 1881, p. 216 (quotes Fitch): in 5th Rept. U. S. Ent. Commis., 1890, p. 802, f. 272 (quotes Fitch).

Provancher: Pet. Faun. Ent. Canada, iii,—Hemipt., 1886, p. 260 (?var. of *C. Proteus*).

From Miss A. H. Wolsey, of Matteawan, Dutchess Co., N. Y., were received, June 1st, larvæ of a leaf-hopper, enveloped in frothy masses

Fig. 12. Larva of Clastoptera on pine — side and dorsal views. (From Packard.)

among the terminal tips of pine, which are quite well represented by the figures of the above-named species, in the *Fifth Report of the U. S. Entomological Commission*, by Dr. Packard, at page 802.

The Insect Described.

Dr. Fitch characterizes the insect, in his 4th Report, as follows:

Puncturing the leaves [of pine] and sucking their juices, in July, a small, shining, broad, oval tree-hopper, 0.14 long, of a black color, its head pale yellow with a black band on its anterior margin, its thorax prettily sculptured with fine transverse lines and with a pale yellow band anteriorly, its wing-covers with a broad, hyaline, white margin on the outer side, interrupted with black back of the middle, and having a shining black dot near the tip, its under side and legs pale yellow.

The Larva.

The larvæ received by me presented the following features: The head and its appendages, thorax (except the white, sharp lateral margin of the prothorax), terminal segment, ventral mesial plates, and legs (except at the joints, which are white) are glossy black. The abdomen above and laterally is flesh-colored, with a tinge of red on the back and on the sides.

A larva observed traveling about in the box containing the twigs, on June 4th, had the abdomen wholly black.

The Larvæ Observed on Pines.

Miss Wolsey accompanied her sending with the following note relating to the insects:

On the pines this spring I find on hundreds of young twigs a frothy, sappy exudation. Wiping this away, a nimble crawling insect is found, or two insects together, new to me. They are a quarter of an inch long, with a small, shining black head and shoulders, and three pairs of jointed, slender black legs. The body behind is broad, flat-

tened, flesh color, sometimes brick red, and ringed and horny in substance. It seems like an insect in transition somewhat. The exuded sap is evidently its work. It is very active, and may be one cause of the death of terminal twigs and branchlets occurring late in the season.

Miss Wolsey was requested to search the pines early in June for the mature insect, the features of which were given, that positive identification might be made of the larvæ. Heavy rains had meantime occurred, and it was thought that they may have destroyed the insect in its immature stages or driven away the imagoes.

Chauliodes pectinicornis (Linn.).

The Comb-horned Fish-fly.

(Order Neuroptera: Fam. Sialidæ.)

Hemerobius pectinicornis Linn.: Amoen. Acad., vi, 1763, p. 412; Syst. Nat., i, pars ii, xii edit., 1767, p. 911.1.

Hemerobius pectinicornis Fabr.: Syst. Ent., 1775, p. 309.1.

Semblis pectinicornis Fabr.: Spec. Ins., 1781, i, p. 286.1.

Sembris pectinicornis Fabr.: Mant. Ins., i, 1787, p. 244.1.

Chauliodes pectinicornis Latr.: Gen. Crust. Ins., iii, 1807, p. 198.

Hagen: Synop. Neurop. N. A., 1862, p. 189 (descrip. imago and distribution); in Proc. Ent. Soc. Phila., ii, 1863, p. 181 (mention; in Proc. Bost. Soc. Nat. Hist., xv, 1872, p. 29 (in Harris Collection).

Walsh-Riley: in Amer. Ent., i, 1869, p. 245 (characters of imago).

Packard: Guide Study Ins., 1869, p. 607; Entomol. Begin., 1888, p. 87 (mention).

Pettit: in Canad. Entomol., vi, 1874, p. 45 (in Canada).

Moody: in Psyche, ii, 1877, p. 52 (description and habits of larva).

Riley: in Canad. Ent., xi, 1879, pp. 97, 98; in Proc. Amer. Assoc. Adv. Sc. for 1878, July 1879, xxvii, pp. 286, 287 (eggs and features of Chauliodes larvæ, incl. this species?).

Comstock: Introduc. Entomol., 1888, p. 220 (mention).

Banks: in Trans. Amer. Ent. Soc., xix, 1892, p. 357 (cited).

The illustrations of Plate 1, from drawings made by Mr. J. Bridgham, are from a larva of the above-named insect, which was received from Mr. W. C. Hitchcock, of Tiashcke, N. Y. It had been taken from a pond in that vicinity early in March, from a hole cut in the ice. It was the only specimen of the kind observed, and none others could be found, although search was made for them in compliance with a request for additional examples for rearing.

Literature.

But little has been published of this insect, and no figure had been presented of its early stages. Dr. Hagen, in his *Synopsis of the Neuroptera of North America*, in 1862, states: "The larva is unknown; perhaps it is aquatic."

The following year, 1863, Mr. Walsh described* the larva of a nearly allied species, *Chauliodes rastricornis* Ramb., frequently found in the Southern States, and probably in Missouri, as Mr. Walsh had "bred many specimens of the insect from the larva, which occurs under the loose bark of floating logs, apparently beneath the surface of the water, and retires under logs, etc., on the dry land to assume the pupa state, forming a rude cell there, as does *Corydalis cornuta* (Linn.)." The same species has recently been described and figured in its different stages by Prof. C. M. Weed, from examples taken from under logs lying under water in ponds in Ohio;† the figures, through permission of the Ohio Agricultural Experiment Station are herewith given.

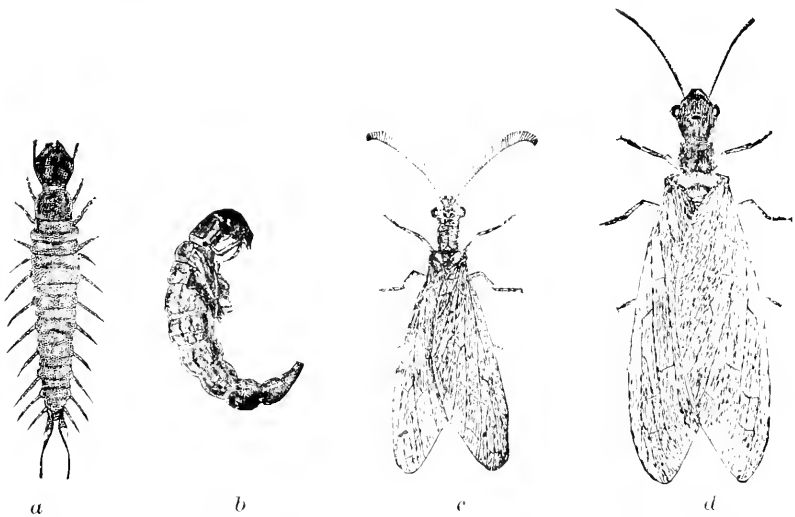

FIG. 13.— CHAULIODES RASTRICORNIS: *a*, larva; *b*, pupa; *c*, male imago; *d*, female imago — all in natural size. (After Weed.)

The Canadian Entomologist for May, 1879, contains an abstract of a paper read by Professor Riley before the American Association for the Advancement of Science (the entire paper has not been published), entitled: "Larval Characteristics of Corydalus and Chauliodes." In this abstract some of the larval features of *Chauliodes* are given, and

Proceedings of the Entomological Society of Philadelphia, ii, 1863, p. 263.

†*Bulletin of the Ohio Agricultural Exper. Station*. Technical Series, vol. 1, No. 1, October 1889, pp. 7–10, pl. 1, fig. 3.

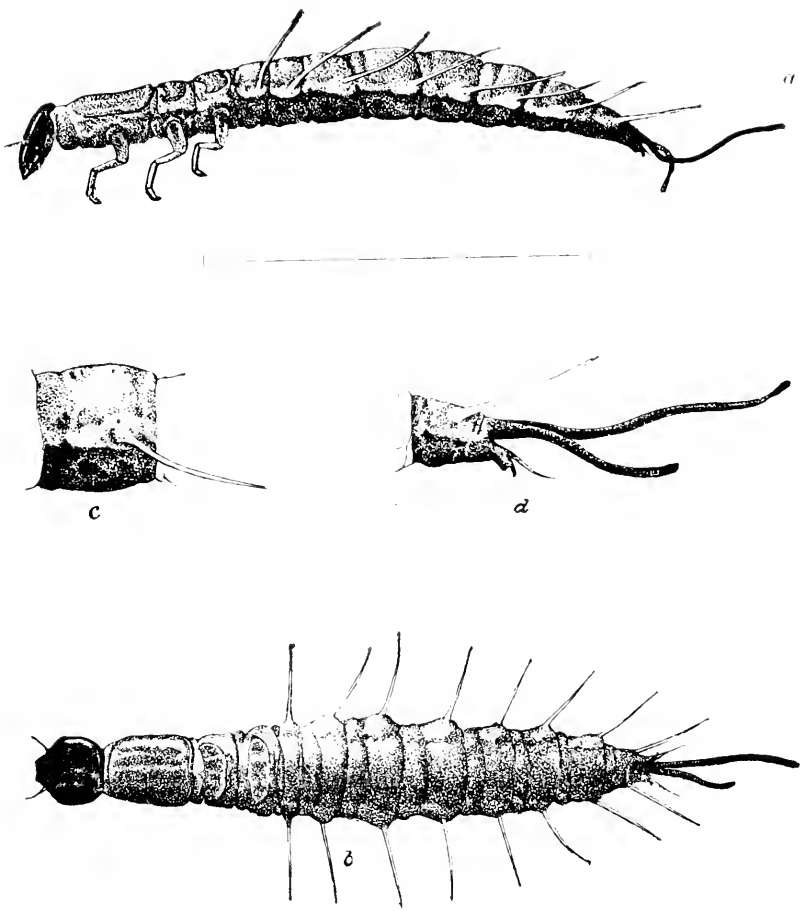

PLATE 1.— Larva of CHAULIODES PECTINICORNIS: *a*, side view; *b*, dorsal view; *c*, an abdominal segment more enlarged; *d*, anal segment with appendages similarly enlarged. (Original.)

errors made by Mr. Walsh, in his description, noticed. Professor Riley was probably acquainted with the *C. pectinicornis* larva at the time of the above publication.

The Larva of Chauliodes pectinicornis.

Very little has been written of this insect. All the notices that I have been able to find of it are cited in the bibliography on the preceding page. The account given of it by Henry L. Moody in *Psyche, loc. cit.*, seems to embrace all of what has been published of it. Mr. Moody found a larva on October 21st in a cavity in moist sand under a stone, nearly ready for pupation. It changed to a pupa two days thereafter, and in twelve days more to the perfect stage.

Of another example subsequently taken, and believed to have been of the same species, which it probably was, as *C. rastricornis* rarely occurs in New England, Mr. Moody has given the following particulars:

Its movements in the water, other than by walking, are always backward, and are performed by a downward and forward sweep of the tail. It could move rapidly, but at times would drift lazily about near the surface of the water. It ate houseflies if they were held before it by a forceeps so that they could be seized without first touching the larva.

"It was thirty-five mm. long, rather slender, narrowing moderately from the middle of the body to the head, and more strongly in the opposite direction to a narrow final segment. The head is large and prominent, the body moderately flattened and somewhat appressed. The mandibles are rather large and strong, nearly straight and strongly toothed on the inner edge at the tip. The mandibles are usually widely extended when the larva is walking at the bottom of the vessel. On each side of each segment after the thoracic ones there is a slender whitish filament, which is a little longer than the body is wide at its widest part. From the posterior edge of the terminal segment there arise two filaments, contiguous at their base, long, blackish, very contractile and rather thicker than those of the sides. These filaments are undoubtedly respiratory organs, and are usually directed upwards, so that their tips reach the surface of the water. There is a long, stout bifurcated proleg just beneath these filaments. The color of the head is chestnut-brown; that of the body rather light brown, with a black, interrupted medio-dorsal line, and on each side a much narrower and more obscure similar line. The legs are rather stout, of moderate length and honey yellow."

Habits of Chauliodes.

The brief pupal stage noted above by Mr. Moody of *C. pectinicornis* (twelve days) is also a feature of *C. rastricornis* as observed by Mr. Weed — in one instance, fourteen days, and in another the very short period of eight days. Of this last-named species, the following habits

are recorded by Mr. Weed in the article cited, which probably are identical with those which would be displayed by *C. pectinicornis:*

Their ordinary mode of locomotion is by crawling along weeds and the debris of various kinds which gathers at the bottom of ponds, but when alarmed they can swim rapidly by suddenly doubling the body up, bringing the head in contact with the abdomen, by which means they are propelled some distance through the water. They evidently live upon various animals, as I have seen them feeding on dead back-swimmers (*Notonecta undulata*), flies which had fallen into the aquarium, and in one case a spider which I had thrown in. When a Notonecta or Zaitha would come near the Chauliodes while feeding, the latter would snap viciously at it with its powerful jaws. * * * When handled, the Chauliodes larvæ occasionally eject from the mouth a considerable quantity of a blackish fluid, reminding one of a similar habit of certain locusts (*Acridida*). These larvæ have also a peculiar habit of walking on the surface of the water, body downward. They can move along in this manner quite rapidly.

C. rastricornis was for a long time thought to be confined to the Southern States, but it appears to be not an uncommon species in Ohio, as Prof. Weed records the capture of at least a dozen species in the

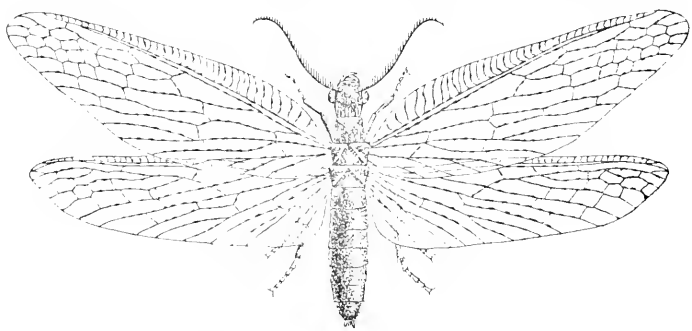

FIG. 15 — The comb-horned fish-fly, CHAULIODES PECTINICORNIS, in natural size (original).

year 1889, in that State. Mr. Samuel Henshaw has taken the insect in June, presumably in Boston or its vicinity, and Dr. Hagen has received it from Milton, Mass., and also from Illinois.

The Winged Insect.

In its perfect stage, *Chauliodes pectinicornis* resembles in general appearance the horned Corydalis, *C. cornuta*—a much more common insect, and with which most persons are more familiar. Its more striking differences are a smaller size, a less robust build, the wingt not so strongly veined, its mandibles much shorter and projecting bus little beyond the front of the head, the antennæ with long pectinations like the teeth of a comb, in both sexes, the front wings without the small round white spots within the cells, seen in Corydalis, and with the brown veins interrupted with white.

It is a rather common insect in localities favorable for it in the State of New York, it having been frequently taken by me at Schenectady, on the Mohawk river, in the months of June and July, and extending into August, where, also, *Chauliodes serricornis* Say, was not rare in the month of June, while *C. rastricornis* has not occurred with me, in New York. Examples of *C. pectinicornis* in the Harris collection, and now in the collection of the Boston Society of Natural History, according to Dr. Hagen (*loc. cit.*), bear the following dates of capture: July and August, 1821; May 25, 1827; June 10, 1827; September 20, 1829; N. Carolina; June, New York, Calverley.

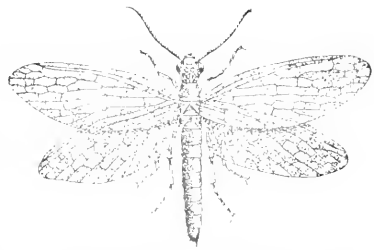

Fig. 16.—The saw-horned fish-fly, Chauliodes serricornis, in natural size (original).

Not an Injurious Insect.

While of a carnivorous habit, the food of the larva, for the most part taken from the bottom of the waters which it inhabits, would naturally consist of both injurious and beneficial forms, perhaps about equally divided. It has been suggested that with a seeming preference for a pond life, it might become injurious should it ever abound in fish ponds, from feeding on the eggs of fishes and the young fry; but knowing the fondness of the bass and several other fishes for the horned corydalis — the "dobson,"— there need be no fear that this weaker and less formidable looking creature would ever be permitted to become injuriously abundant in any water where desirable fish-food is not in excess.

Corydalis cornuta (Linn.).

The Horned Corydalis.

(Ord. Neuroptera: Fam. Sialidæ.)

Linnæus: Syst. Nat., i, pars ii, xii edit., 1767, p. 916.3 (*Raphidia*).

Fabricius: Sp. Ins., i, 1781, p. 392.1; Mant. Ins., i, 1787, p. 246.1; Ent. Syst., ii, 1793, p. 81.1 (*Hemerobius*).

Latreille: Gen. Crust. Ins., iii, 1809, p. 199.1 (*Corydalis*).

Haldeman: in Mem. Acad. Arts-Sci., Jan., 1850, pp. 162–168, pl. 1–3 (transformations).

Hagen: Synop. Neurop. N. A., 1861, p. 192 (bibliography and description); in Proc. Ent. Soc. Phila., ii, 1863, p. 181 (respiration and habits).

Walsh: in Proc. Ent. Soc. Phila., ii, 1863, p. 265 (traveling habits of larva and transformations); in Pract. Entomol., i, 1866, p. 113 (habits); in *id.*, ii, 1867, p. 107 (horns of the male).

Walsh-Riley: in Amer. Entomol., i, 1867, pp. 61, 62, f. 56 (general account).

Packard: in Amer. Nat., i, 1867, p. 436, figs. 1, 2 (description of larva and imago); Guide Study Ins., 1869, p. 607, f. 594 (female); in 3d Rept. U. S. Ent. Commis., 1883; pp. 335–338, pl. lii, figs. 1–3 (structural characters); Entomol. Begin., 1888, p. 87, figs. 74–76 (mention); in Psyche, v, 1889, p. 224 (epipharynx).

Saunders: in 3d Rept. Ent. Soc. Ont., for 1872, 1873, pp. 56–58, figs. 47, 48, not 49; the same in Canad. Entomol., vii, 1875, pp. 64–67, figs. 9, 10 (natural history).

Riley: 5th Rept. Ins. Mo., 1873, pp. 142–145, figs. 69, 71 (general account); in Scientif. Amer., l, 1873, pp. 392, 393 (habits, figures of stages, etc.); 9th Rept. Ins. Mo., 1877, pp. 125–129, figs. 30, 31 (early stages); in Proc. Amer. Assoc. Adv. Sci. for 1876, xxv, 1877, pp. 275–279 (eggs); in *id.* for 1878, xxvii, 1879, pp. 285–287 (eggs, larva, imago, respiration, etc.); in Canad. Entomol., xi, 1879, pp. 96–98 (larval characteristics). Prec. as *Corydalus cornutus*.

Barnard: in Amer. Entomol., iii, 1880, p. 178 (as *Corydalus* — eggs).

Krauss: in Psyche, iv, 1884, pp. 179–184, pl. 2 (as *Corydalus* — nervous system of larval head).

Fyles: in 15th Rept. Ent. Soc. Ont., 1885, pp. 46–48, figs. 6, 7 (transformations).

Comstock: Introduc. Entomol., 1888, pp. 219–221, figs. 196, 191 (eggs, larva, and transformations).

Lintner: 7th Rept. Ins. N. Y., 1891, p. 254 (the larva a traveler).

Banks: in Synop. Cat. Bib. Neurop. N. A., in Trans. Am. Ent. Soc., xix, 1892, p. 357.

This insect has been mentioned in my reports, but it has received no extended notice, although inquiries have frequently been made of it by letter and in person. Personal inquiries have uniformly been met by presenting the excellent figures and account given by Professor Riley in the *American Entomologist*, for December, 1868. The figures of that article are herewith given from electrotypes obtained from Professor Riley. For another paper upon the insect from the same author, but essentially the same, the reader, may refer, if more convenient, to the Fifth Missouri Report. It may be noted here that in each of these the eggs of the insect are erroneously figured, as was subsequently learned, and for their correct representation and description, the Ninth Missouri Report may be seen, where, also, the young larva is for the first time described and figured.

References to other writings on this insect are given in the above bibliography, and as some of them, at least, may be conveniently referred to by those who would like to know more of its interesting habits and transformations, it is thought not desirable to embody them in a general account for the present report.

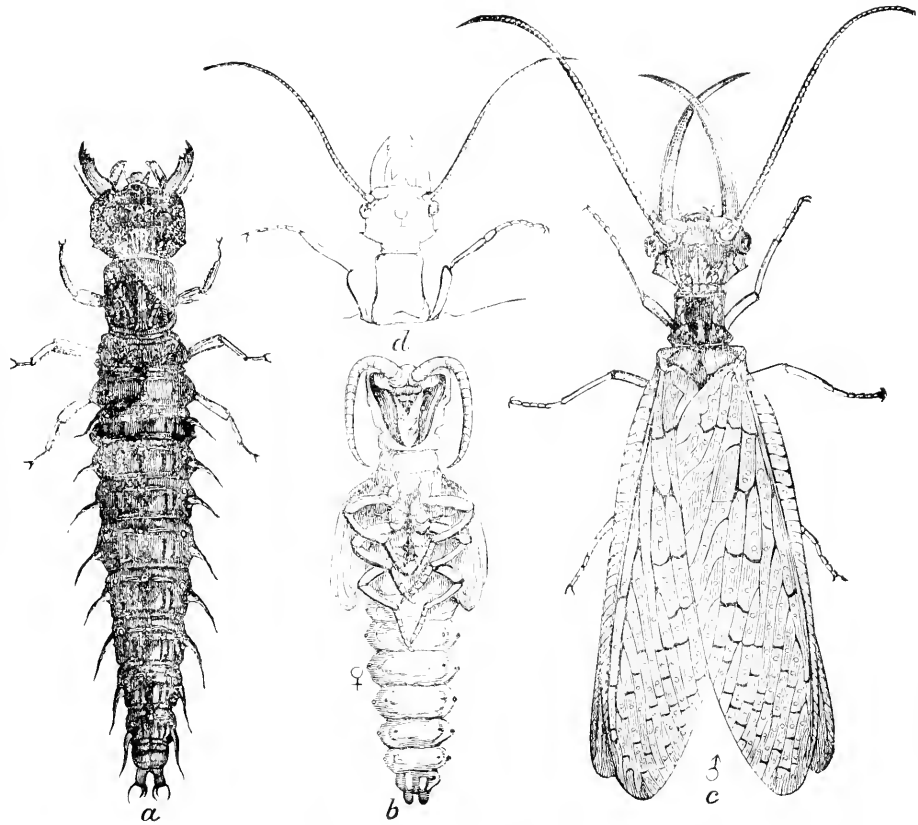

PLATE 2.—The horned Corydalis, CORYDALIS CORNUTA : *a*, the larva; *b*, the pupa; *c*, the male imago; *d*, head and thorax of the female.

The following was sent to a correspondent, Mr. C. L. Shear, in Alcove, N. Y., who wrote July 7th, 1891:

Will you please give me the name of the inclosed insect, and tell me whether it is common or not; also whether there is any notice of it in your reports. The specimen is somewhat mutilated, owing to the carelessness of the collector, which was a cat.

The insect is the "horned Corydalis," *Corydalis cornuta*, so named from the two long curved mandibles borne by the male. It belongs to the order of Neuroptera, and is allied to the dragon flies — like them, its larvæ living in the water. It is a common species, and is distributed over a large part of the United States. The larvæ are often collected by boys from beneath stones in running streams, and sold to fishermen at a good paying price, as bait, particularly suited to bass — it being, in piscatorial parlance, "the dobson," or "the crawler." They are formidable looking creatures, measuring, when full-grown, about three and one-half inches in length, with a large flattened head provided with unusually long and strong mandibles, three pairs of long legs and two sets on each side of floating lateral appendages which are breathing organs or gills, for its use in the water. It is also provided with the usual number of spiracles or breathing pores, to serve for respiration when it leaves the water for its pupation on the land beneath a stone or log. It is shown in Plate 2 at *a*.

Dr. David Norwood, of Esperance, has given me the following information of its habits, which I find recorded among my notes under date of May 3d, 1869:

The larva leaves the water earlier than is usually supposed. At the present time they may be found hidden under stones upon the shores of the Schoharie creek. They sometimes occur at a distance of a hundred yards from the stream in adjoining garden plats beneath stones. They are very numerous in this vicinity, and are extensively used for fish-bait. Quarts of them can be taken at any time by the boys, who adopt the following ingenious plan for capturing them: Wading into the creek, with a seive in one hand and a hooked wire in the other, stone after stone is carefully raised with the hook, and from almost every one a larva is swept out by the running water and dexterously captured by the seive placed in position for receiving it. In this manner a bushel could be easily caught if so many were needed.

The above was communicated to the gentleman in reply to his inquiry. The present opportunity is taken to record some observations recently made by me on the habits and respiration of a larva under confinement.

A larva of this species was kept under observation in an aquarium in my office for eight months, during which time it partook of no food,

although flies and other insects, and small earth worms were offered it. It underwent no moultings or other changes, and at the expiration of the time stated, it died, apparently from not having partaken of nourishment.

Professor Riley has written (in the *Canadian Entomologist*, as cited) of the respiration of this larva as follows: "In the water a constant motion of the ventral branchial tufts is kept up, the main stem being first moved quickly backward and upward so as to bring the whole tuft close to the body, the filaments of which it is composed being then closely appressed to each other. The main stem is then brought more slowly down in the opposite direction, when the filaments spread and enlarge the whole to its utmost. In pure water the motion occurs about once a second; as the water becomes impure the motion becomes more rapid."

The respiration as observed by me, not long after its reception and therefore before it could have become enfeebled, was far from being continuous,—on the contrary it was remarkably intermittent, without any apparent cause. The following note was made at the time:

The branchial tufts may be, and frequently are, used independently of one another. The first and second pairs on segments four and five are the most frequently used, and sometimes those only on one side are in action. An interval of twelve seconds has been observed, without the slighest branchial motion. Occasionally, the only respiration seen was in the movement of a single branchial tuft. When transferred to fresh water the respiration was increased in rapidity, fifty-two motions having been counted in a minute.

Professor Riley has written: "The motion of the larva is invariably backward." During its confinement in the aquarium, my specimen was often seen to swim in a forward direction, almost completing the circuit of the vessel, and with a facility very nearly equaling that of its ordinary mode of progression.

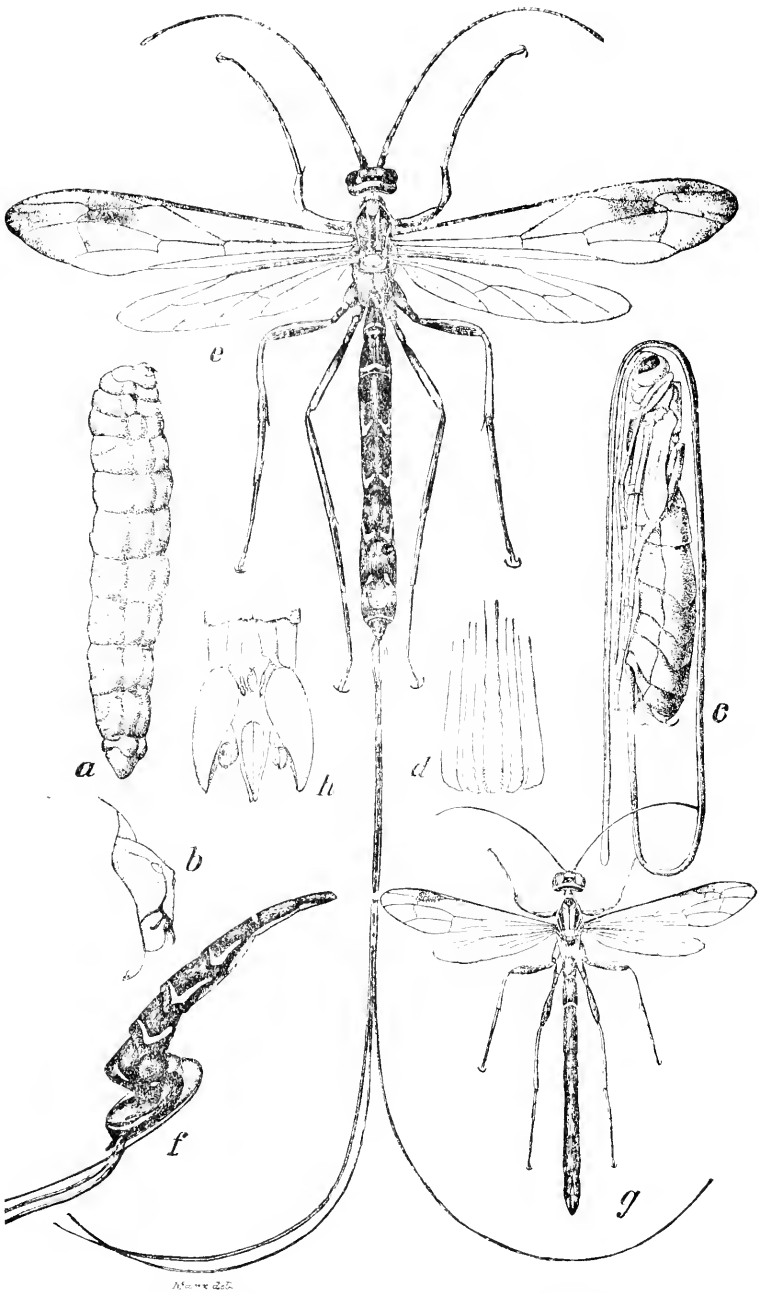

PLATE 3.—The lunated long-sting, THALESSA LUNATOR: *a*, larva; *b*, side view of head; *c*, pupa; *d*, tip of pupal ovipositor showing the five parts; *e*, the female; *f*, side view of abdomen; *g*, the male; *h*, anal extremity of male, enlarged.

NOTES ON VARIOUS INSECTS.

Thalessa lunator (Fabr.).

The Lunated Long-sting.

About twenty examples of this insect, males and females, were taken by me during the month of September, from the dead trunk of an elm left standing on a sidewalk in Albany, after its top had been cut off at a height of ten feet from the ground. The bark had been removed from the tree while it was still living for about one-half its circumference and the wood painted to arrest further decay or injury. Early in September my attention was arrested by a quantity of sawdust clinging to the painted portion of the trunk, where, on examination, it was found to be perforated with hundreds of small round holes of a diameter of about one-tenth of an inch; while a still larger quantity of the dust had fallen down and was covering the bark at and near the base. From eight to ten of these holes could be counted, in places, in a square inch of surface. Many of them, judging from their diameter, were the work of the wood-wasp, *Pemphredon concolor* Say, numbers of which were observed upon the trunk, running over it, entering the holes, and emerging from them, during the time above stated. About twenty examples were captured for the State collection.

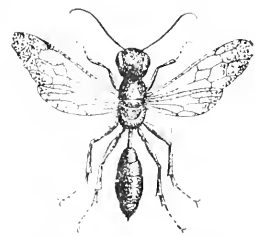

FIG. 18. A wood-wasp, PEMPHREDON CONCOLOR Say (original.

I find nothing written of the habits of either of our two species of Pemphredon (*marginatus* Say, the other). Curtis, in his *Farm Insects* (page 76), says of two English species, *Pemphredon unicolor* Latr., and *P. lugubris* (Fabr.), that they may be seen during the summer months carrying immense quantities of aphides into holes in wood, posts, etc., to feed their young upon.

A single example of *Tremex columba* (Linn.) was taken from the trunk September 16th. The "insects" (which of them could not be definitely stated, but probably "the long-stings,") had been so abundant during the month of August that they had attracted the attention of persons living in the vicinity, and small boys, it was reported, had been amusing themselves by catching and killing them.

The Thalessas were only seen upon the bark. The males were apparently awaiting the emergence of the females from the can be readily known by its antennæ longer than the body, and quit-

trunk, for if disturbed, they would frequently fly up for a short circuit and then return. The females, rarely seen until the latter part of the afternoon, were always intent on oviposition either getting in readiness to insert the ovipositor, or with it already entered at various depths to a maximum of two inches, and with the abdominal muscular sac aiding in oviposition, distended in different degrees. The wood was apparently solid where the oviposition was occurring, but the bark had been perforated as numerously by the wood-wasps as had been the decorticated portion. That the wood was at least comparatively solid was shown by the firmness with which the ovipositor clung to it. In an attempt to remove an example, while holding it by the thorax and abdomen, the body was torn in two near its terminal end. But by seizing the ovipositor between the thumb and finger and pulling it steadily but gently, it could invariably be withdrawn entire in from fifteen to twenty seconds of time.

The tree was passed daily in my walks to and from my office. The Thalessas were observed for the last time on September 18th and the Pemphredons on September 22d.

In the notice of *Thalessa lunator* in my Fourth Report, the question was asked: "Does Thalessa oviposit in exposed larvæ?" An oviposition of a large Ichneumonidan in a colony of a *Datana* on a hickory tree, observed by me about the year 1860, was described and referred, from memory, to *Thalessa lunator*. In Dr. Riley's admirable paper on "The Habits of Thalessa and Tremex," on pages 168-179 of *Insect Life* for December, 1888, in replying to the above query, he has endeavored to show that this method of oviposition was impossible to Thalessa, and suggested that my memory of the species that I had seen thus engaged must have been at fault,—some other large Ichneumon having been mistaken for Thalessa. That Dr. Riley is correct in this opinion finds strong support in a notice entitled "Oviposition of Anomalon sp.," by Prof. C. P. Gillette, in *Entomological News*, i, 1890, p. 130, in which is related the oviposition of a large black Anomalon species, in a colony of *Datana ministra*, in a manner and with all the attendant circumstances identical with the operations as described by me.

In the *Journal of the New York Microscopical Society*, for October, 1891, page 135, Rev. J. L. Zabriskie gives an interesting account of the very serious results attending a wound said to have been inflicted by one of the "long stings" on the arm near the wrist of a robust, healthy laboring man. "For four or five days intense pain, and great swelling involving the entire arm, the axilla and a portion of the side of the body, gave symptoms of a severe case of erysipelas."

In my Fourth Report, a figure is given on page 39 of a Thalessa in the act of ovipositing, taken from some old cut, which, under the supposition that it was intended to represent *T. lunator*, was so designated by me. Dr. Riley, in *Insect Life*, i, p. 173, has copied from the *American Agriculturist*, a figure almost identical with this, which he refers to *Rhyssa persuasoria* (Linn.)—an European species, having a shorter ovipositor than ours, and with other differential features that have given it place in another genus. In correction of my error, the figure of my Fourth Report is herewith given with its corrected name, and in Plate 2 [Figure 17], I also present the excellent plate of *Thalessa lunator* which was one of the illustrations of Dr. Riley's paper previously referred to.

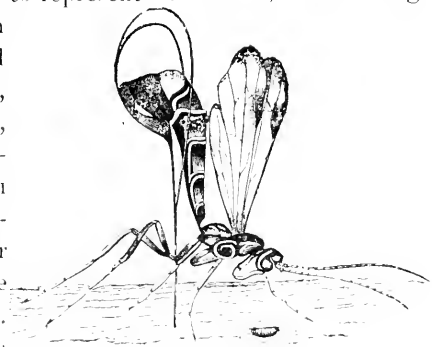

Fig. 20—The long-sting, Rhyssa persuasoria, female, ovipositing.

The illustration of *Tremex Columba*, in its larval, pupal and perfect stages, from the same paper is also given herewith, as being a great

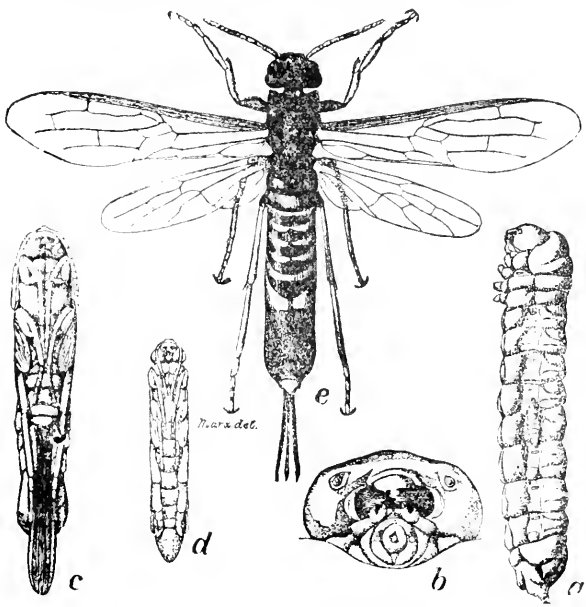

Fig. 21—Tremex Columba: *a*, larva showing the Thalessa larva fastened to its side; *b*, head of larva; *c*, pupa of female; *d*, male pupa; *e*, adult female—all slightly enlarged.

improvement upon the representations hitherto published of this species, and as illustrating the parasitic association with it of *T. lunator*.

Provancher, in his *Faune Hyménoptérologique de la Province de Québec*, names *Rhyssa persuasoria* as found in Canada; and Mr. W. H. Harrington in the 21st *Annual Report of the Entomological Society of Ontario*, 1891, states of it: "I have not recognized this species at Ottawa yet, but have a male apparently belonging to it from Rev. G. W. Taylor, of Victoria, B. C."

? Janus flaviventris Fitch.

The Currant-stem Girdler.

Of the operations of this insect, which was noticed in the *Fourth Report on the Insects of New York*, page 47, and which, up to the present we have not been able to refer, positively, to any known currant pest, Mr. J. F. Rose, of South Byron, N. Y., has written, under date of June 6, 1891, as follows:

I inclose specimens of a few currant stems which show the work of an insect which cuts them off so that about two or three inches of the young growth breaks over. A few years ago I was badly tormented with currant borers, and, on marking several shoots in June that were injured in this way, found that each of them in the spring had a borer. Since that time it has been my habit to go over the currants several times, cutting off these shoots about one inch below the injury and burning the injured tips. I now find very few borers. Am I right in thinking that the saw-fly, or whatever it is that does the cutting, is the egg-inserter that makes the currant stalk-borer?

Replying to Mr. Rose, he was informed of the puzzle that this girdler had been, and request was made that he mark some of the punctured stems, and send them in the early spring for examination for the pupa or matured insect, that the insect causing the injury might be identified. Its operations were seen by me on the grounds of Mr. George T. Powell, at Ghent, N. Y., on June 8th of the present year, in his extensive plantation of Fay's Prolific currant, but only in a few examples.

A dissection of two of the punctured twigs received from Mr. Rose disclosed the egg within the stem, at about a half-inch in each instance below the puncture. It was white, transparent, rounded at the ends, one-twentieth of an inch in length and half as broad.

The following, taken from *Insect Life*, iii, 1891, p. 407, may prove to be the recognition and identification of the "currant-stem girdler," above referred to:

I send you by this mail one male parent of a native Hymenopterous currant worm, the same as was noted a year or two ago by Professor Lintner, in his Fourth New York Report. I first bred one pair in 1887 from larvæ grown in 1886, and this was raised in 1888–'89. The springs of 1888 and 1890 I was not able to find any. Please report name, etc.—[E. W. Allis, Adrian, Michigan, December 3, 1890.]

Reply.—This insect is without doubt *Janus flaviventris* Fitch; see Fitch's seventh report, species No. 12. This discovery of yours is a very interesting one, if the insect works in the way described by Lintner in his fourth report, page 47.—[December 5, 1890.]

On turning to Dr. Fitch's Seventh Report (page 165 of the Sixth–Ninth Reports, 1865), we find, as Nos. 12 and 13, *Janus flaviventris*, n. sp., and *Phyllœcus trimaculatus* Say, followed by: "In rye fields toward harvest time, scattering heads of the grain remaining erect and having a prematurely ripe appearance, the straw bored its whole length by a footless worm a half-inch long." In the text following, Dr. Fitch questions whether this may be the work of some species of *Chlorops*, or of some saw-fly nearly related to the *Cephus pygmeus* of Europe [since found in the State of New York]. He then adds: "A New York insect of this kind, the same in size with the European species, and coming abroad like it the last of May, has the hind body cylindrical instead of being compressed, and consequently pertains to the genus *Janus*."

Dr. Fitch's description of the species is herewith given, that it may be seen hereafter if it be the one that may be bred from the girdled currant stems. The girdling operation would be anomalous in the *Cephida*.

It is a pretty little fly of a shining black color, with its hind body lemon-yellow except at its base, its mouth being straw-colored, and also the hind margin of its collar, the base of its wings, a small black spot above its sockets, and the fore and hind margins of the metathorax. The hind body is more narrow than the fore body, and more narrow and long than in the typical species of this genus, forming almost two-thirds of the total length of the insect. Its basal segment is black, edged anteriorly with straw-yellow, and with a slender line of this color along its middle, ending in a large triangular spot. The second segment is also black except at its hind end; and on the sides is a blackish cloud on the surface of each of the remaining segments. The wings are hyaline and glossy, their stigma sooty brown, which color extends inward, occupying most of the anterior marginal cell. A faint smoky cloud may also be perceived near the middle of the posterior apical cell, and another along the margin of the anterior one. The hind feet are dusky.

Janus is a genus of the *Urocerida*, allied to *Cephus*. *J. flaviventris* Fitch is the only species recorded in this country. Mr. Edward Norton has included it in his "Catalogue of the Tenthredinidæ and Urocerida of North America," in 1867, in the last-named family, but had not seen the species.* Mr. E. T. Cresson, in his later Catalogue (1880) of the same families, includes it among the *Tenthredinida*, and in his more recent "Synopsis of the Hymenoptera of North America," in the *Urocerida* (page 172).

* In *Transactions of the American Entomological Society*, ii, 1869, p. 341 (quotes Fitch's description).

From perhaps a dozen of the burrowed twigs subsequently sent to me by Mr. Rose in the spring after the girdling had been marked in the preceding spring, a single example of the perfect insect was obtained. It had become moldy and was set aside for cleaning, after an unsatisfactory comparison with the Fitch description had been made, which seemed to indicate a different species. Unfortunately the specimen has been mislaid and can not now be found.

Nematus Erichsonii Hartig.

The Larch Sawfly.

This insect is still continuing its ravages in the Adirondack Mountains. On August 7, 1891, many of the larches observed from the road

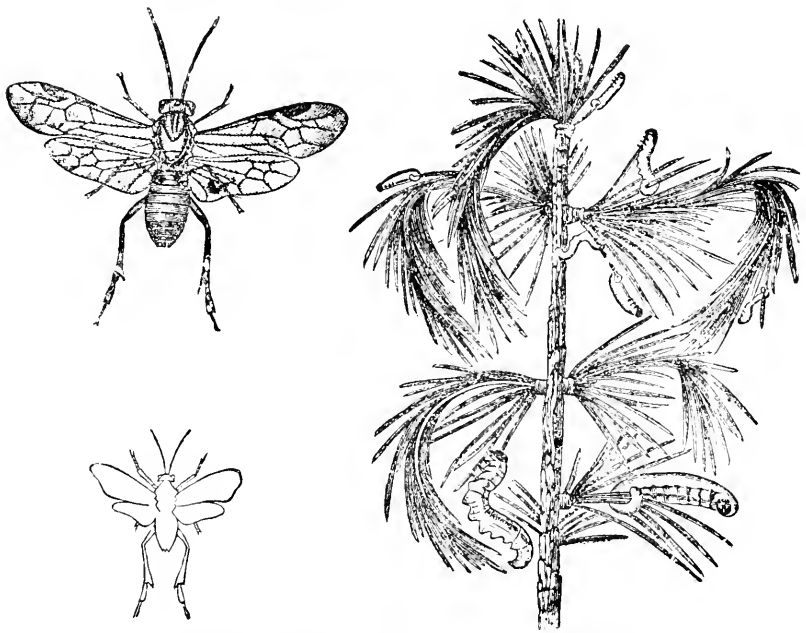

Fig. 22.—The larch saw fly, Nematus Erichsonii, in natural size and enlarged, and the larvæ in different stages in natural size. (After Packard.)

in passing from the Wilmington Notch to the Mountain View House in North Elba, in Essex county, were seen to be nearly or entirely stripped of their leaves. Quite a number of dead larches were noticed which it was thought had been killed by their annual defoliation for a few years past—the attack having been observed by me in the Lake Placid region in the summer of 1888.

At this time the larvæ had entirely left some of the trees, while on a few they were still feeding in small numbers.

The following inquiry of this insect from a gentleman of Kings county, Prince Edward Island, Dominion of Canada, and giving an account of its ravages in the Province, and my reply to the same, is from the *Country Gentleman*, of November 13, 1890 (page 905).

Eds. C. G.—The juniper or larch (*Larix Americana*), which abounds in this vicinity, and, in fact all over the Province, is being devastated of its leaves, and presents a withered, decayed appearance through the action of the saw-fly, *Nematus Erichsonii*. The first indication of this pest was noticed in the summer of 1889, but this summer the injury has been so much aggravated that in the months of July and September it was rare to see a green leaf on a tree. Now, however, they are free from the attacks of the pest, as the larvæ, when matured, fall to the ground, leaving the tree to make a little growth by the aid of the autumn rains. Whether this pest is going to exterminate the larch completely in this Province remains to be seen. It has, however, done great injury to the larch in Nova Scotia. I am informed that the fly was first noticed near Boston, Mass., in 1880. I am also told that there is no remedy to allay the ravages of the fly. Does the sage associate of this paper know of any means? I would like to hear from Dr. Lintner on the subject.—J. A. M., Kings Co., P. E. I.

The communication above gives an interesting account, from an entomological standpoint, of the first notice and rapid spread and serious ravages of this introduced European insect in Prince Edward Island. Its operations there appear to be similar to those which seem everywhere to follow its spread.

That there is no remedy, so far as known, to allay the ravages of the insect is unquestionably too true. When the larvæ make their attack upon an isolated tree in cultivated ground, they may be destroyed by an arsenical spraying, but, as I have elsewhere written, when large areas of the larch are infested, as tamarack swamps, it is useless to attempt to compete with the enemy. Its destruction through any applications that could 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. A somewhat extended and illustrated account of this larch saw-fly appears in my *Fifth Report on the Insects of New York*.

Feniseca Tarquinius (Fabr.).

The Little Orange Butterfly.

This, usually rare butterfly, was frequently seen in Keene Valley during the months of July and August, of 1891. Attention was ordinarily drawn to it by its short, rapid flights in the roadways, flitting at a height of about ten feet from the ground, often in pairs chasing

one another, or, if driven up from the leaves, flying about for a brief time and then returning and alighting upon the branch it had before occupied. It was seldom active except in bright sunlight and at about the middle of the day. In a single instance only was it seen to alight on the ground — in the Wilmington Notch, Adirondack Mts., August 6th, 1891. Examples of the butterfly were taken by me in Keene Valley on the following dates: July 20, 24, 27, 29, August 4, 5, 15, 20. Most of those collected in August were more or less worn.

A larva was found in a colony of *Pemphigus tessellata* (Fitch), on July 20th, which was nearly mature, for after having eaten a few hundred aphides it transformed to a pupa on the side of the box containing it. Brushing from the alder a colony of the aphides for food for the caterpillar, three additional caterpillars were discovered in the box the following day which were unobserved at the time of collecting. It was subsequently noticed that a lump like accumulation of the aphides on the alder twig usually indicated the presence of a nearly full-grown larva beneath it.

It was observed that *Pemphigus tessellata* was much less abundant in Keene than in former years. Probably its numbers had been largely reduced by the Feniseca caterpillars of the first brood.

Of the four larvæ mentioned above, the first pupated on July 23d. Of the other three, the time of pupation was not noted, but was between August 4th and August 8th; of these the first butterfly emerged on September 11th, and a second one during the latter part of November.

Eudryas grata (Fabr.).

The Beautiful Wood-nymph.

With the increase of this insect and the fondness of the caterpillar for the leaves of the Virginia creeper, *Ampelopsis quinquefolia*, it may develop into a household pest. In the spring of 1890, several of the pupæ were found beneath the border of a carpet in the rectory of Grace Episcopal church, in Albany, into the substance of which they had partly burrowed for pupation, and had inflicted some injury by cutting the threads. Almost the entire side of the rectory is covered, and the windows quite surrounded, with the Ampelopsis, but the caterpillars had not been observed as unusually abundant during the preceding year.

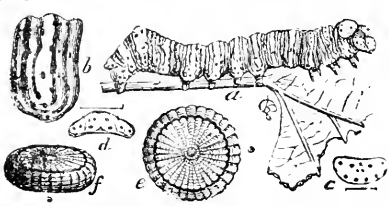

FIG. 23.– EUDRYAS GRATA: *a*, the caterpillar in natural size; *b*, its fifth segment enlarged, *c*, its collar; *d*, markings of the hump on the eleventh segment; *e*, an upper view of the egg, and *f*, a side view: each enlarged from the natural size shown beside them (after Riley).

The caterpillar, which is beautifully marked in black and orange bands (six black ones and one orange on each of the principal segments) and black spots, is shown at *a*, in Figure 23; at *e* and *f*, the delicately ribbed egg of the moth is represented in enlargement, showing its flattened form. In Figure 24, the moth is shown. When seen, in nature, in its varied and tender colors, the names that it bears—both the popular and the scientific, can not fail of being appreciated. See Fifth Report of this series, 1889, p. 181 for its description.

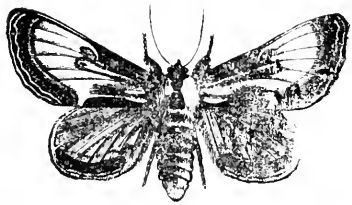

Fig. 24.—The beautiful wood-nymph, Eudryus grata (after Riley).

Scoliopteryx libatrix (Linn.).

The Scallop-Wing.

The caterpillar was taken in Keene Valley, N. Y., in July, feeding on the leaves of willow. At maturity it presented the following features:

Length, 1.75 inch, cylindrical, slender (about one-eighth of an inch broad), tapering at the extremities; velvety green. Head green, as broad as the first segment, traversed mesially by a delicate red line. Abdomen with a yellow or cream-colored line midway between the dorsum and the spiracles, edged below, interruptedly, on segments two to six, with black. Spiracles bordered with orange. Setæ from the setiferous spots, short and inconspicuous. (See figure given by Dr. Packard in the Fifth Report of U. S. Entomological Commission.)

The caterpillar spun its thin cocoon between leaves attached to some threads by its anal spine on the morning of July 24th; on the 26th, it had transformed to the pupa. The moth emerged August 5th—eleven days pupation.

I had previously given the characters of this caterpillar in my *Entomological Contributions* No. I, 1872, p. 63. The following differences therein from the above may be noted: The yellow lateral stripe is shaded beneath with brown; head crossed by a black stripe; pupation of the summer brood from fifteen to twenty days. (See, also, note in *Ent. Contrib.*, III, 1874, p. 164.)

I have taken this moth on May 6th, which was probably a hibernated individual. Stainton remarks of its habits in England*: "The single species of this genus is well known for its hibernating faculties and

*Manual of British Butterflies and Moths, 1857, i, p. 308.

partiality to out-houses; it is consequently frequently met with by incipients during the winter months, and may be found on the wing at the end of April and in May."

The moth was of common occurrence "at sugar" in collections made by me at Schenectady, N. Y., in the year 1875, having been taken July 8 (sugaring commenced July 7), 10, 12, 13, 14, 15, 20, 24, 30. The following year it was taken or noted, also "at sugar," on May 20 (not on sixteen succeeding nights of sugaring), June 26, 27, 28, 29, July 1, 3, 7, 8 (being each night of sugaring), 15 (absent on ten nights following), August 9, 10, 14, 19 (not seen on September 4 and 6, when the collections were discontinued). It was the most numerous during the last of June. These observations indicate two broods a year — in June and August. According to Guenée, Noct. ii, page 405, it has, so to speak, no fixed time for its appearance from the pupa. Roüast, in his *Catalogue des Chenilles Européennes*, gives as the food-plants of the caterpillar, willow and poplar, in summer and autumn. With us it has only been recorded on the willow.

Exechia species?

A Fungus Gnat.

A number of specimens of this fly were brought to me by Mr. A. L. Train, as having occurred in such abundance in his room, in Albany, as to excite his curiosity as to their source and purpose.

Being unknown to me, they were submitted to Mr. F. Kowarz, the distinguished Dipterologist of Franzensbad, Bohemia, for name and habits, if known, who very obligingly returned the following information in regard to the insect:

It belongs to the genus *Exechia* Winnertz, of the family of *Mycetophilidæ*. Baron Osten Sacken does not mention this genus in his *Catalogue of North American Diptera*, 1878. The various species of *Exechia* live, like their kindred, almost all in mushrooms, which are fully destroyed by the larvæ of *Mycetophilidæ*. To speak of their utility or destructiveness in an agricultural sense depends altogether on the value of the mushrooms for the farmer. With us the opinion regarding mushrooms is divided.

Mr. F. V. Theobald, in his volume just published — *An Account of British Flies* — states that the *Exechia* larvæ live in fungi. *E. fungorum* and *E. lateralis* are common British species, while eight other species occur in England. These fungus gnats often appear in great numbers on windows in houses, especially in the autumn.

Telephorus ?bilineatus (Say);

Occurring on Snow.

A remarkable occurrence of the larva of what is believed to be the above named insect, was reported by Mr. Holdredge, of Center, Herkimer county, N. Y., through Mr. Daniel Batchelor, of Utica, N. Y.

Mr. Holdredge's statement is, that on or near the 10th of February last (1891), during a rain, the insects "fell" by millions on his farm and upon the adjoining one, owned by Mr. Morgan. For the distance of a half mile and for about twelve rods in width, the snow was literally alive and black with "the worms," while beyond this strip in every direction, they were quite, but less, abundant. They were seen to travel about for a day or two, while some of them penetrated into the snow, and others were frozen stiff on the surface. Some of the frozen ones were taken into his house, where exposed to warmth, they became active and quite lively again.

Examples of the larvæ sent me were submitted to Dr. Riley, and were identified by him as those of *Telephorus bilineatus*, with the possibility of their being *T. Carolinus* (Fabr.), the northern representative of the genus. While according very well with the former, there appeared some slight differences in the density of the velvety covering. Figure 25 (after Riley), illustrates the insect, and Figure 26 (after Packard), the larval head and prothorax from above and below.

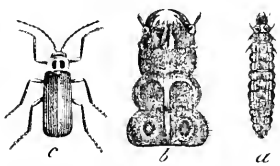

FIG. 25.—TELEPHORUS BILINEATUS: *a*, larva, natural size; *b*, head and anterior segments enlarged; *c*, the beetle, natural size.

The explanation of the larvæ appearing on the snow would be, that they were drawn from the ground by the [warm?] rain, and with the change of rain into snow, they continued, with its increasing depth to mount to the surface, as other larvæ have been known to do. (See the account of the occurrence of the bronze-colored cut-worm, *Nephelodes violans* Guen., on snow, in Canada, and in Sullivan county, N. Y., related in the *Fourth Report on the Insects of New York*, 1888, pp. 54–56.)

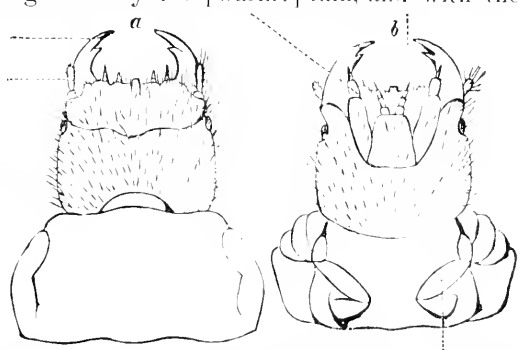

FIG 26.—Head and prothoracic segment, from above and below of TELEPHORUS BILINEATUS.

Another singular occurrence of this Telephorus larva is that in which many specimens were drawn up from a well in Bloomfield, Conn., adhering to the bucket, from the latter part of November, 1875, to the month of April following, being the most abundant about Christmas, on which day forty or fifty were drawn up at once. Dr. Riley's explanation of their presence, is that "they must have been feeding upon small animals in the crevices between the bricks [stones?], from which they occasionally fell into the water and instinctively adhered to the bucket."*

Of the normal habits of *Telephorus bilineatus*, Dr. Packard states, that Mr. P. S. Sprague has found the larva near Boston under stones in the spring, when it pupates, and early in May becomes a beetle.

It should probably be regarded as a beneficial species from its habit of feeding on other insects. Dr. Riley has bred the beetle from larvæ found feeding on the apple-worm of the codling-moth, *Carpocapsa pomonella*, and has frequently met with it under apple trees among early wind-falls, where it was probably searching for the worms of the infested fruit. He has also found it in the tree upon the apples. The perfect insect appears to be mainly a vegetable feeder, having been shaken from the branches of plum, peach, and apricot trees. Dr. Packard states that early in May it feeds on the newly expanded leaves of the birch.†

This insect belongs to a subfamily of the *Lampyridæ*, or fire-flies, viz., the *Telephorinæ*. No light-organs exist in any of the species. "They are more active than the other *Lampyridæ*, and are often found upon flowers, or running over the surface of leaves in search for their prey, which seems to consist mostly of the soft larvæ of other insects" (LeBaron).

?Lachnosterna fusca (Fröhl.).

White Grub of the May Beetle.

In reply to a request from Red Bank, N. J., for name and habits of specimens sent, the following answer was made through the *Country Gentleman* of October 29, 1891:

The insects sent are white grubs, varying in size from about one-fourth grown to nearly full growth, and are from egg deposits of

* *First Annual Report of the U. S. Entomological Commission*, 1878, p. 303.

† *First Annual Report of the Injurious and Beneficial Insects of Massachusetts*, 1871, p. 26.

different years. They are either the "white-grub" of the common May or June beetle, *Lachnosterna fusca*, or a nearly allied species. There are a number of these *Scarabaeidæ* which so closely resemble *L. fusca* that the beetles can be with difficulty separated, and indeed we do not know, or do writers agree, which should be recognized as species or regarded merely as varieties. Dr. Horn, in his "Revision of the Species of Lachnosterna of North America,"* has referred twenty-one species to the *L. fusca* group, while more recently Professor J. B. Smith has found structural features in six forms previously confounded with *L. fusca*, and has named them as species.†

FIG. 27.—The White-grub of LACHNOSTERNA FUSCA (Fröhl.).

The little that is known of the larvæ of these beetles renders it absolutely impossible to separate and determine them. After enumerating and characterizing ninety-one species of American Lachnosterna, Professor Smith makes regretfully this confession: "As it stands at present, *we do not know, positively, the larva of a single specie of Lachnosterna.*"‡

The habits of these "white-grubs" of the *fusca* and nearly allied groups, may be presumed to be very much alike—all feeding on the roots or grasses, various plants and shrubs, or other vegetation.

Although the examples sent can not be positively named, yet if there is anything connected with their finding that renders it particularly desirable to know more of them, they will be given further study for approximate determination.

Cyllene pictus (Drury).

The Hickory Borer.

Some insects taken from burrows in dry hickory wood were received early in March, from New Market, New Jersey, with inquiries of them. They were recognized as the pupæ of the hickory borer, *Cyllene pictus*, formerly known and appearing in many of our entomological writings, as *Clytus pictus*. This species was confounded with the locust borer, *Cyllene robiniæ* (Foerst.), for a long time, and until it was separated from it by distinctive characters by Mr. Walsh, in 1864.§ The females of the two species can be distinguished only with difficulty, but the male of *C. pictus* can be readily known by its antennæ longer than the body, and quite

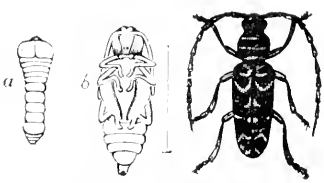

FIG. 28.—The hickory tree borer, CYLLENE PICTUS; *a*, larva; *b*, pupa.

* *Transactions of the American Entomological Society*, iv, 1887, pp. 209–296, Plate 3.

† Notes on the Species of Lachnosterna of Temperate North America: *Proc. U. S. National Museum*, xi, 1889, p. 503.

‡ *Id., ib.*, p. 523.

§ *Proceedings of the American Entomological Society*, iii, 1864, pp. 420–422.

stout; and "the wing-covers widened at the base and tapered toward their tip, so that the two together just before their extreme tip equal the basal width of one of them." The insect is represented in its several stages in Figure 28. In the pupæ received, the characteristic W-marking in yellow of the black wing-covers, and the yellow transverse bands of the thorax are already to be seen, indicating that they are near their perfect stage. The beetles may emerge, if kept in a warm room during the month of March, although under their natural conditions they would not appear until May or June. The species never injures hickory trees to the extent that its congener does locusts. In many localities the locust trees have been entirely destroyed by this pernicious borer.

A detailed account of the larva (grub) of this species is contained in the *Fifth Report of the U. S. Entomological Commission*, by Dr. Packard, 1890, page 287.

In addition to the hickory (*Carya alba*), *C. pictus* also burrows in the black walnut (*Juglans nigra*) and in the butternut (*Juglans cinerea*).

This species appears abroad early in the spring (in May and June), while *C. robiniæ* occurs during the month of September. Remembering this will enable any one to identify at once the examples of the two from any that may be captured abroad, or from dates of collections indicated in cabinets.

Tenebrio molitor (Linn.).

The Meal-worm.

Two of the pupæ and two beetles, identified as the above named insect, were received from Newark Valley, N. Y., as having been found, together with many of the "grubs," in Ashton's factory-filled salt which had been stored, unopened, for two months in a tight meal room. The question was asked how they came there and if it was safe to use the salt in which they occurred, in butter and food.

If the pupæ and beetles sent were actually found *within the salt*, the following explanation of their occurrence there, is the only one that presents itself. The meal-room, in all probability, harbored numbers of the meal-worm — the larvæ of the beetles. After having fed to maturity on the meal or flour at hand, in leaving it for some convenient place for transformation to the pupal and perfect stages, they entered the sack or barrel through some hole or crevice

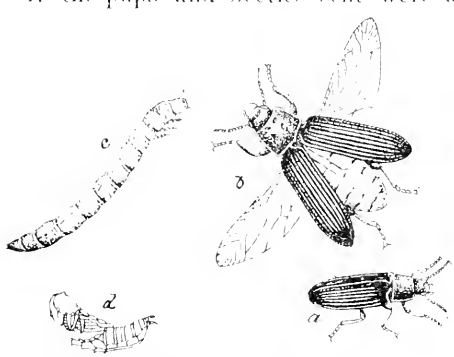

FIG. 29.—The meal worm, TENEBRIO MOLITOR; *c*, *d*, *a*, the larva, pupa, and imago, natural size; also the beetle enlarged.

where, after their changes, they were found. The larvæ could not feed upon the salt, nor could it be of any particular service to them in any manner. Their presence would not in the slightest degree impair the value of the salt for use. The pupæ would be readily seen; the beetles would at once escape, and no eggs would have been deposited in the salt.

The insect has not been figured by any of our writers. The accompanying illustrations of its larval, pupal, and perfect stages are from Curtis' *Farm Insects*. In shape and general appearance the beetle is much like *T. obscurus* Fabr., but while that is of a dead opaque-black color, this is of a shining black. Its larva "is about an inch long, cylindrical, smooth and glossy, with the terminal segment semicircular, slighly serrated on the edges, and terminated in a single point" (Packard). Curtis describes it as "cylindric, smooth, ochreous, with bright rusty bands and a few scattered hairs; two small horns, six pectoral legs, and two minute spines at the tail."

It is a common species in the Old World, and has been quite largely distributed by commerce in all commercial countries. It is said to have been recently introduced, intentionally, in Chili for the purpose of using its larvæ for bird-food.* Dr. Packard's remark, "that it is found in all its stages about corn- and rye-meal, and is frequently swallowed with food," finds apparent confirmation in a notice entitled, "Larvæ of Tenebrio molitor in a Woman's Stomach,"† in which two insects reported by a physician to have been ejected from the stomach, are identified as the above, and the statement accepted as probable, with the suggestion that the larvæ may have been swallowed without undergoing mastication in corn-meal mush; the irritation that their movements would occasion, would naturally excite vomiting and their ejection.

Another account of this same insect, which is quite amusing, is related, where the scratching sounds caused by a number of the beetles which had bred within a pin-cushion filled "with coarse shorts," led the guest at a hotel to believe, and make complaint, that the room to which he had been assigned, and in which he had passed a sleepless night, was haunted.‡

Pulvinaria innumerabilis (Rathvon).

The Maple-tree Scale Insect.

Referring to the notice of this insect in the *Sixth Report on the Insects of New York*, Mr. Andrew S. Fuller, in a communication to me, under date of February 20th, 1891, has written as follows of its

* *Insect Life*, i, 1888, page 154. † *Id.*, page 379. ‡ *Id.* ii., 1890, page 148.

increase and injuries as observed by him, in the city of Brooklyn, N. Y.:

The *Pulvinaria innumerabilis* is not only destroying all of the soft maples, *Acer rubrum*, and white or silver-leaved maple, *Acer dasycarpum*, in the city of Brooklyn, but it has also invaded the gardens and is rapidly destroying the grapevines, and the Japan ivy, *Ampelopsis Vetchii*, which covers the brick walls of many fine residences and churches. On the latter the pest has a most excellent retreat and shelter, and can not be dislodged by ordinary remedies. There are already many thousands of trees dying from the attack of this sucking pest, and the city is doing nothing to check it. A few thousands of dollars properly expended a few years ago might have saved the trees, but now a million of dollars would not replace the damaged trees. I have written several articles calling the attention of the residents of Brooklyn to this pest, and made one report to the Board of Parks (by request) on the same, but the owners of fine shade trees groan over their loss but make no practical effort to repair it.

FIG. 30.—The maple-tree scale insect, PULVINARIA INNUMERABILIS.

The future entomologist is likely to have quite as much to do as those of the present day, and it is to be hoped that his labors will be more highly appreciated.

The scale of the insect with the large, white, cottony mass thrown out from beneath it for the protection of the eggs and the newly-hatched young is represented in Figure 30.

Mr. E. P. Van Duzee, of Buffalo, N. Y., in a letter dated February 28th, 1891, has written of the large numbers of this insect observed by him, after the falling of the leaves the preceding autumn, on the maples planted as shade trees along the streets of Buffalo. He was apprehensive that, in their increase, they would prove to be a great scourge the following summer.

Gryllus luctuosus Serville.

The Common Black Cricket.

Mr. Wm. B. Marshall, of the New York State Museum, at Albany, reports that during a sojourn at Cape May, N. J., in the month of July last, a suit of clothes belonging to a friend, which had just been received from the tailor, and was hanging over the back of a chair, was completely ruined in a single night by crickets that had entered through open windows and eaten large holes in the garments. On request, some of the crickets were secured and sent to me for identification. They proved to be *Gryllus luctuosus* Serv.

While we believe this is not of frequent occurrence, yet it has long been known that the *Gryllida* as well as the *Acridida* are not exclusively vegetarian in their feeding habits. Thus, Walsh has recorded of *Gryllus abbreviatus* Serv. — a species closely allied to, and usually associated with, the above, that "whenever they gained admission into houses, after eating into apples and other vegetable matter that they found there, often concluded their repast by gnawing holes into boots, shoes, and woolen clothes."* He has also remarked: "All the crickets feed indiscriminately both on animal and vegetable substances. I have repeatedly noticed *abbreviatus* under dead putrid birds, etc."†

Clothing long worn and charged with animal matter from the person and from extraneous sources, might naturally be supposed to attract crickets that have acquired the taste indicated above, just as soiled clothing has occasionally been eaten by *Dermestes lardarius*, the larder beetle; but that new woolen clothing should be eaten in preference to old, can only be accounted for upon the supposition that a special attraction, in this case, was found in the animal matter belonging to the wool, or employed in its dressing, and remaining in the woven fabric.

Trombidium locustarum Riley.

The Locust Mite.

Please give me the name and history of the parasite that deposits its small, oval, red eggs near the base of the grasshopper's wings.—I. G. I., Adena, O., September 10th, 1891.

The "small, oval, red eggs" of which inquiry is made, is the locust mite, *Trombidium locustarum* Riley. It renders most excellent ser-

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American Entomologist, i, 1868, p. 53.

† *Practical Entomologist*, i, 1866, p. 126.

vice — at times, of almost incalculable value — in the destruction of the eggs of the western locusts (commonly called grasshoppers), which it seeks when buried in the ground and eagerly devours. The young mites are very active little creatures, living at first in the ground where they feed on decaying animal and vegetable substances. When the opportunity is given them, they crawl upon the bodies of the locusts

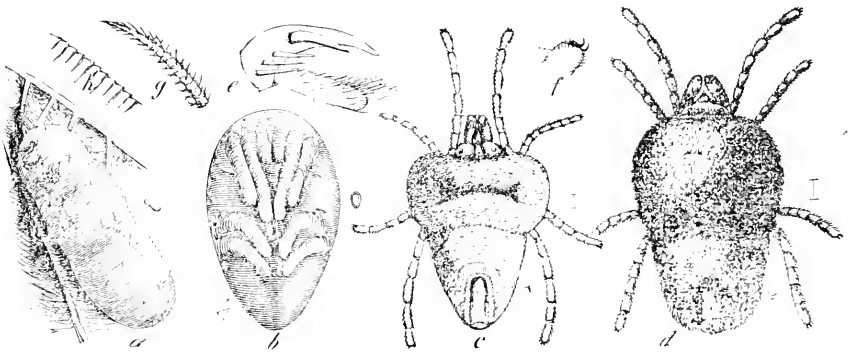

Fig. 31.— Trombidium locustarum.— *a*, mature larva when about to leave the wing of a locust; *b*, pupa; *c*, male adult; *d*, female adult; *e*, palpal claw and thumb; *f*, pedal claws; *g*, one of the barbed hairs; *h*, the striations on the larval skin. (After Riley.)

and attach themselves, in preference beneath the base of the wings, but sometimes, when unusually abundant, covering the entire body. While upon the locust, they are immature, being in their larval stage, and having only six legs. As they gorge themselves with the juices of their host, their bodies swell out into an oval sack-like form, almost concealing the legs, although they are long, and in this condition [represented at *a* in the figure] they may very easily be mistaken, as in the above inquiry, for eggs. After they have completed their larval growth they drop to the ground, where they undergo two changes — first to the pupa [shown at *b* in the figure] and then to the perfect eight-legged form [shown at *c* and *d*]. They pass the winter in the ground, and are said to be active whenever the temperature is a few degrees above the freezing.

A detailed and interesting article on this mite from the pen of Professor Riley, from which the above facts and figures have been taken, is to be found in the *First Annual Report of the United States Entomological Commission*, pages 306–311.

This mite is not confined to the Central or Western States, but has been observed in New Hampshire preying in very large numbers, both on the eggs and the mature insect of the lesser locust, *Melanoplus atlanis* (Riley).*

* Marlett, in *Insect Life*, ii, 1889, pp. 67, 68.

INSECT ATTACKS — THEIR REMEDIES AND PREVENTIVES.

The number of our more injurious insect pests is so large that comparatively few have been treated of in the seven preceding reports of the State Entomologist. It is desirable that each should be presented to the agriculturists of the State of New York in such detail and length of notice as would meet the requirements of the more advanced farmers, fruit-growers, and gardeners. In the main, this would be met in the presentation of the literature, history, description, illustrative figures, habits, life-history, distribution, and, above all, the best approved remedies and preventives, of the several species. A work of this magnitude, however, would require at least a score of years for its completion. In the meantime, it would certainly be of considerable service if there could be given to the public even brief notices of our more injurious pests, in which their features were sufficiently described for their identification, their transformations and more interesting habits stated, together with some simple methods by which their injuries can be prevented or lessened.

A number of notices, embracing some of the above particulars, have been contributed by the Entomologist during preceding years to agricultural papers — notably to the *Country Gentleman* and *New England Homestead*, in reply to inquiries received of the more common pests of the garden, orchard, and farm. As each of these is believed to contain matter of some importance and value, it may not be amiss to extend their usefulness by incorporating them from time to time in this series of annual reports, where they may serve some purpose (one would be, convenience of reference) until the time shall arrive when the insects of which they speak may receive more careful and studied consideration.

With the above will also be included some communications made to individuals, relating to insects of somewhat general interest.

Remedies for the Peach-Tree Borer.

The following communication was received from a correspondent in Waynesville, Ohio :

I wish you, or some of your experienced correspondents, would give directions for destroying, and also for preventing, borers

in young peach trees. The principal danger seems to be while the trees are young and tender. If one has but a few trees, perhaps the best way would be to search the borer out and destroy it, but during a part of the life of this pest it is very small and difficult to find so close to the ground; besides, in large orchards it would be an exceedingly slow and expensive process.

I see in the *Scientific American*, copied from the *N. E. Homestead*, that an effectual treatment is to "make a mixture of wood ashes and water, in the proportion of one quart of ashes to a pail of water. Stir well; make a little ridge of earth around the tree, a few inches from it, and pour in the mixture. It will soak into the worm-holes, and will kill them every time." The writer says he has used it for years successfully. He says that it may be necessary to do it twice the first year, but after that a very little care will keep the trees free from them. For want of ashes a thin solution of lime will do, he says. Why not heap a quart of ashes around the tree and let the rains supply the water? Now what I want to know is, whether this treatment has been sufficiently tested to justify me or any one else in depending on it in a large way — a thousand trees or more?

Would not an application of whitewash be as good a treatment as could be desired, after the trees are two or three years old — or thick soap-suds, applied with a brush or a rag? The first year the bark would no doubt be too tender for the whitewash.

Is it not found that it greatly increases the life and vitality of the peach tree to shorten in the branches every year after the season's growth is completed? Peach trees are generally short-lived; it is desirable to prolong their lives if we can, and such treatment will probably make them less liable to break down, owing to the disposition of the limbs to grow to great length, with most of the fruit far from the trunk of the tree.

It is not a difficult task to control this insect, *Ægeria exitiosa*, the *Sannina exitiosa* of many recent writers, if the proper means are

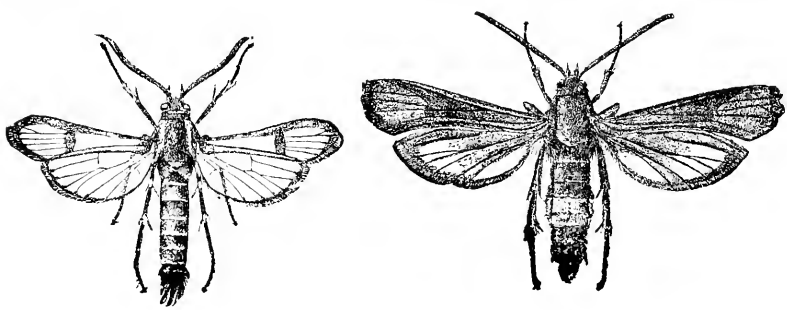

FIG. 32.—The peach-tree borer, SANNINA EXITIOSA (Say): 1, the male moth; 2, the female moth.

taken for it. It is possible to prevent its injuries to a great extent by the old method of searching for the presence of, and cutting out, the larvæ. There are those who contend that the destruction of the insect is the only proper thing to do, since by the applica-

tion of preventives you do not reduce its number, but only drive it away to unprotected orchards. A sufficient answer to this is, that there should be no unprotected orchards, and that the peach-grower who is too ignorant or indolent to employ the simple and inexpensive means by which his trees may be protected, does not deserve that they should give him remunerative crops.

Fig. 33.—Male and female moths of the peach tree borer, enlarged (after Emmons).

[The male and female moths, which are quite unlike in appearance, are shown in Figure 23, in twice their natural size, taken from Dr. Coquillet's "Our Injurious Ægerians," in vol. v of the *Journal of the Columbus Horticultural Society*. Figure 33, after Emmons, also illustrates the same insects.]

The treatment quoted above, of wood ashes and water placed in a funnel-shaped cavity about the tree, would unquestionably serve a good purpose in the destruction of the eggs and the young larvæ, if applied a few days after the deposit of the eggs or their hatching. But as the period of egg-laying of the peach-tree moth extends over the months of June, July, and August, it would require too frequent an application of the ash remedy to render it reliable and practical.

Carbolic Acid Wash.

This wash has been tested for several years, and so far as we know, has never failed to give satisfaction. Several large peach-growers have used no other method of protection. Two or three formulas have been given for it, but probably the best is that presented by Mr. Bateham of Painesville, O., in the *Country Gentleman*, vol. xlv, 1880, p. 246, and also published, with others, in the *Second Report on the Insects of New York*, 1885, pp. 24-26:

"For an orchard of five hundred bearing trees we buy a pint of crude carbolic acid (or half as much of the refined), costing not over twenty-five cents; then take a gallon of good soft soap and thin it with a gallon of hot water, stirring in the acid, and letting it stand over night or longer; then add eight gallons of cold soft water and stir. We

have then ten gallons of the liquid ready for use. The wash should be thoroughly applied with a swab or brush around the base of each tree, taking pains to have it enter all crevices."

Mr. Bateham gives for his locality (about 42 degrees of N. latitude), as the proper time to apply the above, during the last of June, if the weather is hot, or the first of July. He had never seen the moth depositing its eggs before the last-named date, and if eggs had been deposited a few days earlier, he claims that the wash would kill them at once.

Carbolic Acid and Paris Green Wash.

Mr. J. H. Hale, a successful peach-grower in South Glastonbury, Conn., has recommended in a paper published in the *Transactions of the Massachusetts Horticultural Society*, for 1888 (Part I, p. 66), a wash for the prevention and killing of the peach-tree borer, which would seem, on some accounts, to be even preferable to the preceding. He represents the egg-laying period of the moth to commence in the latter part of May, and continuing into September. On rare occasions he had seen the moth deposit eggs in the crotches of the larger limbs. Has this been observed, or the larvæ found in such localities by any one else?

The objects sought in the wash are: first, to smooth the bark; second, to prevent oviposition; and third, to kill the egg or larva if oviposition has occurred. The exact proportions are not very important. To a common bucketful of water take two quarts of strong soft soap, half a pint of crude carbolic acid, two ounces of Paris green, first reduced to a paste, with water and lime enough to form a thin paste that will adhere to the tree. A little clay may be added to assist in making it stick. Apply with a swab or brush before the first of June.

Killing the Borer.

Although the above is given as almost a sure preventive, Mr. Hale recommends that in addition, the tree should be examined in October, and where traces of the borer are discovered, as in exuding gum or the sawdust-like castings at the base of the tree, remove a little of the earth, scrape off the gum with a sharp knife, cut away the bark, and with a piece of wire follow up any channel that it does not seem best to cut open, crush or draw out the larva, which at this time will be from a half-inch to an inch long. [The full-grown larva, its cocoon, and the contained pupa are shown in Figure 34.]

Fig. 34.—Larva, cocoon, and pupa of Sannina exitiosa (after Emmons).

The Shaker Peach-tree Borer Wash.

The following is the recipe of the wash in use by the thrifty Shakers of Shaker Station, Hartford Co., Conn., which has been sold for past years at three dollars, but has recently been communicated to the *New England Homestead:*

Fish oil, 3 pts.; soft soap made from wood ashes, 3 pts.; whale-oil soap, 2 lbs.; powdered sulphur, 2 lbs. Mix the oil with the whale-oil soap, beating the lumps up thoroughly into a perfect emulsion. Then add the soft soap and, after mixing this thoroughly, stir in the sulphur. The more perfect the mixing is done the better. These ingredients can be obtained at almost any country store, and ought not to make the cost more than sixty cents the gallon. One man can mix a barrel and apply it to five hundred trees in a day. The application should be made every spring from May 15th to June 1st, in latitude 42°.

Preparatory to applying the above, it is recommended to remove with care, by the aid of a wooden trowel and broom, the ground for about a foot from the trunk, so as to lay bare the base and main roots. Examining them after three days, if any borers are present, they will be discovered at a glance by the oozing gum and their excrements or borings, and can be easily cut out with a sharp knife. After which, apply the compound with a paint brush to the cleaned roots, and up the trunk for eight or ten inches above the surface of the ground. Sprinkle on all the powdered sulphur that will adhere, and return the ground.

Mounding.

This method of protection is highly esteemed by some peach-growers. It is done by throwing up around the base of the tree, at any time before the deposit of the eggs, a mound of earth of about a foot in height, and pressing it closely to the trunk with the foot. In the following years, a few inches may be added annually. By this means the roots of the trees where they are given off from the trunk, are placed out of reach of the insect. The mounding is believed, also, to have a beneficial influence on the health of the trees, in prolonging their period of bearing and exempting them from disease. It has been claimed that this method has given entire exemption from the borer attack, at the cost of a very little labor.

A New Tree-Protector.

A model of a device has lately been shown me which promises to give complete protection for young trees from the attack of the peach-tree borer. A cylinder made of fine wire netting, about fifteen inches high, mounted on a galvanized metal base, gathered in at the top so as to adjust itself closely to the tree, opens at one side for passing it around the trunk, and is then secured and

fastened to the ground, and slightly into it, by a sliding pin. With this protection, the moth would be effectually prevented from depositing an egg upon or near the base of the tree. The cylinders could be quickly applied, and with proper care in housing them, they would last for many years. It is thought that they can be offered for sale at about twelve dollars the hundred.

It is undoubtedly very beneficial to shorten-in peach trees annually. It can be done in the autumn, or in the early spring, by clipping off at least one-third of the last year's growth.—*Country Gentleman*, for June 4, 1891.

In a communication to the *Rural New Yorker*, of October 17th, 1891 (page 736), Mr. J. S. Woodward, the ex-secretary of the New York State Agricultural Society, and a highly successful fruit-grower, condemns the recommendation made in a late number of the same journal (page 593) for treating trees infested with the peach-tree borer, by piling wood ashes just about the body of the tree and on the roots after some of the surface soil has been removed. He had seen trees killed from leached ashes piled about them, and unleached ashes would be almost sure death, and besides, they would be effective, if harmless, only for a short time. Mr. Woodward gives the following preventive for the borer as being entirely safe, and as sure as it is safe:

Take some dirty soap — the dirtier the better, — and add to it sweet skim milk so as to make strong soap suds. Into this mix hydraulic cement (common water-lime) in quantity sufficient to make a thick white-wash, and using a stiff brush or old broom, with this coat the trees from the ground or a little below, to from twelve to eighteen inches above, using plenty of the wash. This will form a solid coat of mail that no insect can penetrate, and unless broken with hoe, harrow or other tool, will last for a full year, or until the growth and expansion of the bark of the tree fills it with cracks. To eradicate borers already lodged in the tree, there is nothing so good as a sharp, strong knife and a sharp pointed wire.

An Ichneumonized Caterpillar — Interesting Case of Parasitism.

Eds. Country Gentleman.— Inclosed I send a peculiar worm found on my hop vine. At time of finding it was of a light green color, two and a half inches in length. Please name, and state whether it is in any way injurious to the plant. Last year I found on the same vine two worms, dark brown in color, with highly iridescent spots all over them, shining with metallic luster, while the worms themselves were almost as heavy as so much lead. I put them in a box, but neglected to send them until they became too shrunken for examination.

Mrs. K. M. B., *Wabash, Ind.*

The caterpillar taken on the hop vine comes in such a shriveled and broken condition that it can not be definitely named, but it is one of the Sphinges, and an examination of its head indicates that it is probably that of *Darapsa Myron*. This species feeds on the grapevine and the Virginia creeper, but many larvæ leave their food-plants and wander to other vegetation after they have reached maturity. I do not know of any species of the *Sphingida* that feeds upon the hop vine.

The caterpillar had been attacked by an ichneumon fly, which had inserted within its body over one hundred eggs. These had hatched and fed to maturity inside of the caterpillar, when they ate their way out of the body, each through a separate hole, and spun upon its surface small, elongate, oval, white cocoons, standing on end, and, from their number, nearly covering the entire body, as shown in Figure 35.

Fig. 35.—Caterpillar of Darapsa Myron (Cramer), ichneumonized by *Apanteles congregatus*.

An unusual circumstance attended this particular brood of parasites. While engaged in the spinning of their cocoon, they were discovered and appropriated for the prey of another parasite—a small Chalcid insect, of less than one-half the size of the larva which it attacked. A Chalcid egg was inserted in each larva—not a single one being overlooked. The cocoons were completed as usual, but their architects were thereafter made the food of their chalcid guests. As the result, instead of the cocoons subsequently opening at their upper end, by a nicely fitting hinged lid for the escape of the ichneumon fly, in each instance the perfected chalcid—a pretty metallic-green creature, with iridescent wings—has made its escape through an irregular hole eaten near the end of the cocoon.

The first parasite was in all probability *Apanteles congregatus* (Say); the second, the chalcid, has not been determined.

The "two worms with iridescent spots, shining with a metallic luster," can not be named from the characters given. Could they have been the dark brown chrysalids of the interrogation butterfly, *Grapta interrogationis* (Fabr.), ornamented with its silvery spots? This and the chrysalis of the comma butterfly, *Grapta comma* (Harris), are often known in hop yards as the "hop merchant," and are thought by some to foretell the future value of the crop, as the metallic markings may be more or less conspicuous.— *Country Gentleman*, for September 27, 1888.

A NEW ONION PEST, AGROTIS YPSILON (Rott.).

The following editorial notice in the Canastota [N. Y.] Journal, of June 20th, 1891, refers to a new insect pest that had recently made its appearance and was the occasion of considerable alarm:

Onion growers in the vicinity of Canastota are dismayed by the appearance of a pest that is making fearful havoc in some of the onion fields lying north and west of this village. The pest was first seen about a week ago. Growers noticed that their onions were getting thin and the plants appeared to be dying. Investigation, however, disclosed the fact that the plants were being eaten by a voracious dark-colored worm. The worms were of all sizes up to about one inch and a quarter in length and the thickness of a lead pencil. They seemed to work in spots, some parts of a field being overrun with the worms while in other places no traces of the pest could be found until they had migrated from the infested portions. Where they appeared, they were very numerous and quickly ate all the vegetation, including weeds.

The muck land lying north of Canastota, and in the adjoining portion of the town of Sullivan, is peculiarly favorable to the profitable culture of onions, and great quantities of them have been raised during the past five or six years. Hundreds of acres were sown to the fragrant vegetable this spring. The work of the worms will be of incalculable damage to the crop. The loss at present is estimated at one-fourth of the total acreage.

Examples of the caterpillar, as they proved to be, were received from the editor, Mr. P. F. Milmoe, with request for their examination and for aid in the emergency. Reply was returned, under date of June 17th, as below:

EDITOR OF JOURNAL.— DEAR SIR: Yours of yesterday, informing me of the severe attack in the onion fields of your vicinity, and accompanied by specimens of the depredator, is just received, and I send immediate reply.

These sudden outbursts of insect injury are not infrequent occurrences, and are often impossible to account for satisfactorily. On reading your note, I confidently expected to find, in this instance, a repetition of the attack made in the spring of 1885 upon the onion fields in Goshen and vicinity, in Orange county, N. Y., whereby many acres of onions were destroyed and serious losses inflicted, as described in Prof. Riley's Report to the Commissioner of Agriculture for that year (pp. 270-275), through the operations of the dark-sided cut-worm, *Agrotis messoria* Harris.

The examples you have sent me show it to be a different insect — a cut-worm, but of another species. So far as I can determine from the larval characters, which are somewhat variable, and show marked differences of feature in the different stages of growth, this is the black

cut-worm, *Agrotis ypsilon* (Rott.) — one of our most abundant species, common almost everywhere over the United States and Canada, and occurring throughout Europe, in the East Indies, the Hawaiian islands, and elsewhere. [The caterpillar and the moth that it produces are shown in Figure 36.] A peculiarity of this species, and one that would seem to add to the amount of injury that it may cause the onion grower, is the unusually long time that it is present with us. It is almost the earliest of the *Agrotis* species to make its appearance in the winged state. I have taken it as early as May 30th, and in collections made by me "at sugar," have observed it every night through the months of June, July, and August, over half the nights of September, and continuing until the last week of October. This would seem to indicate that its caterpillars are in the ground and continue their depredations through most of the spring and summer months. Whether this is the result of a long period of egg-laying of the moth, giving us the caterpillars at various stages of growth throughout the season, or if there are two or more overlapping broods, we are unable to say. Of some of the cut-worms, we could safely predict that they would disappear from view and their injuries cease within a limited time — a week or two,— but of the black cut-worm, no such gratifying prediction can be made. It may speedily disappear or its trouble may continue for several weeks longer. The size of the worms at present will enable you to form some opinion of their future operations. Those sent me are nearly full-grown. If nearly all are of this size — an inch and one-fourth in length when at rest — I would expect that their work would cease within two weeks from this time, when they should stop feeding, bury in the ground and form a cell for their pupation, from which they would emerge later as the winged moth. But if many of the larvæ are still small, you would be compelled to look forward to a longer battle with them. What shall be done with them to stop their ravages? This is the important question with the onion growers.

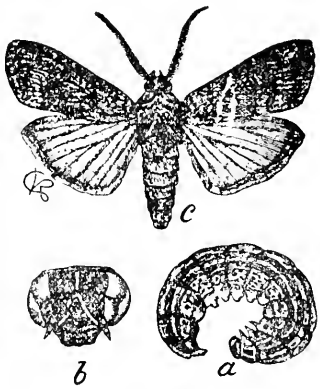

Fig. 36.—The black cut-worm, Agrotis ypsilon: *a*, larva; *b*, enlarged head of same; *c*, the moth. (After Riley.)

If I am able within a few days to go and look over the ground, I will do so, for then I could give you better advice. In the mean time I will suggest some means which, from the known habits of cut-worms, should afford very material relief. I presume that they feed mostly at night and spend the day within the ground near the plants at about an

inch below the surface. If the children, with a tin pail in hand holding some water with kerosene on its top, will go through the fields, and, working away the ground with their fingers, pick out the worms and drop them into the pail, much good will be accomplished. At Goshen, it was not unusual for a child to fill a quart pail in going over a field in this manner. Night collections, with the aid of a lantern, should be made, when the caterpillars, if small, will be seen at work upon the tops of the plants, or, if larger, cutting off the plants near the base for food or traveling over the ground. If, as possible, they are too abundant for hand-picking (although at Goshen entire nights of whole families were devoted to the work), then I would advise spraying at night with a kerosene emulsion for killing them.

The emulsion is easily made in the following manner: Dissolve in one gallon of boiling water, one-half pound of hard soap or a half-gallon of soft soap, and, by the aid of a force pump, mix with the solution one quart of kerosene until of a uniform mixture and wholly emulsified. Add to this enough water to make two gallons of liquid. This will give one part of kerosene to eight of the liquid, which should kill all the worms that it comes in contact with, without injuring the plants. If, however, found necessary, the proportion of kerosene could be increased. The above could be applied at night with a force-pump, or with any suitable sprinkler. Mr. P. C. Lewis of Catskill, N. Y., makes a pump which would be good for this purpose, at a cost of $5.50. A circular explaining it would be sent on application.

At Goshen it was found that a simple solution of a quart of soft soap in seven quarts of water, sprinkled over the plants, protected them from attack and also killed those of the worms that it reached. This is so simple that perhaps it might be first tried before resorting to the other remedies.

I trust that the above remarks will be adapted to present wants. Later, I will advise as to the best methods of preventing a recurrence of the attack another year, through preparation of the ground. I need hardly remark that the insect could not have been carried to your locality in the seed, as you suggested may have been done. You doubtless had it with you in preceding years, but not in remarkable numbers. For some reason the present year has been very favorable for its multiplication. The "black cut-worm" is known as a very general feeder, often proving destructive to strawberry plants, but I find no record of its injuries to onions. Very truly yours.

I was unable to visit the locality in season for observation of the attack, but learned that it ceased a week or two thereafter, doubtless

from the maturing of the caterpillars and their entering the ground for pupation.

It is not improbable that this larva is cannibalistic at times. Mr. Milmoe had inclosed about a dozen in a close-fitting box to send to me, but being forgotten for a day, when opened, to his surprise only two remained. He had been told that the larger ones had been seen eating the smaller in the fields.

The first of the caterpillars received pupated June 16th, and disclosed the moth, *Agrotis ypsilon*, July 12th — a pupation of twenty-seven days. A second became a pupa July 2d, and a third July 6th.

The Stalk-borer, Gortyna nitela, as an External Feeder.

Mr. H. H. Rich, of Hartford, Conn., has sent, with inquiries, a caterpillar which he had detected feeding on the tassels of his corn. It is the larva of *Gortyna nitela* Guenée, probably about three-fourths grown, as it is at maturity somewhat over one inch in length. It is a well-known pest of our gardens and fields, known under the common name of "the stalk-borer," and unfortunately is one of those which makes its attack upon a large number of food-plants, quite varied in their character. In my First Report, where I have discussed the insect at considerable length (pages 110–116), its food-plants, in the stems of which it lives, are given as follows: Tomato, potato, spinach, wheat, corn, dahlias, asters, lilies, spiræa, salvia, milkweed, castor bean, rhubarb, chenipodium, peach-twigs, currant-twigs, rag-weed, and hearts-ease. It also eats the fruit of the tomato and strawberry, and bores into the cobs of ears of corn, as well as in the stalk. The above list will serve to show what a general feeder it is, and that it rarely appears except as an internal borer in stalks, stems, and twigs.

Fig 37.—The stalk-borer, Gortyna nitela *Guen.* The moth and its caterpillar. (After Riley.)

It has often been sent to me in potato stalks and in the stalks of young corn, but I have never met with it before as an external feeder. Walsh and Riley record it as boring through the cob of growing Indian corn, and strangely confining itself to that portion of the ear, and also as boring into the stem of the same plant. Miss E. A. Smith and Professor French have recorded its operations in the stalk of young corn, and other writers have mentioned like injuries from it.

The caterpillar may be easily recognized by its head, first segment, and anal plate, being of a wax-yellow color, and its purplish-brown body, conspicuously lined with three white stripes, of which the central one is continuous from the first to the last segment, while the side ones are interrupted over the third to the eighth segments. A black band borders the side of the anal plate and the first segment and crosses the side of the head; the three pairs of thoracic legs are glossy black, the others (prolegs) are whitish. The caterpillar and the moth into which it develops are shown in Figure 37.

In Professor J. B. Smith's recent Catalogue of the Noctuidæ of Boreal America, this and its allied species are referred to the genus *Hydrœcia*.

The example sent is darker colored than any I have previously seen, being almost black. It manifests nothing of the restlessness and apparent timidity of those that I have taken from burrows

The present attack is of entomological interest rather than of economic importance. It probably will not occur in sufficient number on the tassels to prevent or even interfere with the proper pollenization of the plants. In the pieces of the tassels sent, as showing the operations of the caterpillars, a few of the flowers (staminate) have been nearly consumed and others partly eaten into, but the resultant injury will be so slight that no anxiety need be felt, in this instance, on account of the presence of the caterpillar, and no remedy for it need be suggested. (*New England Homestead*, for July 13, 1889.)

THE COW-HORN FLY IN NEW YORK.

A letter received from Miss Drake, of Demster, Oswego county, in the latter part of August, of the present year (1891), announced the presence of this fly on farms in that locality. In addition to replying to her request for information, the following notice was sent to the *Oswego Times*, and was published in the semi-weekly edition, dated September 4th.

Hon. John A. Place:

DEAR SIR: — I am sorry to be obliged to announce the advent in your county of a very injurious insect pest, which is destined to increase and do much harm to the dairy interest, whatever efforts may be made to arrest its spread. With timely warning, however, and a general effort to prevent the increase of the pest, its injuries may be materially lessened.

The newcomer is the cow-horn fly, *Hæmatobia serrata* R. Desv. Its introduction into your county is quite recent, and it was doubtless brought by one of your railroads—probably the R., W. & O., which traverses the northern part of your county, as it was reported to me under date of August 25th from a farm at Demster, through which the above-named railroad passes.

The fly is armed with a long, stout, sharp proboscis which it thrusts into the skin of the cattle where it is the thinnest and sucks the blood. In general appearance it resembles the common house-fly, but it is smaller and more closely allied to the biting fly, *Stomoxys calcitrans*, which appears in autumn and attacks animals and men, often entering our houses and inflicting a sharp, stinging bite through the stocking or elsewhere on the leg.

It was imported from France a few years ago, and was first noticed, in Pennsylvania, in 1886. For the past two years it has been abundant and troublesome in New Jersey. It occurs also in Delaware, Maryland, Virginia, and Ohio. In the early spring of this year it had extended into one of the southeastern counties of New York bordering on New Jersey.

Looking for its gradual spread through our State, I was greatly surprised to hear that it was present in large numbers in Oswego county. Although the account given me of its operations evidently pointed out the insect, yet I felt some doubt until, at my request, examples of the fly were sent to me.

Replying to a letter from Miss Drake, of Demster, who first informed me of the presence of the fly on their farm, I stated that if it was, as I supposed, the horn fly, it could be recognized by its congregating in large numbers upon the base of the horns. Answer was returned: "They annoy the cows by getting on their horns and between them, but can not say that they prefer those places, as sometimes it appears that they literally cover the entire body, especially on the back and shoulders. Our neighbors are all troubled with them, and all the cows are shrinking of their milk."

In a letter received this morning, I have intimation of the occurrence of the fly in Oneida county, and that it had made its appearance there a year ago.

It seems strange that interested parties will not at once send notice to the State entomologist of the appearance of any new insect pest, for if commenced in time, means may often be taken to prevent the spread, or rapid multiplication, of newly introduced insect pests.

Mr. A. J. Fly, of Delta, Oneida county, writes as follows:

I write to you for information in regard to a fly, which made its appearance in these parts about a year ago, and is proving a source of much damage to the dairymen and of suffering to the stock. The fly has increased very fast and attacks the cattle in swarms, causing sometimes large, raw sores on the shoulders and by the root of the tail, and also by the navel. They also cover the horns at times. They apparently attack fat cattle as readily as those in poor flesh. White and light colored cattle do not seem to be as much attacked as the black or dark ones. On spotted cattle the flies are sometimes thick on the black spots, while there are hardly any on the white. The fly seems more hardy than our common one, and takes more to kill it. If there is anything that can be done to get rid of this plague, our dairymen would be glad to know it, and avail themselves of the information, that they may relieve their cattle which are suffering greatly day and night.

The injuries from the attack of this fly do not result in the death of the infested animals, as was first reported, but they occasion large sores upon the body in various places, and from the irritation and inflammation that the myriad flies cause, there follows a great falling off in the amount of milk given — variously estimated at from one-third to one-half. The cattle also lose materially in flesh.

In New Jersey it has been found that the fly was most troublesome in June and early July, and that after the middle of August it gave comparatively little trouble. But even if you are to escape from any serious further harm from it this year, you should do what you can to prevent its continued multiplication.

Knowing that the fly deposits its eggs in the fresh droppings of the cattle, and mostly during the night, and that it lives and matures therein, I would urgently recommend that every morning, in infested localities, these droppings be carefully and thinly spread in the fields, so that it may quickly dry. The eggs and the larvæ would die in the dry material and could not mature therein. Another method of killing the insect in its early stages, but perhaps not so good as the preceding, is to scatter lime over the fresh droppings. To prevent the flies from biting the cattle, I know nothing better than once a week going over the bodies with a sponge dipped in whale-oil in which some carbolic acid has been mixed, only applying it to the tips of the hairs. I have treated of this fly, and given figures of it, in my *Fifth Report on the Insects of New York*, 1889, pp. 220–227. Possibly you might make some extracts from this, which would be serviceable and interesting to some of your readers.

Very truly yours.

The following communication relating to the fly, containing further notes of distribution and other additional information, was made to the *Country Gentleman*, of September 10, 1891:

Three years ago, in the autumn of 1888, the serious injuries to cattle in New Jersey, from the immense number of this biting fly that gathered upon the backs and sides of cattle and sucked their blood, was noticed in several numbers of the *Country Gentleman*. As at that time it had extended southward and westward into Delaware, Maryland, Virginia, and Pennsylvania, it was thought somewhat strange that it had not been observed in New York. It is now known to have entered our State as early, at least, as the summer of last year, but no published record of its occurrence was made until the present summer, when Mr. J. D. Lyons of Monticello communicated to the June number of *Insect Life* the statement of its abundance at that place during the preceding autumn, and that it had been first observed by him about the middle of August. Monticello is in Sullivan county, in the southeastern part of the State, and about twenty miles north of the northern limit of New Jersey.

On August 24th of this year, I was surprised to have the insect reported to me from Oswego (on the southern curve of Lake Ontario), and so abundantly that on a farm at Demster they were literally covering the backs and shoulders of the cattle, annoying them greatly, and largely reducing the yield of milk. Upon looking at the location of Demster, it was found to be on the Rome, Watertown and Ogdensburg railroad, and it therefore seemed probable that the fly had been carried to that remote part of the State by railroad transportation, either upon cattle or in cattle cars.

The following day a newspaper item noted the presence of the fly on many farms in Caton, Steuben county, N. Y.—this county being at the middle of the southern tier, and the town of Caton, bordering on Pennsylvania, whence it had doubtless been introduced.

From the above known localities of this troublesome insect, there is every probability that it has already been, or very soon will be, largely distributed throughout the State of New York.

While it will not occasion the alarm that attended its first formidable attack upon the cattle in New Jersey—excited by the sensational reports that from the clusters of the fly upon the horns, larvæ were produced which burrowed into the head and brain, causing death within twenty-four hours—still, its injuries are of such a character that it is very desirable that proper effort should be made by every dairyman—first, to prevent the attack of the fly, which is followed

by unsightly and unhealthful sores, and a diminution in the flow of milk from one-third to one-half: and, secondly, to reduce the number of the flies by preventing their breeding. It is not difficult to do this. While there are several greasy substances which, if applied to the cattle, will prevent the flies from alighting and inflicting their bites, it is thought that the best results have been obtained from the application, at least once a week, to the tips of the hair with a sponge, of fish-oil in which a little carbolic acid has been mixed. This has been found to give almost entire immunity from attack for nearly a week. Any application of tar to the horns is useless, as when gathered there the flies do no serious harm, having only selected a convenient resting place from which they may not be dislodged by the sweep of the tail, or by ordinary rubbing.

A knowledge of the breeding habit of the fly suggests a simple remedy available against its multiplication. The insect breeds in the droppings of the cattle. Its eggs are deposited almost wholly during the night in the fresh droppings; it has been stated that from their point of observation about the base of the tail, the flies follow the droppings to the ground, and at once deposit their eggs therein. For the hatching of the eggs and the development of the larvæ into the winged insects, moisture is required. If, therefore, every morning during the prevalence of the fly the droppings of the night be thinly spread over the field with a shovel, so as to permit its speedy and thorough drying, the eggs and the larvæ that may be therein will die from want of the proper moisture needed for their development. This method is so simple that no dairyman should hesitate to charge himself with its diligent performance. Another means of killing the insect in its early stages is said to be sprinkling lime over the droppings. While this does not seem as simple a remedy as the one before mentioned, it might be desirable for use in stables.

In the *Fifth Report on the Insects of New York*, 1889, several pages have been given to the life-history and habits of this insect (*Hæmatobia serrata*), its introduction from the south of France into this country, the character of its injuries, its distribution, together with some preventives and remedies which have not been named in this notice. A representation of the fly and its peculiar and formidable biting and sucking apparatus is also there given.

Professor John B. Smith, entomologist of the New Jersey Agricultural College Experiment Station, has given a bulletin (No. 62, November, 1889) of forty pages on "The Horn Fly," which is an interesting and highly valuable paper. It is possible that some copies of

this bulletin are still to be obtained, and may be had upon application to Director James Neilson of the Station, at New Brunswick.

At the recent meeting of the Association of Economic Entomologists at Washington, D. C., the presence of this fly in Ohio was reported. Like most of the introduced European pests it will doubtless have an extended distribution throughout the States of the Union, and also a speedy one, from the ease with which it may be conveyed in cattle cars by rail.

Wire-worms and Remedies for Them.

Eds. Country Gentleman.—The wire-worms have become so plenty in this county that it is nearly impossible to raise a respectable crop of potatoes, corn or oats; they also work heavy on timothy meadows. All remedies applied so far have failed to do away with them. Could not some one of your readers who has experimented with them give us his views on this subject? M. L., *Potter County, Pa.*

Although I have not had the opportunity of experimenting with wire-worms, or of making special study of means for controlling them, yet the results of what has been done and reported by others, may be of value to the above inquirer, and to a host of others who are troubled with "the wire-worm"—one of the most annoying pests with which the agriculturist has to do.

Of the many methods that might be recommended for dealing with these insects, and for mitigating their ravages to a greater or less extent, the three following are named as probably the best and most efficient that may be employed:

1. *Starvation.*—When a crop is known to have been injured by them, upon the removal of the crop, collect thoroughly and burn all the material upon which the larvæ might feed another season, for the larval life is long-extended—it is believed, in most of the species, to three years, and in some, it is claimed, even to five years. If the ground has been cultivated for potatoes, or vegetables of any kind, gather in piles all the stalks, stems, or vines, together with the roots, and burn them. When timothy meadows, or grass lands of any kind, have been infested, after feeding as closely as possible, plow thoroughly and fallow—as also in the cultivated fields—during the autumn, with such additional plowings and harrowings as shall best tend to destroy all vegetable life. Gas lime, if procurable, may at this time, to great advantage, be spread upon and washed into the soil. Repeat these operations the following spring, and allow the field to lie fallow for the year. This will certainly arrest the wire-worm attack.

2. *Buckwheat Remedy.*—If the fallowing for the year be thought an unnecessarily high price to pay for the arrest of the injury, it may per-

haps be accomplished in this manner: After the ground has received the thorough breaking up and working over in the autumn and spring above recommended, follow with a crop of buckwheat. Wonderful efficacy has been claimed for this plant in freeing ground from wire-worms. Of the abundant testimony that might be quoted on this point, we will only give that of the late Hon. A. B. Dickinson, who has stated as follows:

"After experimenting with salt and lime, and many other things recommended, I have found only one remedy for the rascals, and that is to break the sod and sow it to buckwheat. Plow late, and as often as possible, in the fall, and then sow it to pease in the spring. With a like plowing the next fall, they will not injure any crop the following season."

3. *Mustard Remedy.*—In England a crop of mustard is regarded by many as an absolute specific against the wire-worm. In an address before an agricultural society there, the speaker, after narrating some successful experiments which he had made with mustard, on a small scale, made the following explicit statement:

"Thus encouraged by these results, I sowed with mustard the next year a whole field of forty-two acres, which had never repaid me for nineteen years, in consequence of nearly every crop having been destroyed by the wire-worm. I am warranted in stating that *not a single wire-worm could be found the following year*, and the crop of wheat throughout was superior to any that I have grown for twenty-one years!"

As possibly some of the readers of the *Country Gentleman* may not distinguish between the wire-worm, the cut-worm, and the "thousand-

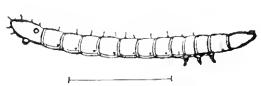

Fig. 38.—Larva of Agriotes mancus. (After Fitch.)

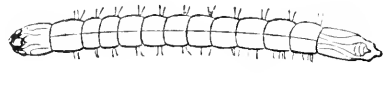

Fig. 39.—Larva of Melanotus communis. (After Fitch.)

legged" worm, it may be desirable to state that the first-named is a small (usually less than an inch in length), slender, flattened creature, with shining surface, and often of a hort-color or pale brown or yellowish shade; its texture is tough and leathery. The first three segments of the body are each furnished with a pair of rather long four-jointed legs, while the last segment bears a single retractile proleg. Figures 38 and 39 are rude representations of two of the common species—Figure 38 being the *Agriotes mancus* of Say (regarded by Dr. Fitch as *A. truncatus* of Melsheimer), and Figure 39, *Melanotus com-*

munis (Gyll.). The perfect insects into which they develop — known from their habit, when placed on their back, of springing into the air in order to regain their feet in the fall — as "snapping-bettles," are represented in part by Figure 40. Figure 41 shows, in enlargement, one of the wire-worms in the act of burrowing into and feeding on a kernel of corn. Figure 42 represents one of the common cut-worms, *Agrotis clandestina*, in the well-known curled attitude that it assumes upon being unearthed. Figure 43 is one of the thousand-legged worms — *Julus caeruleocinctus* Wood.

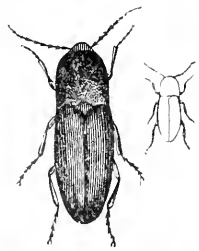

FIG. 40.—MELANOTUS COMMUNIS, natural size and enlarged (After Fitch.)

The wire-worms — members of the family of *Elaterida* — are very numerous in species, but the early stages and life-histories of but a few have been studied, and even those are imperfectly known. Their faithful study is a great desideratum, but unfortunately the difficulties that it presents has deterred most of our entomologists from its prosecution.

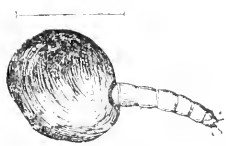

FIG. 41.—A wire-worm attacking corn. (After Fitch.)

The *Country Gentleman* has presented its readers with many excellent articles on wire-worms, remedies for them, etc., which may be consulted to advantage by those who are sufferers from their depredations. Among these, the following issues may be cited: May 8, 1877, p. 281; June 14, 1877, p. 377; August 5, 1877, p. 220; December 11, 1879, p. 793; February 8, 1883, p. 105; May 31, 1883, p. 441; November 29, 1883, p. 961; April 12, 1888, p. 284. There are also many others, which may readily be found by turning to the elaborate and careful indexes that accompany each volume.—*C.-G.*, November 29, 1888.

FIG. 42.—The W-marked cut-worm of AGROTIS CLANDESTINA.

FIG. 43.—Thousand-legged worm, JULUS CŒRULEOCINCTUS Wood.

NOTE.—A careful study of wire-worms, extending over three years, has since been made at Cornell University, Ithaca, N. Y., by Professors Comstock and Slingerland, and the results published in "Bulletin 33 of the Cornell University Experiment Station," for November, 1891. The experiments conducted in the course of the study embraced trials with various insecticides for the destruction of the larvæ and beetles; killing

the larvæ by fallowing, starvation, growth of the supposed immune crops; protection of seed by tar coating, and soaking in kerosene, salt and copperas, and other solutions: the effects of certain fertilizers; methods of destroying the pupæ and beetles, etc., etc.

The experiments in remedies and preventives against the larvæ gave no satisfactory results or such, at least as seemed to be of practical importance in preventing to any great degree their ravages. It appeared as if the efforts of the agriculturists could be directed with better results toward the destruction of the beetles.

The Bulletin closes with the life-histories and larval descriptions of five species of our wire-worms, viz.: *Agriotes mancus* (Say), *Asaphes decoloratus* (Say), *Melanotus communis* (Gyll.), *Drasterius elegans* (Fabr.), *and Cryptohypnus abbreviatus* (Say),— covering twenty-two pages, which are of special value in consideration of the comparative little study that has, up to the present, been given to this family, and its great economic importance.

THE ROSE BUG AND HOW TO KILL IT.

The following notice was communicated to the *New England Homestead*, of May 9, 1891 (vol. xxv, p. 265), in compliance with a request from the editor: "Will you please tell our readers how to kill the rose-bug?"

There are localities as notably in the State of New Jersey, where the grape crop can not be protected from destruction by the rose-bug. This insect has its breeding ground in wet places in sandy regions. Under favorable conditions these breeding grounds, in the course of years, become so extended that at a regular period, known almost to the very day (about the 25th of May in New Jersey), such immense armies are sent abroad, that their combined attack is perfectly irresistible. Although hundreds of thousands may be killed, yet as fast

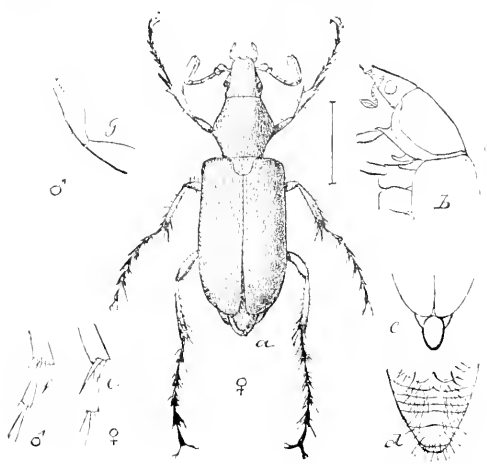

FIG. 44.— The rose-bug, MACRODACTYLUS SUBSPINOSUS, with structural details. (From *Insect Life.*)

as destroyed others take their place, until the crop they attack is entirely consumed. Contest with them is hopeless, and may as well be abandoned at the outset, so far as the preservation of the crop is concerned.

Usually in the New England States and in New York, the beetle does not appear in irresistible numbers, and is within our control. Often this can be accomplished by beating the insects from the plants, at intervals during the day, for perhaps a week or two, into a pan of water and kerosene. When occurring in still larger numbers, severe injury from them may be prevented by repeated sprayings with kerosene emulsion. The efficacy of this method is attested by Professor M. H. Beckwith, in Bulletin No. 12, for March, 1891, of the Delaware Agricultural Experiment Station. Prof. Beckwith first tried spraying grapevines, upon the blossom buds of which the beetles had commenced to feed on the 27th of May, with London purple of the strength of one pound to two hundred gallons of water. The beetles were entirely unaffected by the arsenite, and not a single dead one could be found as the result.

The vines were next sprayed with a mixture of lime and water, completely covering with it the foliage and blossom buds. This application at first seemed to be distasteful to the insects, and checked their feeding for awhile, but in a few hours they resumed their attack, and completed the destruction of the buds.

The next experiment was made with kerosene emulsion. This was entirely successful. Rose bushes thronged with the beetles were sprayed with an emulsion of one part of kerosene to nine of water. When the spray struck the beetles they at once fell to the ground. The application was made in the evening, and the following morning many of the dead beetles were lying on the ground underneath the bushes. Several of the sprayed roses containing many of the beetles were picked off and placed in a well-ventilated breeding cage, and in the morning every beetle was dead. It should be borne in mind that the emulsion kills only by contact, and that therefore successive applications of it must be made as often as the beetles reappear upon the plants. It seems to kill all the insects that it reaches.

Another remedy for this most pernicious insect is found, upon the testimony of Professor J. B. Smith, of the New Jersey Agricultural Experiment Station, in the sludge-oil soap, manufactured by the Columbia Chemical works, at Brooklyn, N. Y. It was tried upon the beetles, when appearing in full force in New Jersey, after everything

else that had been used — perhaps twenty different insecticides — had entirely failed. The sludge-oil soap was the only material that would conquer these insects, in the experience of Professor Smith. Col. Pearson, of Vineland, who has so long and faithfully been experimenting with methods for controlling the rose-bug, also had most gratifying success in the use of this valuable insecticide. It therefore appears, that in the use of kerosene emulsion and sludge-oil soap, we have two reliable insecticides with which we are able to control the ravages of this pest of the horticulturist and fruit-grower, whenever it does not appear in overwhelming numbers. In New Jersey, a successful fight against it can only be made in the discovery and breaking up of its breeding grounds.

In *Insect Life*, ii, March, 1890, pp. 295–302, Dr. Riley has given a quite full account and excellent figures of this insect. The figure illustrating the beetle is given herewith: the details of structure will be readily understood without special reference to them.

Professor Smith has also given in Bulletin 82, July 3, 1891, of the New Jersey Agricultural Station (40 pages, 10 figures), and in the Annual Report of the Station for 1891, an excellent account of "The Rose Chafer or Rose Bug," containing many new observations, and detailing, in 22 pages, the numerous experiments made by him for its destruction or prevention of its ravages.

THE MAPLE-TREE BORER, GLYCOBIUS SPECIOSUS (Say).

From Mr. Henry Herrick, of Amsterdam, N. Y., the following inquiry was received, dated Sept. 23d, 1891:

Grubs or worms are destroying my maple shade trees. They either work around the trunk under the bark, or in an upward direction for a yard or more and then go into the wood to the depth of four or five inches. I have had a man to cut out the dead bark and trace them to the hole, where I can insert a stick in many cases for five inches. I would like to know what I can put in the hole to kill the grub without harm to the tree. A stick or a wire may fail to reach him in the burrow from its not being straight. Can I throw something in with a syringe that will do the work?

Mr. Herrick was answered: It will not be worth your while to attempt to kill the grubs in your maples by injecting an insecticide. The long burrows contain no grubs, they all having emerged from the trees through holes in the bark in July. At the present time all of the grubs are within easy reach of your knife. Their location in the tree, if you will go carefully over the bark, may be discovered, as Dr. Packard has told us, by "a rusty, irregular discoloration of the bark of about the size of a cent, and especially by the frass or castings, which,

to the length of an inch or more, are attached, like a broken corkscrew, to the bark."

On cutting into the bark at this place you will find the slender burrow, probably running in an upward direction for about an inch, and the young grub, of about one-fourth of an inch long, lying in its upper end.

This is the most simple and effective way in which to arrest the injuries of this destructive borer. It is far preferable to wrapping the trunk with cloth during July or August, or applying repellants for preventing the deposit of the eggs, for, by the means above suggested, the insect is killed instead of being driven away to other trees.

The following notice of this insect is contained in the "Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1886," but as only a few copies of this paper were printed for distribution it is republished here, containing as it does, some observations that have not been given elsewhere.

A lady writing from Canajoharie, New York, complains with much feeling of the ravages of a borer which is rapidly destroying some highly valued maples which shade and adorn her home.

From the account given of its operations, it is undoubtedly the maple borer above named (*Glycobius speciosus*), which was first described by Say in 1824, in *Long's Second Expedition to the Sources of St. Peter's River* (ii, p. 290), as a rare insect. In addition to the specimen taken on the Wisconsin river during the expedition, one other only was known, which had probably been taken in Pennsylvania, and was in the possession of the Philadelphia museum. It was subsequently illustrated in Say's *American Entomology*. Dr. Harris has noticed and figured it in his *Insects Injurious to Vegetation*, giving at the same time one of those popular and graphic descriptions which enable his readers to recognize the insect unaided by illustration, and have lent such a charm to his invaluable report. Of later years the beetle has become comparatively abundant, being found in nearly all collections, and having been frequently written of by a number of authors. It is one of our most beautiful species, as its specific name of *speciosus* (meaning beautiful) implies, being a member of the family of longicorns (*Cerambycidæ*) and measuring over an inch in length, marked with the strongly contrasting colors of yellow and black, and bearing conspicuously a w-like character on the front part of its wing covers. [See Figure 45, reproduced from Emmons.]

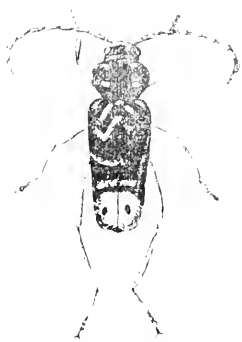

Fig. 15 — The sugar-maple borer, Glycobius speciosus.

Despite its beauty, it is a highly pernicious insect. Not content, as are most of its associates, with burrowing in dead or sickly vegetation, its attack is usually made on perfectly healthy trees.

It was my privilege several years ago to follow an attack of this insect on a row of maples at Schoharie, New York, which I passed daily, and had for years observed with pleasure their vigorous and healthful growth. As adding to the testimony of Dr. Packard of the attack of healthy trees (*Insects Injurious to Forest and Shade Trees* — Bulletin No. 7 of the United States Entomological Division, pp. 103, 104), I herewith copy the record made under date of November 30, 1859:

I have noticed this autumn, for the first time, that our sugar maples, which we have always regarded as our most valuable shade tree, from the almost complete immunity which they have enjoyed in trunk and leaf from insect depredation, have been attacked by a borer so pernicious in its work as to threaten their destruction unless some means shall be found to arrest the attack.

In its simplest form it reveals itself by the bark parting longitudinally and breaking away, disclosing the wood of the tree in a narrow strip for some five or six inches in length. On the surface of the wood can be seen the furrow of the grub, cut to a slight depth, gradually increasing in its dimensions as it descends, and at the lower end entering the trunk of the tree: over the borders of the groove the growth of sapwood made since the injury, impinges. This, I presume to be the work of a grub proceeding from an egg deposited late in the season, and compelled to seek an early refuge by approaching winter. A wound no more serious than this, would close over in two or three years and no permanent injury result. But when the grub has had full time allowed it for its work the injury is far more important.

In several instances I have traced the furrow, packed tightly with fine powder for two feet or more in extent, with an average breadth at its lower portion of over half an inch and nearly one-fourth of an inch in depth. To render it the more serious the grub, almost invariably before entering the tree, leaves its downward path and winds nearly horizontally around the trunk until it completes about half a circuit. It then enters the trunk an inch or thereabouts back from the end of its burrow, ascending at an angle of about ten degrees. The perfect insect emerges from the tree above its point of entrance through an opening which can be probed horizontally for three or four inches, the mouth of which is smoothly cut and somewhat elliptical, the broadest diameter being about .35 of an inch.

One maple which I have examined, of about ten inches in diameter at the base, which has been more seriously affected than others, and probably the first to be attacked, has been nearly destroyed. Several of the grubs had commenced their ravages side by side, and by their united cuttings have in places exposed the trunk for over a hand's breadth. The tree has been attacked in various places from above its first limbs nearly to its base,— the injury extending beneath the surface of the ground. The entire circumference of the tree has been grooved,

although not continuously. Circulation is still maintained by winding around and among the furrows; but one more season's work will, it is believed, take the life of the tree

In a row of maples bordering a lawn scarcely a single tree is entirely exempt from injury — all apparently the work of this grub. If these injuries are to continue and increase, and I see nothing to prevent it, our maples, which we prize so highly, will share the fate of the locust and be abandoned to the borer as too unsightly a tree for ornamental use.

The "beautiful Clytus" is a difficult insect to control, and very many of the fine old maples, which have ornamented our streets and afforded us so agreeable shade, have been or are being killed by it. A few years ago it was a source of much pain to me to see at Bennington, Vt., the large number of old maples that were standing dead upon the streets or rapidly dying from the merciless burrowing of this borer that had scarred and excavated their trunks. Recently the same ravages, although not as yet to the same extent, were observed by me at Glens Falls, N. Y.

Probably the best method of arresting the ravages of this pernicious borer would be to watch for the commencement of the operations and kill the young larva. The eggs are laid in July and August. [The means communicated to the lady for finding and killing the borer were virtually the same as those given in the reply to Mr. Herrick, and therefore need not be repeated here.]

THE SQUASH-BUG, ANASA TRISTIS (De Geer).

A correspondent desires to know what is best for the destruction of the black squash-bug, *Anasa tristis*. Can Paris green be used with safety? If not, what can be used quickly and safely on an acre or two of squashes?

Paris green is of no service against the squash-bug, or the many other bugs of the Order of Hemiptera that take their food through a proboscis from the interior of plants. The best remedies, so far as known at the present, for the squash-bug are found in trapping and killing the females before their oviposition, and in the destruction of the eggs. Some success has attended experiments made for preventing attack, by the employment of strong-smelling substances, as for example, dipping corn-cobs in gas-tar and thrusting them in the ground among the plants, and occasionally renewing the tar.

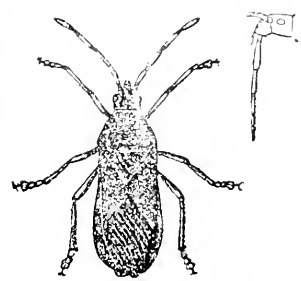

FIG. 46.—The Squash-bug, "ANASA TRISTIS — enlarged one-half diameter; head and beak still more enlarged.

The first appearance of the bugs among the plants should be watched for, that operations against them may be promptly commenced,—or what may be still better, traps should be arranged for them a little in advance of their expected time of coming. In the Northern States they generally come abroad from their winter hiding places toward the latter part of June. The traps may be pieces of bark, chips, bits of wood or strips of board, laid upon the ground near the hills. It is claimed, by some that the best possible trap is found in the leaves stripped from the lower part of the plants and spread beneath, as the insects are particularly fond of the juices of the wilted foliage. The traps should be turned over and examined morning and evening, and the bugs which have hidden beneath them for the day (coming abroad at night for the deposit of their eggs), captured and destroyed.

In addition to the daily examination of the traps, careful inspection should be made of the underside of the lower leaves for the patches of eggs that may be deposited on them, which when found are to be crushed. The eggs may be recognized by their being of a dull orange color, flattened on their two sides, and occurring in clusters. As the female does not deposit all of her eggs at once, and as fresh bugs continue to make their appearance for the space of two or three weeks, the daily search may be advantageously continued for that length of time and as much longer as the life of the ovipositing female is extended beyond it.

Later, while searching for the eggs, companies of the young squash-bugs will be found on the leaves, each with a green body, the head and thorax black, and the antennæ pink. When two or three days old, the color of their body changes to ash-gray, and the others portions to black.

The employment of the above remedies involves considerable labor, but where the insect is unusually numerous, it will be amply repaid. If commenced in season and faithfully continued into July, much of the accustomed damage of the notorious pest, will be prevented, and but few of the mature forms with their increased power for injury will be found during the months of September and October.

Care should be taken not to permit the bugs to gather around the base of the main stalk, as they are sometimes wont to do (for sucking its juice) in such number as to girdle it. This may usually be prevented by drawing away some of the ground from around the stalk and applying a mixture of dry ashes and salt. Without this precaution, it is said that the bugs will at times burrow into the ground out of sight where they feed securely and unsuspectedly on the sap of the plant. High fertili-

zation, will of course, assist materially in the ability of the plants to resist the attack made upon them by this pernicious insect. (*Country Gentleman*, for January 8, 1891.)

The Hop-vine Aphis and Remedies.

At the request of the editor of the *New England Homestead* for an article upon the best methods known for controlling the hop-vine aphis, the following notice was communicated, and was published in the issue for May 2, 1891. It was copied in a number of other papers in the hop districts of the State:

The one great uncertainty in the successful cultivation of the hop crop is its liability to attack and destruction by the hop-vine aphis — sometimes known as "the fly" or "the green fly." Although this insect is not entirely absent from our hop yards in any year, yet its multiplication and the excessive injury that it frequently inflicts is dependent upon atmospheric and meteorological conditions. Unfortunately these can not be predicted, and, therefore, the hop-grower usually defers action that would serve to prevent aphis multiplication until the attack has been made in force — can not be wholly arrested, and can only be mitigated at a great expense.

Hop-vine Aphis in Europe and America.

The hop-vine aphis, *Phorodon humuli* (Schrank), is an European pest, which was first observed in the United States in 1862. For a long time it has been allowed to work its ravages in this country, in years of its abundance, without effort made against it. Quite different has been the course pursued in England, where no hop-grower attempts to grow a crop without his regular "hop-washings."

Its Life-history Discovered.

Four years ago (in 1887), the life-history of the insect was, for the first time, worked out, in the hop yards of New York, by the entomological division of the U. S. Department of Agriculture. With this knowledge at our command, it is safe to say that, *with proper care and without great expense, our hop crops can be saved from aphis destruction.*

The insect, deserting the hop yards in the autumn, passes to plum trees, on the smaller twigs of which its eggs are laid and survive the winter. Hatching in the early spring [and producing the "stem-mother," shown in Figure 47], three broods are developed on the plum, the third brood being winged. This brood at once takes wing, deserts the plum trees, and flies to the hop yards. This flight takes place *in the month of May*—in England it has been noticed on the 28th of May. The precise time would, of course, vary with the temperature of different seasons, but could be ascertained by a careful examination of the hop leaves daily at about the usual time for its appearance.

FIG. 47.—The hop-vine aphis, PHORODON HUMULI, the stem-mother, enlarged; head and antenna still more enlarged. (From *Insect Life.*)

When to Attack the Aphis.

The winged aphides [the "migrants," shown in Figure 48] would be found at first *on the upper leaves of the outer rows of plants in the yard.* This is the time, without any delay, to commence operations

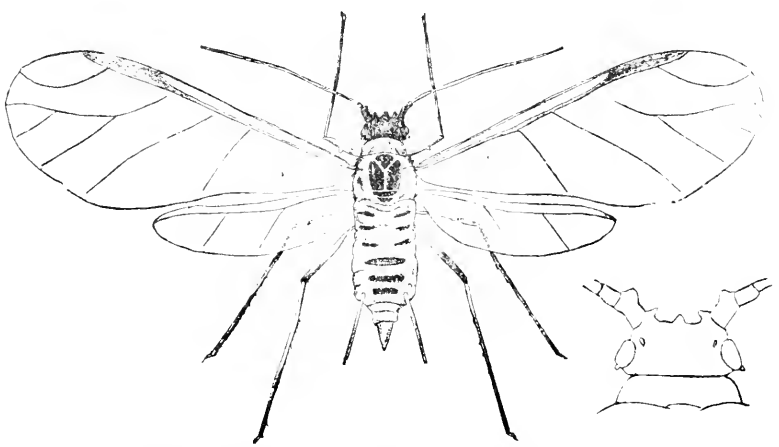

FIG. 48.—The hop-vine aphis, PHORODON HUMULI, migrant from plum, of the third generation, enlarged; head still more enlarged. (From *Insect Life.*)

against them. They should be killed, and thereby prevent the enormous progeny to which they would give rise in the nine rapidly succeeding generations said to have been observed on the hop-plants. This multiplication, in favorable seasons, is simply appalling—almost incredible, but it need not be permitted.

It may be prevented by *killing the plum-tree migrating brood while upon the outer rows of the yards.*

How to Kill the Aphis.

The best insecticide for use is believed to be kerosene emulsion, prepared after the formula which has been so often given in leading agricultural journals.

The emulsion is made as follows: Take of kerosene, two gallons; common soap, a half-pound; water, one gallon. Dissolve the soap in the boiling water, and, after removing from the fire and while yet boiling, add the kerosene, emulsifying the mixture by pumping it through a force pump with a spray nozzle into the same vessel until it assumes the appearance of thick cream and the oil does not rise to the surface.

For ordinary use, on trees, etc., dilute the above mixture with nine parts of water.

For the hop-vine aphis one part of the emulsion to twenty-five of water should be used, as a greater strength is liable to blacken and injure the leaves.

Properly applied, by spraying with a suitable force pump through a fine nozzle, it will not fail of killing every aphis with which it comes in contact. It is all important that it be applied so as to bring it in contact with each insect, as it kills only by this means, and not, as do the arsenical mixtures, by depositing the poison on the leaves to be subsequently eaten by the insects. All plant-lice are sucking insects, feeding only on the sap of the vegetation that they infest.

As the kerosene emulsion requires some labor in its preparation, possibly some of our hop-growers would prefer to use the hop wash which, for a long term of years, has been successfully used by the English hop-growers, and we accordingly give the formula for it:

One hundred gallons of water (if hard water, with soda added).

Four to five pounds of soft soap.

Six to eight pounds of quassia chips, first steeped in cold water and afterwards steamed or boiled.

The efficacy of this washing has been clearly demonstrated. Hop-growers who have sprayed with it in England have grown crops of 700 to 900 pounds per acre, while those not using it grew nothing, or next to nothing.

Repeat Spraying as Often as Necessary.

As the plum tree brood does not migrate *en masse* at the same time, a second spraying should follow the first in a few days thereafter. Watch should be kept for the advent of newcomers, either through flight or by reproduction, as the new broods occur at intervals of a few days, and are therefore frequent during the season. The spraying should be repeated as often as is necessary to prevent the multiplication which would otherwise destroy the crop.

Preventives of Hop-vine Aphis Attack.

There are at least three methods by which much may be done to prevent attack:

1. Cut down and burn all the wild plum trees in localities where hops are grown, so as to afford fewer places where the hop-vine aphis may oviposit in the autumn. Include in this such cultivated plum trees as are not yielding paying crops, particularly if infested with black-knot.

2. Spray all cultivated plum trees with a strong kerosene emulsion during the winter, or in the early spring before the leaves are out, in order to destroy the eggs of the hop-vine aphis which may have been deposited there the preceding autumn. The kerosene should penetrate and quickly kill all the eggs which it reaches.*

3. Collect and burn all the refuse (leaves and vines) of the hop-yard as soon as the crop is picked. At this time many of the male aphides, which are the last to leave the yard, are still upon the vines, and in the burning, it is believed, that their number may be reduced to the extent that enough will not remain to fertilize all the females that have already taken their departure. The mating occurs largely, if not wholly, upon the plum trees.

The above directions involve watchfulness and labor, but the demand they make is trifling in comparison with the value of the crop that may thereby be rescued from destruction.

The figures in the above are from the Entomological Division of the U. S. Department of Agriculture, obtained through the kindness of Dr. Riley.

THE MELON APHIS, APHIS CUCUMERIS Forbes.

LOWELL, MASS., *August 27th.*

EDS. COUNTRY GENTLEMAN.—I send you by mail a box containing some muskmelon leaves and shoots that have been attacked by what seems to be a kind of plant-louse. Last season they destroyed my little plat when the melons were half-grown, the vines appearing as if touched by frost. Can you tell me what the creature is, and what means could be used as a preventive? I presume that it is too late now to save the vines, though I did not notice any trouble until yesterday.—T. C. B.

The aphides or plant-lice, from the fortnight's delay in reaching me, had become shriveled and discolored, but there is scarcely a doubt that they are the species which was described and named by Professor Forbes,

* Late experiments have shown it to be doubtful if aphis eggs can uniformly be killed by spraying with the emulsion. It would certainly be effective if made to reach the young aphides soon after their coming from the egg.

State Entomologist of Illinois, as *Aphis cucumeris*, and was treated of by him at considerable length (nine pages) in the *Twelfth Report on the Insects of Illinois*, published in 1883.

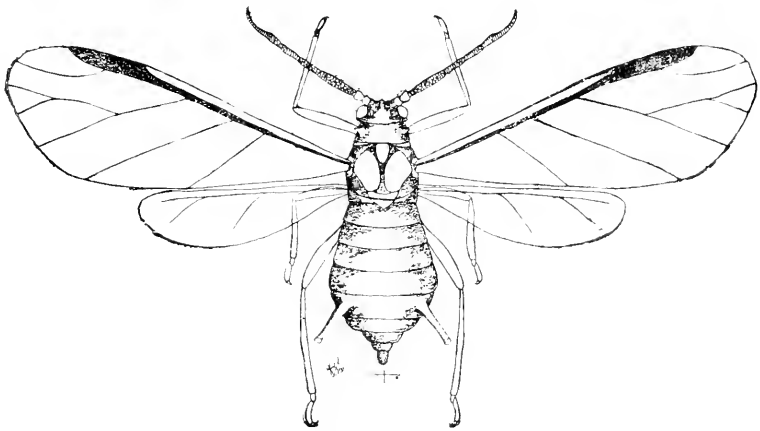

Fig. 49.— The melon aphis, Aphis cucumeris, winged oviparous female. (After J. B. Smith.)

It is there characterized as "a minute, very sluggish, green or greenish-black insect, occurring in immense numbers from spring to late summer, on the underside of the leaves, and also upon the roots of muskmelons, cucumbers, squashes, and other cucurbitaceous plants, causing the leaves to curl and shrivel and lose their color, and greatly hindering the development of the plants."

It further appears, from Professor Forbes' account, that it was first observed in Illinois, in 1880, as doing much injury to nutmeg and muskmelon vines, and also to the cucumber vines. Early in the spring of 1882 it made an overwhelming attack on both watermelons and muskmelons, in many localities in Illinois, entirely killing the plants. Cucumber vines growing in the vicinity were not greatly injured; squash vines to a slight extent.

In some instances, where the vines were not at once killed by excessive numbers, the plant-lice disappeared from them about the 1st of August, permitting the plants to rally somewhat and yield a partial crop. Many of the insects had been parasitized, and their dead bodies, by thousands, were found clinging to the leaves.

This insect has not, so far as we know, been previously reported from the eastern part of the United States. It is to be hoped that in its presence here it may be met by the same parasitic attack that checked its increase at Normal, Illinois. The operations of the parasite — a

minute insect that deposits its eggs within the plant-louse — may readily be recognized by the aphis becoming greatly swollen in size and rounded, and changing to a pale brown color.

In the absence of parasitic attack, Professor Forbes, as the result of experiments, recommends the following:

Sprinkling the underside of the leaves with road dust. In experiments, where it adhered, the insects were killed, or disappeared.

Dusting the underside of the leaves by means of a powder bellows, with pyrethrum powder. After twenty-four hours all the insects had fallen from the leaves, and were dead and dried up.

Spraying with a kerosene emulsion killed all it reached, and cleared many leaves entirely.

Tobacco smoke, forced by means of a common bee-smoker, under large pieces of canvas (hay-caps) covering a section of the plants, and keeping the space beneath well filled with smoke for ten minutes, killed seventy-five per cent of the insects.

For garden use, where the plants are comparatively few, the last-named remedy is deemed the most feasible.

It is advisable whenever this attack occurs, to destroy the old vines and leaves, within which the insect may be hibernating, and not to grow the same crop on the same ground the following season.

The muskmelon "shoots" submitted, show a different and a quite interesting form of attack, in which the smaller leaves have been transformed into small, irregular, subovate, downy galls. These have given out their insects, which are found to be a species of *Cecidomyia.* As I can find no mention of *Cecidomyia* attack on any of the *Cucurbitaceæ*, the insect is probably new to science. If it proves to be so, it might appropriately be named *Cecidomyia cucumeris.* It will be noticed hereafter. (*C. G.*, for September 27, 1888.)

Melon and Strawberry Pests: Aphis cucumeris and Corimelæna pulicaria.

Eds. Country Gentleman.— Be kind enough to inform me how to prevent lice from eating cantaloupe or cucumber vines; and, if spraying will do any good, what to spray with to destroy the insects and not injure the vines. There is also an insect that stings the stem of strawberry blossoms about half an inch from the carp; then they dry up and fall off. Is there anything to prevent this?

H. H.

Wellham's Cross Roads, Md.

The "lice" infesting melon and cucumber vines are probably the cucumber aphis, *Aphis cucumeris* Forbes. It may be killed if kerosene emulsion, pyrethrum powder or pyrethrum in water, fish-oil soap, or strong tobacco water, is applied to it. But as it usually occurs on the underside of the leaves, and causes them to curl irregularly, it is almost impossible to reach the insects by ordinary spraying. If a knapsack pump, provided with a rod and a Vermorel nozzle, be used, the liquid could be thrown very effectually upon the lower surface of the leaves. The eggs of this aphis are deposited in the autumn, and probably on the dead leaves and vines. If these, therefore, are collected and burned each year, the attack of the insect would be largely prevented.

The insect that punctures the blossom-stems of the strawberry is probably "the flea-like negro-bug," *Corimelæna pulicaria* Germ. (If possible, examples of insects of which information is desired, should be sent with the inquiry.) It is the size of some of the flea-beetles — about one-tenth of an inch long, and is shining black with a white stripe on each side. As this little bug has a large number of food-plants, as the raspberry, cherry, quince, garden flowers, and several weeds of which it is very fond, it is difficult to bring it under control. The same substances recommended above for the aphis would probably kill it.

Fig. 50.—The flea-like negro-bug Corimelæna pulicaria. (After Riley.)

[The insect is shown in Figure 50.]

Professor Riley states that this troublesome and destructive insect is particularly partial to two weeds, upon which it breeds, and beneath which it may often be found in the month of June in countless numbers — viz., the red-root or New Jersey tea-plant (*Ceanothus americanus*), and neckweed or purslane speedwell (*Veronica peregrina*). He therefore advises the propagation of a small plat of either of these weeds near a strawberry patch or other infested crop, as a decoy for the bugs, which may thus be drawn away from the cultivated crops and easily destroyed when congregated in large numbers in a limited space. (*C. G.*, for June 4, 1891.)

Since the publication of the preceding notices of the cucumber aphis, Professor J. B. Smith has reported its destructiveness to all kinds of cucurbitaceous vines in all parts of the State of New Jersey, in 1889 (*Bulletin 72, October*, 1890, *N. J. Agr. Coll. Exp. St.*), and in the Annual Report of the Station, 1890, page 484, he refers to it as having been troublesome to growers for years past.

Professor Smith recommends as the best remedy for this insect, and a preventive of all injury if applied in time, fish-oil soap in the proportion of one pound to eight gallons of water, put on with the cyclone or Vermorel nozzle.

SCALE INSECTS ON CAMELLIA AND OLEANDER.

A lady has sent the following inquiry of scale insects which are infesting her plants in Jacksonville, Ala. Reply was sent through the *Country Gentleman* of March 25th, 1891.

I inclose two leaves, one of *Camellia japonica*, the other of oleander, both of which are infested with parasitic fungi. The disease spreads over the plants, which alternately succumb to its attacks, in the greenhouse as well as in the open air. Will you kindly inform me what it is, and if there is any known means of its prevention.

The leaves give no indication of fungus attack (upon the authority of State Botanist Peck), but are infested with scale-insects. The oleander shows on its underside, along the midrib and scattered over its surface, numerous small, rounded white spots of about one-twentieth

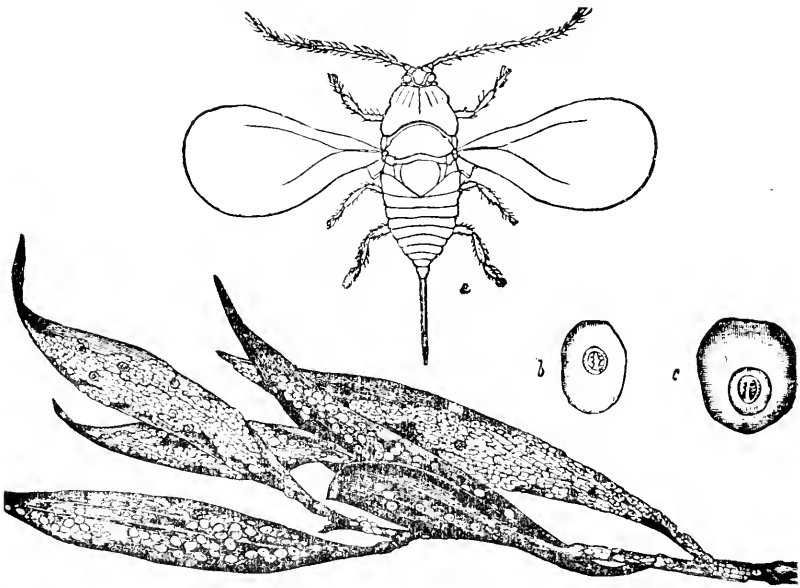

FIG. 51.—The white scale, ASPIDIOTUS NERII, on an acacia twig; *a*, the male insect; *b*, the male scale; *c*, the female scale—each enlarged.

of an inch in diameter, having a wrinkled, pale orange center. These are the common "oleander scale," *Aspidiotus nerii* Bouché, which occurs over the whole of the United States and in Europe, and on a great

variety of plants and trees, viz., magnolia, acacia, ivy, maple, plum, cherry, currant, orange, lemon, etc. The true insect, when mature, is found beneath the scale—the white portion of the scale being a protective secretion thrown out by the larva, having upon its center one or two orange-colored larval skins cast off at its moltings. [See, also, *Fifth Report on the Insects of New York*, pp. 278, 279.]

The camellia leaf is infested with a different species of scale. It is brown, elongate, bearing the cast skins upon its pointed and narrow end, quite broad at the other extremity (which in one example is white), and resembles in shape the well-known oyster-shell scale of the apple tree, except that it is not curved. It apparently belongs to the genus *Parlatoria*.

An assured remedy for these insects is spraying them with the kerosene emulsion or whale-oil soap solution. The latter might not be effectual except when applied to the young soon after they have hatched from the egg, and before they are protected beneath their scale. When infesting house-plants, as oleander and camellia, the insects may be destroyed by passing over the stalk and branches, and the leaves on their underside, with a sponge or piece of flannel dipped in a little sweet oil or kerosene. The oil will penetrate the scale and kill the insects beneath. Upon some old oleanders which had become badly infested through neglect, kerosene was used so freely that misgivings were entertained of the result, but the effect was only beneficial.

A GRAPEVINE SCALE INSECT, LECANIUM SP.?

Complaint was made that a grapevine which trails against a shed in Springfield, Mass., was covered with a multitude of scale-insects, similar to the specimens sent. The vine had not been so infested before, and another vine near by was not infested.

The piece of vine is almost entirely covered with the large scales of this insect — in some cases even overlapping one another. They are of a dark mahogany color. A few are of a pale brown color, with two broad subdorsal blackish stripes and about eight narrower transverse bands. They are smooth and without a carina, broadly oval, their dorsal elevation about one-half of their diameter, and the largest measure one-sixth of an inch in length. On raising the scales from the bark they were found to be packed with small transparent white eggs, elliptical in form, with a length of about double their breadth. These scales are

identical with some described by me in the *Country Gentleman* for July 4th, 1878, and not identified at the time.

Associated with the above are some smaller pale brown, more elongate scales, which in their carination and transverse constrictions bear resemblance to *Pulvinaria innumerabilis* [Rath.], while they are evidently a species of *Lecanium*. A few of the eggs have hatched at this date (June 4th), and the young larvæ are running rapidly over the scales. No cottony secretion is present, but when the scale and eggs are brushed away, a white powdery substance is found beneath them.

As, on a former occasion, I have counted 1,054 eggs beneath one of these scales, the rapid rate at which the insect may multiply, is evident. It will be necessary, therefore, to free the infested vine from them, or they will speedily destroy it and extend to other vines.

If the scales are confined to a portion of the vine, they could be removed from it at the present time and many of the eggs destroyed by crushing them with a cloth held in the hands and moved over the stem with a twisting motion. The cloth might be wet with a carbolic acid solution or strong soap suds; or the scales could be scraped from the vine with some blunt instrument and received in a broad basin of water covered with kerosene. The eggs should by no means be permitted to survive the operation of their removal, to continue the attack and destroy the vine, as they undoubtedly would if not properly treated. With the eggs hatched, the empty scales, it is hardly necessary to add, would be harmless. (*New England Homestead*, June 12, 1886.)

Apple-tree Insects of Early Spring.

Apple-tree Aphis — Apple-tree Case-bearer — Eye-spotted Bud-moth — Apple-leaf Bucculatrix — Pear-tree Psylla.

Insect attacks upon the unfolding buds of the apple tree are either unusually abundant the present season (the spring of 1891) or our fruit-growers are more carefully watching for insect depredations, and more eager for the knowledge of means of checking them than they have been in former years. Such action is wise, for just at this time orchards are exposed to attack of several insect pests, which, if not promptly checked, can not as well be destroyed later, and must necessarily prove of serious injury to the coming crop.

Mr. Dwight Stone, of Lansing, Oswego county, N. Y., has written me under date of April 27th, as follows:

Inclosed I mail you two insects; the little green one is easy to find, but the other is more difficult to detect. It is a worm in a sheath, which, when fastened to the leaf, stands out at an angle of 45°, and looks, to the naked eye, something like a lettuce seed. When detached from the leaf, it comes (partly) out from the sheath and crawls like a worm. If touched it quickly draws back into its sheath. There are millions of the first named insects, and but few of the last in my orchard. Please give me their names and the probability of the latter to increase and do damage.

The green insects, of which there were many creeping over the opening buds, are the common apple-tree aphis. *Aphis mali* Fabr. They are still quite small, but have already undergone one molting since hatching from the eggs, as numbers of their cast shriveled skins are fastened to the buds. Wherever abundant, the injury that this insect causes in extracting the sap from the buds is so great that its increase should be promptly arrested by spraying with a strong soap solution, tobacco water, or the kerosene emulsion—the last, the most reliable.

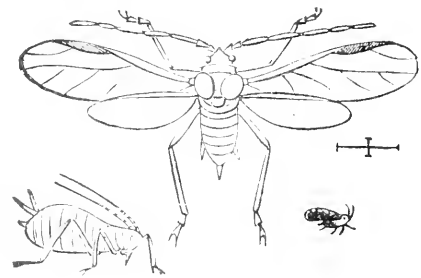

Fig. 52. Apple tree aphis, Aphis mali; winged and wingless forms.

The other insect, inclosed in a "sheath," is the apple-tree case-bearer, *Coleophora malivorella* Riley. It is apparently rare in the State of New York, as it is but the second time that it has come to my notice, the first having been noticed in the *Country Gentleman* for July 6th, 1882 (vol. xlvii, p. 533), as occurring in South Byron, Genesee county, N. Y. Its eggs were laid last July—the caterpillars hatching therefrom in September, and at once inclosing themselves in a brown, parchment-like cylindrical case, leaving an opening for the head and anterior segments to protrude, so as to admit of

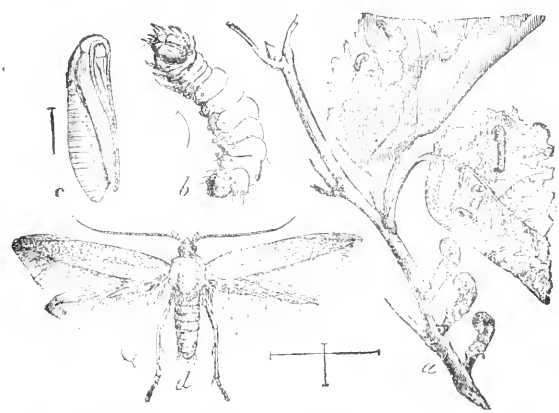

Fig. 53. The apple tree case bearer, Coleophora malivorella.—*a, a, a*, the cases containing the larvæ, shown in natural size; *b*, larva, enlarged; *c*, pupa, enlarged; *d*, the moth enlarged. (From Riley.)

locomotion and feeding. The insect hibernated within this case, fastened closely to the twig. A few days ago, on awakening from its winter sleep, it sought the unfolding buds, and commenced to feed thereon. The case, which is slightly curved at its anterior end, is at this time, about one-twelfth of an inch in length. The larvæ will continue, unless destroyed, to feed upon the foliage until about the middle of June, when they complete their growth, transform to the pupa state within the pistol-shaped cases, which will then measure one-fourth of an inch in length, and give out the moth during the month of July.*

The proper treatment for this insect is arsenical spraying at the time of the opening of the buds, and at intervals thereafter, if required. It has been noticed at length in my *First Report on the Insects of New York*. The figure illustrating the insect is herewith given.

A third insect was found associated with the above, viz., the caterpillar of the eye-spotted bud-moth. *Tmetocera ocellana* (Schiff). This destructive caterpillar, which in its early stage eats out the buds of the apple tree and completely destroys them, is causing serious injury, and is apparently annually increasing in the orchards of our State. It may be killed by thorough spraying with Paris green, at the same time as for the case-bearer.

Mr. Malcom Little, of Malcom, Seneca county, has sent the following communication, dated April 27th :

I inclose with this a box containing apple buds with at least two kinds of enemies. One is the aphis and the other a worm entirely new to me. There are empty cocoons on some of the twigs. The worm cuts the bud off in some instances. Will spraying with kerosene emulsion kill the worm?

The buds submitted showed the presence of three insects. The apple-tree aphis was quite abundant. The little brown, black-headed caterpillar of the eye-spotted bud-moth was eating into several of the buds. The short bits of twigs bearing the blossom buds were, in some instances, whitened with the little ribbed, ellipsoidal, white cocoons of the apple-leaf Bucculatrix, *Bucculatrix pomifoliella* Clemens. Most of the cocoons were old ones of last year which had given out the moth and were more or less broken, but a number of them contained the living pupa, as was found by crushing them beneath the finger, which would in a few days have disclosed the winged insect in the orchard for deposit of the eggs of another brood.

* The larvæ ceased feeding in June and fastened themselves to the sides of the box, but did not give out the imago. On examination, the cases were found to contain the dead and shriveled larvæ.

Both the bud-moth caterpillar and the pupæ of the apple-leaf Bucculatrix could be destroyed by the arsenical spraying repeated as often as found necessary. It would have been more efficient could the spraying have been done two weeks earlier, or at about the time of the first perceptible swelling of the buds. Possibly at this time (April 29th) some of the Bucculatrix moths have emerged, and have commenced depositing their eggs.

A third note of inquiry, from Mr. Frank Mothrop of Lincoln, Wayne county, dated April 26th, is as follows:

Since receiving your reply to my letter concerning spraying our orchard, I have found three different insects that I would like much to know about, and I accordingly send them to you in this mail. The first is a small gray miller, which appears in numbers about my apple trees, especially in warm, sunshiny days. The second is a small green louse, of which there seem to be from one to four on every bud. Are they hurtful to the fruit, and what will have to be done to kill them? The third is a worm of about one-eighth of an inch in length, with a black head and brownish body, which seems to be eating into the bud. I do not find many of this kind, but I fear that more will hatch out.

These insects are giving us a good deal of anxiety, and we would like to know if it would be better to spray for them now or wait until after the blossoming. Please answer as soon as possible.

Reply to the above was made, that although the little gray moths sent had lost nearly all of their scales in catching and handling them there was hardly a doubt that they were the eye-spotted bud-moth (named in the preceding notices), particularly as some of its larvæ, but recently hatched, were found feeding in the buds. This is the third insect mentioned in the above note. The oviposition of the bud-moth extends over quite a period of time, so that the conjecture that others than those now seen will make their appearance, will probably be confirmed. The observed flight of the moth in the daytime is of interest, as it has not been recorded. No time should be lost before spraying with Paris green for the caterpillar. [See Note A, appended.]

The second insect, mentioned as "a small green louse," indicates a new and dangerous attack in the orchards of our State, viz., that of the pear-tree Psylla, *Psylla pyricola* Foerst. This insect was referred to in a communication made by me to the *Country Gentleman* for April 16th, entitled, "Honey-Dew on Pear Twigs." A few days since some blossom buds were brought to me from an apple orchard of Mr. George T. Powell, of Ghent, N. Y., which showed a formidable attack by this pest. The living insects were seen when the buds were picked, but when they came to me only their dead and shriveled remains could

be found, but the stems bearing the buds were thickly and conspicuously coated with a "honey-dew," which had been excreted by the Psyllids. The presence of this honey-dew always serves, at this season and onward, to disclose the attack of the (at this time) small and almost hidden larvæ.

This species of Psylla usually infests the pear. Its occurrence on the apple has been noted by writers, but the above was the first time that it had come under my observation. Its occurrence in the apple orchard at Lincoln is the second instance.

It has not been studied in this country, and most of our knowledge of it is obtained from European authors. From its formidable attack in pear orchards in the Hudson river valley, it now claims the attention of our economic entomologists. [See NOTE B.]

So far as we know its natural history, it may be best fought by spraying with a kerosene emulsion early in the spring, before the hatching of the eggs, or just after the insect has emerged. Later, it will probably be found to be enveloped in its copious excretion of honey-dew that will make it difficult to reach by external applications. In classification and general appearance, Psylla is near the plant-lice, and, like them, takes its food by suction. (*Country Gentleman*, of May 7, 1891.)

NOTE A.—In the light of subsequent studies, it appears that my identification with some doubt, of the moths received from Mr. Mothrop, can not be sustained. Prof. M. V. Slingerland, of Cornell University, has fully worked out the life-history of the eye-spotted bud-moth, and shown that the winged insect comes abroad during the month of June and early July, and that there is but a single brood—not two, as I indicated in a brief notice of the insect in my Seventh Report, page 307. See Bulletin 50, March 1893, of the Cornell University Agricultural Experiment Station, for Professor Slingerland's elaborate study of the insect.

NOTE B.—The pear-tree Psylla, in consideration of its excessive multiplication and severe injuries in 1891, has, since the above was written, been given the study that its economic importance demanded. In Bulletin 44, October, 1892, of the Cornell Experiment Station, Professor Slingerland has given us in careful detail the life-history of this interesting insect, description and illustrations of all its stages, and the satisfactory results of experiments made for its control. My own observations upon it are in the MS. of my Ninth Report, awaiting publication.

Some Injurious Insects of 1890.

The following notes from a paper read by Hon. Daniel K. Young, of Oyster Bay, Queens Co., N. Y., before the Queens County Farmers' Club, were submitted to me for any comments that it might be thought desirable to make upon them.

1. In the summer of 1890, there was noticed in growing wheat a partial blight. The leaves lost their normal green, turned brown, and withered. Rye was similarly effected, but less seriously; there was also noticed in rye scant filled heads and much shriveled grain. This was attributed to insect depredation. The causes were not investigated nor the extent of damage noted.

2. Oats was ruinously blighted in an early stage of growth, similar to, but more seriously than wheat. There is also an insect enemy of many years standing, which has rendered the kernel almost valueless. No satisfactory exposition of this has been made public.

3. The marketable value of potatoes is seriously impaired by what is popularly known as "Scab." This is undoubtedly caused by insect perforation, but when or at what stage of growth of the tuber is not positively known.

4. The elm-leaf beetle, or rather the larva, has disfigured and seriously injured elm trees several seasons past. The frequent drenching rains in August and later in the season of 1889, destroyed quantities of the pests while in the pupa state, before transformation to the perfect beetle was completed. This gave false hope of its destruction. The few that appeared in the spring of 1890 increased without molestation, and the approaching season will probably show a material increase.

5. In view of the fact that the Colorado and the Asparagus beetles have been kept in subjection by remedies which timely investigation proved efficient, the Committee suggest that the managers institute inquiries into these matters, and if necessary, at the proper season invite the State Entomologist to personally investigate, and report upon what they are, their different stages and habits, so that the lay mind may comprehend sufficiently to institute inquiry, observation, and remedies.

A few remarks may be made upon the above:

1. Examination of wheat and rye from several localities, affected in the manner above described, showed the discolored portions to contain multitudes of a minute nematode worm — one of the *Anguillulidæ*, which were undoubtedly the cause of the discoloration and the partial blight. The particular species was not determined.

During the past two or three years, nematode attacks have been found to be very common in a large number of plants. Careful study has been given to them both in this country and in Europe. Dr. J. Ritzema Bos, of Wageningen, Netherlands, has published the results of his elaborate studies of *Tylenchus devastatrix* — one of the most common species. Miss E. A. Ormerod has detected them as causing much of the so-called "clover sickness;" and in this country, the life-

history of *Tylenchus radicola* which infests a large number of our agricultural products, has been worked out by Professor Atkinson, then of the Georgia Agricultural Experiment Station.

The Department of Agriculture, at Washington, has also published an extended report upon the Nematodes prepared by Dr. J. C. Neal, an agent of the Department.

2. The blight in the oats is probably that which has been noticed by Messrs. Galloway and Southworth in the *Journal of Mycology*, vol. vi, 1890, page 72. It was prevalent that year during the months of May and June, in several of the United States — in some of them injuring the crop from thirty-five to seventy-five per cent. Nothing in the way of a fungus or animal parasite as the cause of the trouble could be found, but bacteria were present in every specimen examined.

The insect causing the shriveling of the oats, was the well-known grain-aphis, *Siphonophora avenæ* (Fabr.). It was not destructive generally throughout the State during the year, but in two or three localities it was reported as having injured the wheat crop to an extent of from twenty-five to fifty per cent.

3. For the "potato-scab," of which frequent complaints are being made, no effectual preventive has as yet been found. Much attention has been given to the disease, and considerable progress has been made in its investigation. It appears that there are several kinds of scab, resulting from different causes. It has been variously referred to injuries from insects, as the wire-worm and white-grubs; to injuries from millipedes (thousand-legged worms), earth-worms and mites; to excessive moisture in the soil producing an abnormal growth of the corky tissue; to lime or oxide of iron in the soil; to fertilization by stable manure; to the action of bacteria; and to fungus attack.

That one of the "scabs" is caused by, or at least is always associated with, bacteria, seems to have been demonstrated by Mr. L. H. Bolley.* Another form has been found by Dr. Roland Thaxter, of the Connecticut Agricultural Experiment Station, to be due to a fungus attack, the particular species of which has not yet been determined.† This has been named as the "deep scab," while another form, known as "surface scab," often associated with it, may prove to be only a modification of the former.

4. The beneficial effect of heavy rains in destroying the elm-leaf beetle, *Galerucella xanthomelæna* (Schrank), has not, we believe, been previously reported. That such should be one of the results of heavy

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* *Agricultural Science*, iv, 1890, p. 243.

† *Ann. Rept. Conn. Agr. Exp. St.* for 1890, pp. 81-95, figs. 1, 2.

rain-fall seems quite reasonable, knowing its service in arresting the multiplication of plant-lice in early spring, as well as of other species of insects. This suggests the feasibility of killing the larvæ when descending the tree-trunks for pupation, by simply spraying with cold water, throwing it upon them with force from a nozzle having rather large holes. It would, of course, be more effective, with very little additional trouble, if some simple insecticide, such as tobacco or soap, were added to the water.

5. The State Entomologist will always be glad to investigate any new form of insect attack that may be brought to his notice, or to propose such remedies or preventives as have been found serviceable against such pests as may have been already successfully studied.

The above, essentially, was communicated to Mr. Jacob Hicks, of Old Westbury, N. Y., with thanks for his kind submittal to me of Mr. Young's paper, containing, as it does, observations intelligently made and ably presented.

APPENDIX.

(A)

ENTOMOLOGICAL ADDRESSES.

SOME INJURIOUS INSECTS OF MASSACHUSETTS.

[Read before the Massachusetts State Board of Agriculture at its Country Meeting at Framingham, December 3d, 1885.]

Gentlemen. — Before proceeding to discharge the pleasant duty that I have undertaken in compliance with the kind request that you, through your secretary, have done me the honor of making,— that I would give you some practical remarks on insects with which you have to contend in your farming operations,— will you please allow me a few preliminary words.

Always glad, as I am, of an opportunity to commend the importance of the study of economic entomology, and to give some evidence of what it has accomplished, it is with more than ordinary pleasure that I am permitted to address the Massachusetts State Board of Agriculture. Not because I have been assured that I would find an appreciative audience, but that I can avail myself of the occasion to make public acknowledgment of the debt of gratitude that American agriculture owes to you, to those who have preceded you, and to your State, for what you have done in the promotion of economic entomology.

Here in Massachusetts the science had its birth, and to the fostering care that it has continued to receive we are largely indebted for the proud position that it at present holds.

Nearly a century ago — in the year 1793 — a prize was offered by the Massachusetts Society for Promoting Agriculture, for the best essay to be presented to it upon the "canker-worm,"— an insect which, according to a statement made in the "New England Farmer" in 1790, had at that time been a destructive pest in many portions of New England for fifty years. The prize was awarded by the society to William Dandridge Peck, for his paper

entitled the "Natural History of the Canker-Worm," published in the year 1795. The paper was worthy of being a pioneer in a new line of investigation.

Mr. Peck's studies upon the canker-worm were made at Kittery, Maine, but he was subsequently called to Harvard College. In 1817, another paper, "On the Insects which Destroy the young Branches of the Pear-Tree, and the leading Shoot of the Weymouth-Pine, by W. D. Peck, Esq., Professor of Natural History and Botany, at Harvard University" (I cite from the paper in my library), was published in the "Massachusetts Agricultural Journal" (January, 1817, vol. iv, pp. 205-211), by the society before mentioned.

The lectures of Professor Peck were attended by Thaddeus William Harris, of Dorchester, Mass., during the years 1813-15. Of his instructor, Dr. Harris, in his later years, wrote: "It was this early and much esteemed friend who first developed my taste for entomology, and stimulated me to cultivate it."

I need not dwell at length upon the entomological labors of Dr. Harris, for they are familiar to you all. To him, perhaps more than to any other man, do we owe the widespread interest felt in the study of the insect world. His collection of insects was commenced in or about the year 1820, at the time when he entered upon the practice of his profession at Milton; and during his residence here and at Dorchester most of his out-door researches were made. His studies were untiringly continued for the remainder of his life, during the long period of twenty-five years that he held the librarianship at Harvard University, subsequent to the year 1831.

At the commencement of his librarianship he was honored with the preparation of a Catalogue of the Insects of Massachusetts, which was appended to the geological report of the State by Professor Hitchcock. Ten years later, in 1841, was published his "Report on Insects Injurious to Vegetation,"—one of the scientific reports which were prepared by the Commissioners on the Zo logical and Botanical Survey of Massachusetts, agreeably to an order of the General Court, and at the expense of the State. It has the honor of

being the first government publication on insects issued in the United States. Subsequent editions have appeared of this report, with additions in 1852, and again in 1862,—the latter with illustrations. Of this work it may justly be said,—The State has honored itself in its publication. Although so many years, marked with wonderful progress, have elapsed since its preparation, it is still the first volume that I recommend to those who desire to learn of insects and their habits; for it stands to-day as fresh, as interesting, as valuable as when first issued from the press — unsurpassed, we believe, by any similar report in any other department of natural history ever published.

Your own Board has done much to encourage entomological studies. I have in my possession a paper, entitled "Economic Entomology, by Francis G. Sanborn, Entomologist to the Massachusetts Board of Agriculture," without date of issue, but probably published about the year 1860.

"An Essay on "Some of the Insects of Massachusetts which are Beneficial to Vegetation," by the same author, as entomologist to the Board, and forming a portion of the report of your Secretary for the year 1863, is a valuable contribution, treating of insects in their several orders, and illustrating them in sixty figures.

In the years 1871, 1872, and 1873, three valuable reports were made to your Board by Dr. A. S. Packard, Jr., upon the "Injurious and Beneficial Insects of the State of Massachusetts." So able were these reports and of so great practical importance to agricultural interests, that it is much to be regretted that provision could not have been made for a continuation of the series.

There are, doubtless, among the publications of your Board, other contributions to the science, to which reference deserves to be made, of which I have no present knowledge.

In this connection it is proper that I should refer to a collection in economic entomology that within the last few years has been quietly brought together and built up at the Museum of Comparative Zoölogy, at Cambridge, by the distinguished professor of entomology, Dr. H. A. Hagen, under the fostering care of Alexander Agassiz. It has for its object a better opportunity of acquaintance with the insect world than can be afforded

by the study alone of books. To this end there have been arranged, in convenient cases, in connection with each insect shown, its several stages of the egg, the larva at different periods of its life, and the pupa; its architecture, in its cocoons, nests, burrows, etc.; its various food-plants, showing methods of attack and injury; diseased conditions resulting from fungus and other attacks, or from causes producing monstrosities and deformities; the several parasites that prey upon it,—in short whatever may serve to illustrate the entire natural history of the insect. So rich has this collection already become, in its 5,000 species more or less fully illustrated, that I give it but the praise that it deserves when I say that it has not its equal in any other collection of the kind in the world.

Nor should I omit passing reference to the good that has resulted from the Entomological Department of the Cambridge Museum, in that the study of its collections and the instruction of its professor have largely influenced the habits of thought and paths of labor of several students who are now successful teachers of entomology in our colleges and universities.

I can not now refer to the many notable contributions made by the members of your scientific bodies and others to general entomology, in the extensive collections gathered, in the new forms described, the life-histories given, the anatomical and historical investigations pursued, and the classifactory work done. Not alone are these lines of study, one and all, of great importance in themselves, and their pursuit ennobling—for the humblest insect that lives is richly worthy of the attention of the highest intellect,—but further, each one of you, each member of community, has direct interest in such labor, indispensable as it is to a proper knowledge of the insect world, with which we are brought into such intimate and dependent relations, in our cultivation of the soil, within our homes, and everywhere.

Without occupying more of the time allotted to me in referring to several other topics of which I would love to speak to you, I will pass on to meet the purpose of my invitation hither.

But how could I discharge the duty of even a brief discussion of the numerous insect pests which with each returning year force

themselves upon you, and compel battle with them if you would not permit them to wrest from you often the entire results of a season's toil? Fortunately, your Secretary has kindly extricated me from this dilemma in sugggesting to me a few insects upon which a desire has been expressed by several of your number, for information that will prove serviceable in arresting widespread and serious depredations.

I will ask your attention, first, to a class of insects which — although occurring abundantly in almost every portion of our country, everywhere occasioning serious losses, and although volumes have been written of them — are yet very imperfectly known by those who are suffering from their depredations.

Cut worms.

Before we can contend successfully with our insect foes, it is necessary to know who and what they are. There is no universal panacea for insect injuries. The natural history and habits of each species requires separate study, and not until we have become acquainted with all the conditions of their existence are we prepared to make recommendation of the best means to be employed against them. So varied are these conditions, even among the members, often, of the same genus, that a remedy that will be efficient with one will be powerless against another. The bearing of these remarks will be evident when we state that, not unfrequently, a reported "cut-worm" attack proves, upon examination, to be that of quite a different insect, — perhaps that of the "white-grub" or some allied coleopterous larva, — of one of the many species of "wire-worms," the larvæ of our "snapping beetles," — or it may be of a "thousand-legged worm," which does not even belong to the class of insects. The nature of the injury committed by these several forms is much the same; roots are eaten, or stalks and blades are cut off, and it is *believed* to be caused by a cut-worm. Surely, guessing at the cause of an injury is incompatible with scientific treatment for its arrest. Whenever, therefore, any unknown form of insect attack presents itself to the farmer, the gardener, the horticulturist, the florist, — let him first learn the particular depredator he has to deal with,

and then seek the best remedy, either from books authoritative upon the subject, or from some one prepared and competent to give advice.

If the study of our common insects had that place in our public schools and other institutions of learning that its practical importance entitles it to, the labor of the economic entomologist of the present day would be lightened, and much of what may be regarded as preliminary instruction would be spared him. It should not be necessary in a paper like the present to tell what a "cut-worm" is, yet if I give its principal features, and those of the winged form into which it develops, I think that I shall be imparting serviceable and acceptable information to some.

What are cut-worms? — Cut-worms are the caterpillars of an extensive family of moths known by the name of *Noctuida*, from their coming abroad for flight chiefly during the night; the moths (nocturnal) united with the butterflies (diurnal) forming the order of LEPIDOPTERA, so named from the myriads of small scales which, in symmetrical arrangement like the shingles or tiles of a roof, cover and color both the upper and lower surfaces of the membranous and veined transparent wings.

There are many distinct species of cut-worms, but we can not give even their approximate number. Most of them belong to three genera of the *Noctuida;* viz., *Agrotis*, *Mamestra*, and *Hadena*, of which about 400 United States species have been described. Some of these are known not to possess true cut-worm habits, but of much the larger number the caterpillar stage remains unknown.

The following are the principal cut-worm features possessed in common by nearly all the species, and which should suffice for their recognition. When full-grown, they measure from an inch and a quarter to nearly two inches in length. They have sixteen feet, of which the three anterior pairs (true legs) are pointed, and the five remaining pairs (prolegs), stout, blunt, and armed with minute hooks for clasping. In form they are stout, tapering slightly toward the extremities. In appearance they are usually dull-colored, greasy-looking, dingy-brown, gray or greenish, with some light

and dark longitudinal lines, and sometimes with oblique dashes. They have a large, shining, red or reddish-brown head. The first ring, or collar, bears a darker-colored, shining, horny plate, as does also the last one, known as the anal plate. The body is never hairy, but the several rings have upon each six or eight small, blackish dots or humps, from each of which a short hair is given out.

Their habits.— It is the habit of the cut-worm to pass the day in rest, hidden in a hole made in the ground beside its food-plant or among its roots, or in concealment beneath stones, sticks, rails, or other convenient shelter. The night is the season of their activity, when they seek their food. Some of them feed only beneath the surface of the ground upon the roots of plants; others thrust their body in part from their burrow and cut off the blade, which they take with them into the ground to feed upon at their leisure; while others come abroad and make vigorous attack upon the young annual plants of the garden or the field, feeding upon their tender tips or severing the stalks. If search be made for them at night-time with a lantern, they may often be found by hundreds busily engaged in their destructive work. At the approach of day they again seek their hiding-places, often in the hole made near the plant. When taken from the ground or disturbed in their shelter, they usually curl themselves up in a ring.

A few of the moths may be seen by day, feeding upon the nectar of flowers, as of the golden rod (*Solidago*) and some others; but nearly all of them pass the day in sleep in various hiding-places, such as under the bark of trees, in piles of wood or stone, in crevices of walls, behind closed window-blinds, or in any convenient, dark, secluded retreat. They are generally of obscure colors, in some shade of brown. When in repose, their wings are folded almost parallel to the surface upon which they rest, and in line with their body, giving them an elongated form. The wings are thick, smooth, often shining, and marked with characteristic lines and spots which are usually not very conspicuous.

Natural history.— The eggs that produce the cut-worms are usually deposited by the moth upon some low plant convenient to

the food that is destined to nourish them. Sometimes, however, as in *Agrotis saucia*, they are placed in long, narrow patches upon small twigs of apple, peach, and other fruit trees, quite removed from their natural larval food. The general time of their deposit is in the latter part of summer. Hatching in a short time, the larvæ enter the ground and commence to feed upon the young roots of various plants. With the cold of winter, they cease feeding, and bury deeper in the ground, where they shape for themselves an oval cavity in which to pass the winter in a torpid state. In this condition, if undisturbed, freezing fails to harm them. In the early spring they resume their activity, make their way toward the surface, and commence their feeding upon the starting vegetation.

Within a few weeks they become full grown, when they again bury in the ground, where they mold a cell, or earthen cocoon, in which to undergo their transformation to the pupal state. Two or three weeks are required for this stage, when the moth issues from the rent pupal case, and makes its appearance above ground. The wings, at first small and contracted, are soon expanded, and the insect has reached its perfect stage. The sexes meet, eggs are deposited for another brood, a little food is partaken of, consisting of the nectar of flowers or other sweets, and within two or three weeks, ordinarily, if not sooner terminated by their many enemies, the life-cycle is completed. In some instances a second brood follows during the summer and autumn, but with most of the species the life-history is as above given. Occasionally the hibernation is in the pupal stage.

Food-plants.— Many of our injurious insects confine their depredations to a single food-plant, or to the members of the same genus, or to closely allied plants. The cut-worm, unfortunately, is more indiscriminate in its taste; and although certain species show a decided preference for some particular food-plant, yet, if this is not convenient, other substitutes are readily accepted. When we add to this the varied tastes of a large number of species it ceases to be a surprise that so many of the products of our fields and gardens suffer from their aggression.

Their injury to *grass* is far more serious than is supposed. It is believed that the first half of the active life of many of

the species is passed in feeding upon the roots of grasses, and that they only assume the true cut-worm habits when approaching maturity demands stronger and more abundant food. Usually their presence in grass lands is unnoticed, or, if an impaired growth is observed, it is ascribed to other causes. But at times, for reasons unknown, they multiply to such an extent that we may no longer be blind to their ravages; as in the visitation of the bronze-colored cut-worm, *Nephelodes violans* Guenée, in 1881, in the northern counties of the State of New York, when the pastures and meadows suffered largely from their attack; and of the black-lined cut-worm, *Agrotis fennica* (Tausch.), in Michigan, last year, when, as represented to me by Professor Cook, of the State Agricultural College, there were meadows through which one could not walk without crushing from a dozen to a hundred at each step.

Corn is known to be a favorite food-plant of many species, of which we recognize twelve by name — the two more common ones being *Agrotis clandestina* and *Hadena devastatrix*. Experience has taught every farmer that a cornfield upon a newly turned sod is a luxurious home for the cut-worm, where they particularly abound. It is stated that sixty have been taken from a single hill of corn.

Wheat and *barley* occasionally suffer from their attack, but we are thus far favored by not having had introduced among us, with the scores of imported pests brought by commerce to our shores, the wheat dart-moth, *Agrotis tritici*, or the common dart-moth, *Agrotis segetum*, which cause such enormous losses in the European wheat fields. None of our species are nearly so destructive as these to this staple crop.

Entire settings of young *cabbage plants* are often destroyed by them. In one plot of 600 plants, only thirty escaped. The owner killed about 200 of the worms on the first day of their appearance, and 500 or more on the following day, after which the ground was reset with late cabbages. Of the species known to prey upon cabbage, are *Agrotis clandestina*, *Agrotis saucia*, *Agrotis annexa*, *Mamestra subjuncta*, *Mamestra trifolii*, and *Hadena devastatrix*.

Turnips are liable to attack by being eaten into around the neck of the plant until it is detached, or by its separate leaves being cut off and drawn into holes near the plant.

To *onions* they are at times so destructive as to ruin entire crops. In one field of four acres in Chautauqua county, N. Y., upon which onions had been grown for sixty years, the worms were dug out and killed in almost incredible numbers — to the amount of "bushels," in some years, it is stated.

A remarkable attack was made upon onions, in Goshen, Orange county, N. Y., the present year, where several hundreds of acres of drained swamp-land are devoted to their culture. The worms appeared in myriads, in June, as soon as the onions had started,— first eating them from their tips downward, but later developing the true cut-worm habit in severing the stalks. The species was believed to be *Agrotis malefida*, a southern form, not hitherto noticed injuriously so far north. [On rearing the perfect insect it proved to be *Agrotis messoria* Harris.]

The tender stems of young *beans* furnish tempting food, and every one who has grown them knows the frequency with which they are found, in the morning, with severed stems, showing the operation of the cut-worm.

In portions of Canada, *clover* suffered severely from a formidable attack of a caterpillar which was thought, at first, to be the army-worm, but which, upon rearing the moth, proved to be one of the cut-worms, *Agrotis fennica*.

Tobacco plants, are often cut off in the month of June. In West Meriden, Conn., from one row of 180 plants, 214 of the worms were taken and killed.

They frequently attack and destroy *flowering plants* in our gardens, as hyacinths, pansies, carnations, nasturtiums, phlox, asters, balsams, and many others.

Among other garden and field crops, to which they are destructive, may be mentioned pease, beets, potatoes, tomatoes, pumpkins, melons, and squashes.

Natural enemies.— The large size of the cut-worms, their hairless bodies, and no provision for protection except their concealment by day, render them attractive and an easy prey to their many

enemies who persistently seek them for food, and by the large numbers that they devour greatly mitigate the injuries that their unchecked increase would otherwise cause. Several of our common birds render effective service in this direction. Foremost among these is the robin, of which it has been said: "Its eminently terrestrial habits, its fondness for larvæ of various kinds, and its ability to obtain those that are hidden beneath the turf, give it a usefulness in destroying cut-worms which no other bird possesses in the same degree, and for this feature in its economy alone, its greater abundance should be encouraged. Early in the morning, and toward the close of the evening, the robin may often be seen searching for cut-worms in lawns, pastures, and meadows, and when thus engaged it hops about, gazing apparently more at distant objects than searching for something near at hand; then, suddenly, it commences tearing up the old grass and turf with its bill, and, in another instant, it stands triumphant with its wriggling prize in its bill, for it rarely digs in vain. I have seen a robin capture, in this manner, five cut-worms in less than ten minutes, and five other birds within view were doing the same work."

Other birds that are known to prey upon cut-worms are the cat-bird (*Mimus Carolinensis* L.), the red-winged blackbird (*Agelæus Phœniceus* L.), and the purple grackle (*Quiscalus purpureus*).

Poultry, and especially chickens, are efficient destroyers of them in gardens in the spring, when they scan closely the upturned ground, and are quick to detect and devour them.

Among the members of their own class that feed upon them, is the larva of a ground-beetle, known as *Calosoma calidum* (Fabr.). It is so destructive to them, and attacks them with so much energy, even if the worm be twice its size, that it has been designated as the "cut-worm lion."

The larva of another beetle, *Harpalus caliginosus* (Fabr.), is also its persistent enemy; and from its ferocity in seizing its prey, and its strange, irregular form, it has been called the "cut-worm's dragon." Dr. Fitch has written of it: "When not glutted with food, it is running about incessantly in search of these worms, and slays them without mercy; with its powerful jaws seizing them commonly by the throat, and, regardless of their violent

writhings and contortions, sucking out the contents of their skins." Others of the same family of beetles, the *Carabidæ*, also feed largely upon them.

One of the HEMIPTERA which preys upon quite a number of other species of insects, and which from its belligerent propensities has received for its common name that of the "spined soldier-bug," and is known in science as *Podisus spinosus* (Dallas), will fearlessly attack a young cut-worm much exceeding it in size, and piercing it with its formidable beak, extract its juices from it, leaving only its shrivelled skin.

The toad deserves introduction, shelter and protection in our gardens, from its coming abroad at night during the period of activity of the cut-worms, and contributing largely to the diminution of their numbers.

Parasites. — The quiet and concealment in which these nocturnal marauders of our gardens and fields pass their time during the hours when most of the parasitic insects are upon the wing, in ceaseless search for their victims, into which they can thrust their ovipositor and insert the fatal egg, give them a large degree of immunity from parasitic attack. Yet as even the "white-grub," which never appears above ground, is sought out in its subterranean retreat by its parasite, *Tiphia inornata*, so even these are far from enjoying immunity. The bronze-colored cut-worm before referred to, in my attempts to rear it, has proved to be quite liable to be parasitized by one or more species of a Tachina fly. A species of Microgaster, *Apanteles militaris* (Walsh) and an *Ophion* have also been obtained from it. Other parasites reared from other larvæ are *Paniscus geminatus* (Say), a large yellowish-brown ichneumon fly; *Nemorœa leucaniæ* (Kirkp.); *Masicera archippivora* (Riley); and *Scopolia sequax* Williston — three species of Tachina flies.

Preventives and remedies. — The measures recommended for preventing or arresting cut-worm ravages have been exceedingly numerous, and perhaps each one might claim a degree of value under certain conditions, but at the present only those from which the best results have been obtained will be referred to.

When grass is infested, as in lawns, it is difficult to control the attack. Perhaps gas lime where it can be obtained, applied at the commencement of winter, would penetrate to a sufficient depth to kill the larvæ. Usually it will be found necessary to sacrifice the sod. It is claimed that where land is not allowed to lie in sod for over two years at a time, the worms will not accumulate in it. Removing their food is an effective method. This may be done by turning over the grass before it has made much growth in the spring, and dragging, to bring up the roots to the surface for drying. A week later, another thorough dragging will destroy all green vegetation. Late ploughing, in the autumn, is said to be an effectual remedy, if deferred until the cut-worms have become torpid, and the ploughing sufficiently deep to crush the cells that they have shaped for their winter's sleep.

Two preventives of attack to cornfields have been given, which, from the testimony borne to their efficacy, may be accepted as reliable. The first is the simple and easy application of *salt*, as follows: Immediately after the corn is planted, sprinkle on the hill, over the covered grains, about one tablespoonful of common salt to each hill. The explanation given for the protection of the plants is, that as the salt dissolves and is carried to the roots and taken up into the circulation, the young corn becomes unpalatable to the worms, and they will not eat it, while the direct application of salt to them is harmless, even if they be buried in it.

The second method, which has been tested by the gentleman recommending it and by others for twelve years, and always with success, even upon new ground and clover land, is soaking the corn, before planting, in *copperas water*. Tests had been made by planting portions of a field without the preparation, and these portions in several instances required replanting two or three times. The manner of preparing the corn is as follows:

Put the seed corn in a tight tub or barrel, and pour in enough water to keep it well covered after it swells. For each bushel of corn add a pound or a pound and a half of copperas, dissolved in warm water. Stir well, and allow the corn to remain in the copperas water twenty-four or thirty hours. Stir several times while soaking. Then take it out and sprinkle a small quantity of land-

plaster over it — enough to prevent the grain from sticking together,— and plant. When prepared as directed, if a change should occur in the weather to prevent planting, the corn may be spread out upon a floor and allowed to remain until good planting weather.

As a test of the efficacy of the above preventive, a forty-four-acre field of corn was planted, — first, ten acres without the copperas preparation,— next to it, nearly ten acres with the prepared seed, and the remainder with unprepared,— otherwise, all treated alike. As the result, *not a hill was cut or a worm was found where the copperas had been used;* while the entire field elsewhere was cut, from two to three hills out of five, with sometimes fifteen cut-worms in a hill.

There is a prejudice against the *digging-out-by-hand* method, as requiring too much valuable time and labor, and therefore not available where large fields are to be protected; yet it is one of the best means to be employed against this pest, unless the poisoning method recently recommended, and next to be referred to, shall be found to give easier protection.

Many of our preventives merely drive away the hungry creatures to attack and destroy other and perhaps more valuable crops; but with a cut-worm dug out from its hiding-place beside a wilted plant and killed, there is the satisfaction, not only that its possibility for further harm is ended, but that it will not develop into a moth the following season, which might deposit 200 eggs, each of which would produce a cut-worm.

Mr. Armstrong, secretary of the Elmira Farmers' Club, has stated: "There is really but one way to save the crop after the plants are once attacked by cut-worms; that is, to dig the worms out and kill them. It is not a difficult task, nor is it very costly. I presume that a fourth part of the loss sustained would be a full equivalent of all the labor it would cost. The worm does the mischief at night, and before morning burrows in the ground near the spot where its depredations have been committed. A practised eye will readily discern the entrance to the hiding-place into which the worm has passed and lies concealed. The way to bring the pest up is to thrust a pointed knife down near the hole, and lift out the earth to the depth of two or three inches,

when the malefactor will lie exposed to view, and can be instantly destroyed. I have known large fields to be cleared by this process at a cost of labor so slight as to bear no comparison with the loss that would have otherwise resulted."

The practicability of this method, and an idea of the expense attending it, will appear from a statement made by a correspondent of the *Country Gentleman*. A six-acre field of corn, planted on sod turned over from a pasture before planting, showed a strong attack of cut-worms. Two men were employed to dig them out. Taking a row at a time, and digging down wherever a plant was cut, they went over the field in half a day, killing over fifteen hundred. A few days later they went over it again, not getting as many; and again, for a third time. Without this labor, it was thought that one-half of the crop would have been lost. The three days' work was worth four dollars, and at least 100 bushels of corn were saved by it.

The poisoning method referred to is the use of a *bait of leaves or clover*, of which the worms are fond, *poisoned with Paris green*. Professor Riley, in his last report as entomologist of the United States Department of Agriculture, has recommended clover sprinkled with Paris green water, and laid at intervals between the rows, in loosely tied masses or balls, which serves the double purpose of prolonging the freshness of the bait, and of affording a lure for shelter.

A modification of the method, employed by Dr. Oemler, of Savannah, Ga., was that of preparing cabbage or turnip leaves by dipping them in a well-stirred mixture of a tablespoonful of Paris green to a bucket of water, or sprinkling the side next the ground after first moistening, with a mixture of one part of Paris green to twenty of flour, and then placing the leaves at distances of from fifteen to twenty feet throughout the field to be protected. Two applications of this character, at intervals of three or four days, particularly in cloudy weather, were usually successful in ridding the field of the pest.

Other remedial and preventive measures deserving mention are: application of coal oil; paper frames from six to eight inches square; tin bands, ten inches long by two wide, lapped at the

ends in a ring; paper wraps around the stalks at setting; and trapping in holes, for the protection of young cabbage and tomato plants; as also, thick planting and subsequent thinning; and starvation through the removal of all green food, for more general protection. Notice of these several methods may be found in a paper entitled, *Cut-Worms*, read by me before the New York State Agricultural Society, at its annual meeting, in January of the present year.

Tobacco Worms.

Representation has been made to me that serious and increasing losses are being sustained in portions of Massachusetts, from tobacco worms, accompanied with the request for means of prevention. I am not told what the worm is of which the complaint is made.

If it be the insect that is commonly known as the "tobacco worm," in New York and Connecticut, then it is the larva of a sphinx moth *Sphinx quinquemaculata*. The true tobacco worm is the larva of *Sphinx Carolina*, which is so very destructive to tobacco in the Southern States. The two species are very closely allied in appearance and habits, and in Pennsylvania often occur together.

The larva of our five-spotted Sphinx is well-known to all of our tobacco growers. It is a dark-green, smooth caterpillar, with seven oblique greenish-yellow stripes on each side, a long, curved horn upon its terminal end, and, when full-grown, is of about the size of the third finger of a man's hand. The moth is a large and handsome insect of a general ash-gray color, its stout body marked with a row of five orange-colored spots on each side. It comes abroad at twilight for the deposit of its eggs, and so marked is its resemblance to a humming-bird in size, rapidity of flight, and its hovering over flowers when taking its food, that the popular name of "humming-bird moths" has been given to that group of the *Sphingidæ* to which it belongs.

The eggs of the moth are deposited upon the tobacco plants during the months of June and July. The caterpillars feed upon the leaves of the plants in late July, August, and September, even up to the time of securing the crop. In an instance related

to me,— in a curing-barn, near Albany, N. Y., shortly after the hanging up of the plants for curing, the floor beneath was found "nearly covered" with the caterpillars of *S. quinquemaculata*. As illustrating the abundance in which they at times occur, it may be mentioned that a market gardener collected from one acre and a quarter of tomato plants — a favorite food-plant of the species,— four bushels of the caterpillars, in one day (*Report of the Entomological Society of Ontario for* 1880, page 27).

The only sure remedy for the attack of this insect is that which is known among tobacco growers as "worming." The plants must be searched for the worms two or three times a week, or as often as is found necessary, and the worms destroyed. The mornings and evenings and cloudy days are the most favorable for finding them.

Poisoning the moths to prevent the laying of the eggs is also resorted to. A gentleman gives this as his method: "In every tenth hill, on the outside of my field, I sow the seed of Jamestown-weed (*Datura stramonium*), instead of setting tobacco plants. As the Daturas grow up I pull out all but two to each hill, and when these are in bloom I go around every evening, and, after destroying all but two flowers, pour into these a few drops of common fly poison, mixed with sweetened water and whiskey. The moths sip the poison and die from it, and I find them scattered over the farm for the space of several hundred yards." Another writer gives these directions for the poisoning: "Provide a weak solution of cobalt and a little honey, place it in a bottle having a small quill through the cork, and late each evening go around the jimson weeds and put a few drops of the mixture into the blossoms. The poisoning must be done every day through the fly season, care being taken each evening to pull off the blossoms that were poisoned the day before, as, if left on, they seem to destroy the plants."

So far to the northward as Massachusetts, the Jamestown-weed might not flower in season for the early coming of the moths, unless the seed should be put in as early as possible.

Knowing the attractiveness of the petunia for our Sphinx moths, I would suggest that benefit might be derived from placing a large bed of these flowers in the neighborhood of tobacco fields,

and employing children to catch with insect nets the moths that are attracted to the flowers at twilight, and killing those that bear the five orange-colored spots upon the sides of their abdomen. A pair of them and of the several other species of Sphinges that would at the same time be captured, might be preserved and placed in frames with which to ornament their homes, and to serve, perchance, as the commencement of a general collection of insects and of the fascinating study of entomology.

If the information asked of me be not of these tobacco worms, but of another kind that attack the roots at their setting, then the injury, without much doubt, is chargeable upon the ubiquitous cut-worm which we have been considering. Fortunately we have two ways — both pronounced excellent — of dealing with him, in order to prevent his immoderate use of tobacco.

The first, is dipping the young plants, before their setting, in a solution of white hellebore in water — one-fourth of a pound in ten quarts of water. A writer, from West Meriden reports, that, on the 22d of June, he set 3,000 plants, and on the following morning he took from one row of 180 plants 214 cut-worms. On the same day, in the same field, he set twelve plants dipped in the hellebore solution, which remained untouched, while the rows on either side were more than half destroyed. On June 24th, he set *over* 2,000 *plants treated in the same manner, of which he subsequently found but one plant eaten, and that but slightly.* He believed the hellebore to be a specific for the tobacco cut-worm.

The second, is poisoning with Paris green in the following manner: Four acres of tobacco plants were badly cut down, with sometimes as many as a half-dozen of the worms attacking a single plant. The owner went to a wood toward evening, and collected several kinds of leaves, which he laid in rows between the plants. The worms appeared to prefer the leaves of the chestnut for eating. The following day a large basketful of the chestnut leaves was gathered. These were dipped into a mixture of two gallons of water and two tablespoonfuls of Paris green, and a leaf put on each hill in the field, with a piece of ground or stone to hold it in place. The next morning, on examination, "the

worms lay under the leaves like a hill of potatoes; they had eaten little holes through the leaves, and some were dead and others dying." The tobacco was then reset and no further trouble experienced from the cut-worms.

The Apple-Maggot.

An insect which has come under notice during the last twenty years as exceedingly destructive in many localities in the New England States to early apples, even surpassing the common apple-worm of *Carpocapsa pomonella*, is the *Trypeta pomonella* Walsh, known commonly as the "apple-maggot."

While the apple-worm, with which we have been so long familiar as the cause of the annoying and injurious worm-holes in our fruit, is the offspring of a small but beautifully marked moth, the apple-maggot, as its name imports, is the earlier stage of a fly.

The Fly.— The perfect insect resembles in form the common house-fly, but it is of a smaller size, being only about one-fifth of an inch in expanse. Its wings are white and glossy, and are marked in a pretty pattern with four blackish crossbands, the first of which is near the base, and the other three are connected upon the front margin of the wing and diverge behind. They are thought to represent somewhat the letters IF, with the I placed next the base and its lower end uniting with the lower end of the F. The abdomen has its first four segments broadly banded with white.

Life-history.— The parent fly, during the latter part of July or early in August, deposits a number of its eggs upon or near the calyx end of the apple, selecting often for its purpose fruit that has already been burrowed by the apple-worm. Upon hatching from the eggs the young larvæ enter the apple and commence to feed upon its pulp, not penetrating to the core, as does the apple-worm. Here they produce, at first, little irregularly rounded and discolored excavations of about the size of peas. These, when the larvæ are numerous, run together until the whole interior becomes a mere pulpy mass of disorganized material, or is entirely honeycombed with burrows in the more solid fruit. Meantime, the apple is entirely fair upon its exterior and gives

no evidence of the destructive work being carried on within. Sometimes as many as a dozen larvæ are working together. Their operations are seldom noticed until in September. When they become full-grown, in the autumn, they escape from the fruit through small round holes that they cut in the peel, and enter the ground for pupation. In this condition they remain during the winter and do not emerge as flies until the following July.

From some recent observations it would appear that the larvæ sometimes are delayed in reaching maturity, and have been found feeding within the fruit so late as in the month of January.

The Larva.— The larva in its greatest length measures about one-fifth of an inch, is without feet, and of a white or (as sometimes) of a yellowish or greenish color. The front third of its body tapers toward the minute, pointed head, which is armed beneath with its mouth-parts, consisting of two slender, blunt, coal-black hooks. The remainder of the body is cylindrical, with its terminal end blunt as if obliquely cut off, and bearing upon its slope four pairs of tubercles, of which one pair is longer than the other.

From this description the larva should admit of easy recognition whenever its operations are suspected in apples. The absence of feet and its pointed head will serve to distinguish it from the apple-worm.

Distribution.— The fly is a native species — one of the few of our insect pests which has not been introduced from Europe. It was first described by Mr. B. D. Walsh in 1867, from examples taken in Illinois, where it was discovered feding on thorn and crab apples, prior to any knowledge of its attack upon cultivated fruit. This new habit was first developed in, and was for some time confined to, the Eastern States and New York, but within the last year apples in different localities in Michigan have been attacked by it and entirely ruined.

The most frequent notices of it have been received from Vermont. In New Hampshire it has also become broadly distributed and ruined entire orchards. In Massachusetts it is quite destructive. Mr. L. L. Whitman has informed me that in his orchard at North Ashburnham he had hundreds of bushels of the finest fruit rendered worthless by it in 1883. Mr. Avery P. Slade, of Somer-

set, reports it the present year as honeycombing his apples. Several years ago its operations were observed in Connecticut, and it has been discussed in the late meetings of the State Board of Agriculture. From Brunswick, Maine, it is reported by Mr. T. S. McLellan as having made its appearance in his orchard in 1880, and infested all his sweet apples and most of the tart ones, such as the Haley, Hurlbut, Primate, Porter, etc. He had also heard of it from the northern part of Somerset county (*27th Ann. Rep. Maine St. Board of Agriculture for* 1883, p. 345). Mr. Robert H. Gardiner, President of the Maine State Pomological Society, states that the maggot was very destructive in 1883 to his Talman Sweet, Red Astrachan and Mother apples, but did not trouble other varieties (*Ib.*, p. 332).

In the State of New York it has proved a great pest at North Hempstead, Long Island, and in several of the Hudson river counties, and has also occurred in Delaware, Albany, Schenectady, Oneida, and Chemung counties, and is doubtless to be found in many other portions of the State. As yet we have no knowledge of its extension into New Jersey, Pennsylvania, the Southern or the extreme Western States.*

It appears, thus far, to be a local insect, and the fact that it is so should be an incentive for the use of every known means for the prevention of its distribution, that it may not become as generally distributed as is the apple-worm of the codling-moth.

Preference for Early Apples.— The insect in its past history, especially in its earlier history, has shown a marked preference for summer and autumn apples — always making its most vigorous attack upon sweet and mellow subacid early fruit. Yet it is known to have infested Spitzenbergs, in Brandon, Vt., and Baldwins and other varieties of winter apples, in Wallingford, Conn.

Remedial Measures.— This preference of the insect for certain varieties might be employed as a means for its destruction, by grafting the trees of an infested orchard to the varieties less liable to be infested, or, so far as known, entirely free from attack, and at the same time leaving two or three trees of its favorite fruit to serve as lures for concentrating the attack — the fruit of which

[* In the Smith Catalogue of the Insects of New Jersey, 1890, it is included, with the note, "Locally injurious to apple, but seems confined to very few varieties."]

should be gathered at the proper time and be destroyed with all of the contained larvæ.

If it shall be found that any considerable proportion of the fruit containing the maggot falls to the ground as a consequence of the attack, then, of course, much benefit will be derived from gathering the fruit as fast as it falls and destroying it, or to give sheep the range of the orchard for feeding upon it. But as I have examined fruit offered for sale in the Albany market, presenting so fair and perfect an appearance as to prove beyond a doubt that it had been picked by hand from the tree, and yet teeming interiorly with nearly mature larvæ, it is highly probable that their presence does not cause the falling of the fruit.

Our study of this comparatively new insect depredator has hardly commenced. Careful observations are needed upon the time and manner of the larvæ leaving the fruit, and, in the earlier varieties of apples, when they enter the ground. In the later and stored varieties, it is important to know where they betake themselves for their pupation during the winter. Until these facts are definitely ascertained, together with others that are necessary to the completion of its life-history, we shall not be able to accomplish much toward mitigating the evil. We can prevent the attack of the apple-worm by showering the trees soon after the setting of the fruit, with Paris green or London purple in water, without the least possible chance of injuring the fruit through the poisonous application. But the month of July — when the Trypeta deposits the eggs that produce the apple maggot — would be too late to apply with safety such substance to the fruit, already nearly full-grown and soon to be eaten.

Perhaps, for the present, the best results may attend our efforts to destroy the insect in its pupal stage. If examination should show us that the pupation ordinarily takes place in the orchard, beneath the infested trees, then we may reach it there. But if the pupation follows the gathering and storing of the fruit,— as seems more probable,— then the discovery of the retreat of the larvæ should give us the means for destroying them.

Desiderata in its Life-history. — In my forthcoming report [second in this series] I have indicated several points upon which knowledge is needed toward the completion of the life-history of

this insect. I will introduce them here, accompanying them with the earnest request that you will each, as opportunity may offer, make contribution, to your ability, toward the desired knowledge of this already great pest of our orchards, and which gives every promise of soon becoming still more pernicious. It is manifesting a tendency to widespread distribution, and an unusual adaptability to different varieties of the apple. It would not be surprising if it soon attacked our pears.

Are the eggs of the fly distributed over the apple or placed only near the calyx end?

Do the larvæ occur in apples which have not been perforated by the apple-worm of the codling-moth or by some other insect?

How long a time is required for the larvæ to attain their growth?

How do the larvæ leave the fruit,—by several holes through the skin, through a single hole, or only when the apple has become broken down from decay?

When entering the ground for pupation, to what depth do they bury? This could be ascertained by providing them with a box containing a few inches of earth for burial.

Are both the early and late fruits similarly attacked by this insect? It is possible that the larvæ reported in winter apples may be of a different species.

During what months and portions of months are the larvæ to be found in the apples?

Are the puparia to be found at the bottom of apple barrels, or bins in cellars, or between the staves or boards? Should any doubt exist of the identity of the puparia found under such conditions, the fly should be reared from it to determine the point.

[See an admirable study of this insect which has since been made by Professor F. L. Harvey, and published in the *Report of the Maine State College Agricultural Experiment Station* of 1889, pp. 190-241, plates 1-4. In this paper, the description of the several stages, history, distribution, life-history, etc., of the insect are fully presented, together with the most effective means known for arresting its injuries.]

THE ASPARAGUS BEETLE.

Information upon this insect is desired, and may very properly be given at the present time, as it has but recently extended its depredations into Massachusetts. It is a much easier task to arrest the spread of a new insect pest, than to control its ravages after it has taken full possession of its new territory and perfectly adapted itself to its new conditions. It is therefore important that the insect should be known, so that it may at once be recognized, and prompt measures resorted to, in order to check its increase.

Description.— In general shape and size it resembles the well-known cucumber-beetle, *Diabrotica vittata*, but it is somewhat longer, being about a quarter of an inch long, and its body is more elongated from its parallel sides. It has a black head, and a finely punctured tawny-red thorax, marked with two black spots upon its crown. The lemon-colored, punctured wing-covers are usually broken into three spots each, by a black stripe along their junction, a black transverse band a little beyond their middle, and an interrupted one near their tips; outwardly they are bordered with orange. The body beneath and the legs are shining black. The elytral markings as above given, suggest to some the representation of a black cross, for which reason it is sometimes known, in England, as the "cross-bearer." Other examples of the beetle not unfrequently met with, may be described as having their wing-covers blue-black, margined and tipped with orange, and with three small yellow spots in a line down the middle of each cover.

Its Associates.— The scientific name of the beetle is *Crioceris asparagi*. It was first described by Linnæus, nearly a century ago. It belongs to the same destructive family of the *Chrysomelidæ* with the striped cucumber beetle, the cucumber flea-beetle, the grapevine flea-beetle, the Colorado potato-beetle, etc. For a long time it was the only representative of its genus in this country, but another species has recently been introduced from Europe — *Crioceris* 12-*punctata*, — which was first observed in the vicinity of Baltimore in 1881, and already gives indication of becoming quite destructive to asparagus.

Its Introduction. — *Crioceris asparagi* is an European species, which our commercial and other relations with the Old World have brought to our shores, in common with a large number of our most destructive insect pests. It was first noticed upon the eastern end of Long Island, at Astoria, in the year 1859, and it is worthy of note that, in the same year, the first specimens of another very injurious insect, also introduced from Europe, — the cabbage butterfly, *Pieris rapæ*, was taken, in the city of Quebec. As early as 1862 the beetle had spread over all the asparagus plantations of Long Island. The following year it was attacked by a parasite which destroyed its eggs, and doubtless aided much in arresting its increase. The parasite was not described. It probably disappeared before it could receive scientific attention, for nothing seems to be known of it at the present.

Its Distribution. — In 1868 the beetle had extended its range into New Jersey, where, in the third year of its observation, entire beds were ruined by it. Its rate of distribution, in its earlier years, appears to have been about twenty miles a year, but fortunately this has not been sustained. During the twenty-five years that have elapsed since its introduction, it has not shown a disposition to extend far from the sea-coast, nor to a great distance from New York city, as its center of operations. Serious injuries from it have only been reported from Long Island, the vicinity of New York city, Southern Connecticut, New Jersey and Eastern Pennsylvania. It has not been seen at Albany, although during the last year I have received examples of it collected at the New York State Agricultural Experiment Station, at Geneva — a locality that lies to the westward of the central portion of the State. An equal extension from New York could carry it into any portion of Massachusetts. It is a matter of surprise to me that it has not made, long ere this, formidable demonstration in the eastern — particularly the seaboard — portion of your State.

Its Natural History. — The history of *C. asparagi* is, in brief, as follows: The beetles destined to continue the species survive the winter in dry, sheltered places, as beneath bark, in crevices of wood, and under the clapboards of buildings. Simultaneously with the appearance of the asparagus shoots in early spring, they

emerge from their winter quarters, and commence to feed upon the tips of the plants. The sexes pair, and the female deposits her eggs upon any portion of the exposed shoots. The eggs hatch in an average period of eight days. The larvæ eat voraciously and grow rapidly, so that they complete their growth in about twelve days. They then leave the plants and enter the earth for a short distance, or merely conceal themselves beneath dead leaves or other material on the surface. Constructing a slight cocoon, they undergo their transformation, and remain in their pupal state for about ten days. Thirty days complete the cycle from the egg to the perfect insect. Almost as soon as the beetles emerge they pair, as the sexual instinct is strongly developed in them, as is shown in the frequency in which they come under our observation mated. The eggs are then deposited, and the beetles continue to feed for several days upon the plants, eating holes into the bark of the more tender branches; one was found by Dr. Fitch to feed for a fortnight in confinement. A second brood results from these, appearing about the first of July, followed by a third, probably in August. Hence we have the larvæ and the beetles with us, in their successive broods, through the spring and summer, into September.

Remedies.— Among the remedies proposed and employed against this insect are the following: Hand-picking, when not too abundant, and beating them from the plants into a broad pan of water and kerosene.

Employing fowls to hunt them, which are very eager in catching and eating the beetle, and are not injurious to the plants.

Cutting away all the young seedlings in the spring at the time when the beetles are about to deposit their eggs, thus forcing them to lay their eggs upon the new shoots, which are cut and sent to market before the hatching would occur.

Benefit has been derived from cutting down the seed stems at the close of the season, as also once or twice during the season, leaving the beds bare and smooth.

But, undoubtedly, the best method with which to meet this insect is by the lime application proposed by Mr. A. S. Fuller, of Ridgewood, N. J., as the result of his personal and successful experience. The freshly-slacked lime, he states, may be conveni-

ently scattered over the plants by using an old broom for a duster, or a Paris-green sifter. With a pailful of the lime, a man could in a short time dust an acre of asparagus. It could best be applied in the morning while the dew is on, for then a portion will adhere to the plants as well as to the grubs, and during the day or days following, it will be constantly dropping down or blowing about among the leaves and branches, thereby making the escape of any of the larvæ all the more uncertain.

For the past sixteen years, Mr. Fuller had, according to his statement, used lime as described, upon his asparagus beds, to keep the insect in question in check, and it has done it so effectually that about one application every alternate season was sufficient. Not only is lime cheap and readily procurable everywhere, but it is of benefit to the asparagus roots. It has also the additional merit as an insecticide, that it can be used upon the young plants while they are being cut for market, for the destruction of the first brood of larvæ while Paris green or London purple may not safely be employed.

The Grapevine "Thrips."

Frequent complaints are made of the damage done to grapevines, from an attack upon their leaves by the "Thrips." This is a popular name — but an incorrect one as will be shown hereafter — which has obtained widespread currency among vine growers for some small (about an eighth of an inch long), slender, spindle-shaped, parti-colored leaf-hoppers, which are very destructive to the foliage of grapevines. They abound upon the leaves in their three stages of larva, pupa, and perfect insect, in each of which they are injurious. Their injury to the leaves is caused by puncturing them with their beak or proboscis and feeding upon the sap. They are usually to be found upon the under surface of the leaves. The punctures first produce small discolored spots, which are multiplied over the surface, and rapidly increase in size by their running together and by the greater suctorial power of the growing insect. Later they become large brown blotches, which, if the insects are numerous, extend over and embrace the entire leaf, causing it to dry,— appearing as if scorched by fire,— to die, and fall from the vine. As a consequence of this partial defoliation,

the fruit is dwarfed and its ripening interfered with, and the death of the vine may follow if the insects have been very numerous. These little creatures belong to the order of HEMIPTERA, which embraces a large number of our destructive pests, as the plant-lice (*Aphididæ*), the scale-insects and the mealy-bugs (*Coccidæ*), the grape Phylloxera, etc.— all of which subsist only upon liquid food, but fully equal in destructiveness to those provided with formidable biting jaws.

Several species of these little leaf-hoppers are frequently associated upon the grape leaves. They belong to the genus known as *Erythroneura*, and the more common one is that described by Dr. Harris in 1831, as *Tettigonia vitis*.* It is about one-tenth of an inch long, of a pale yellow or straw-color, with two narrow red lines on its head, and scarlet bands upon its thorax and wing-covers. It appears in June, in its larval stage, when it may be found quietly resting upon the leaves, with its beak thrust therein, unless it be disturbed, when it hops briskly to another leaf. They cast their skins from time to time as they increase in size, and numbers of these white, empty cases may be found fastened to the under surface of the foliage or scattered on the ground beneath. In July they assume their pupal form. In August they mature and acquire wings; when, if the vines are shaken, they may be driven up in swarms, but only to return and resume their destructive work. The winged insect survives the winter, hibernating among the dead leaves or in other sequestered places. The following spring, in the month of May, it comes forth from its retreat, and deposits its eggs upon the leaves of the vines for another brood.

The *Thrips* proper is an entirely different insect. It is a smaller insect than the grapevine leaf-hopper, with long and narrow wings without veins and bordered with long fringes— the two pairs of about equal size. There are a number of species united in the family of *Thripidæ*, the location of which, in our classification, has been the occasion of much discussion and is still in doubt. By Halliday, it was set apart in a distinct order, under the name of THYSANOPTERA, and this arrangement has been

* Now *Typhlocyba vitis* (Harris).

accepted by many entomologists. Dr. Packard and others regard it as properly placed among the HEMIPTERA, to some of the families of which it seems to have a close affinity. Their habits vary greatly; for while many of the species are unquestionably vegetable feeders, and injurious in their operations, others, from their carnivorous propensities, are serviceable in their destruction of gall-insects, the eggs of the curculio, the red spider (*Tetranychus telarius*), the clover-seed midge (*Cecidomyia leguminicola*), the wheat midge (*Diplosis tritici*), and other insect pests.

The method commonly resorted to for the prevention of the ravages of the so-called "Thrips" in graperies, has been fumigation with burned tobacco. This has proved to be partially successful. A still better method has been for some time employed in France, but not to my knowledge to any extent in this country. It is the vaporization of a strong extract of tobacco. One who has thoroughly tested it bears this testimony to its efficacy: "Ever since I adopted it, it has been absolutely impossible to find a 'thrips' in my houses, and other insects have likewise disappeared." The following method of use is given:

Every week, whether there are insects or not, I have a number of braziers containing burning charcoal distributed through my houses. On each brazier is placed an old saucepan containing about a pint of tobacco juice of the strength of fourteen degrees. This is quickly vaporized, and the atmosphere of the house is saturated with the nicotine-laden vapor, which becomes condensed on everything with which it comes in contact. When the contents of the saucepan are reduced to the consistency of thick syrup, about a pint of water is added to each, and the vaporization goes on as before. I consider a pint of tobacco juice sufficient for a house of about 2,000 cubic feet. The smell is not so unpleasant as that from fumigation, and tobacco juice can be used more conveniently than the leaves.

When the operation is completed, if the tongue is applied to a leaf, one can easily understand what has taken place, from the very perceptible taste of tobacco.

The process requires to be repeated in proportion to the extent to which a house is infested. Such troublesome guests are not to be wholly exterminated by a single operation. A new brood

may be hatched on the following day, or some may not have been reached on the first day, so that the vaporization should be frequently carried on, until the insects have entirely disappeared, and after that it should be repeated every week in order to prevent a fresh invasion.

The tobacco juice of the proper strength is purchasable at the tobacco factories in France for about fifteen cents (of our money) a quart. Its expense, at this rate, would be but about twenty-five cents a week for a grapery of about fifty feet by sixteen and ten.

A strong infusion of tobacco leaves, made by boiling, would be a substitute for the above. It might be prepared in quantity and evaporated to the proper degree, for convenience of keeping and for ready use.

Although the so-called thrips — it might properly be designated the "grapevine leaf-hopper"—is more abundant within the shelter of graperies than elsewhere, still in favorable seasons and in certain localities, it is a great pest in vineyards, where it is less amenable to remedial measures. Early in the season, while yet in its larval stage, benefit has been derived from showering the lower surface of the leaves with an infusion of tobacco or soapsuds, or of both combined. A still more effectual application should be spraying with an emulsion of kerosene oil and common soap, made after the formulas given for its preparation.

Another method has been used for destroying this insect, with good results, it is stated. A long strip of building-paper is smeared with coal-tar on one side, and stretched between the rows, when, with a brush, the insects are driven up from the vines against the sticky surface, to which they adhere. Two men and a boy can go over a vineyard in this manner in a short time, and a few repetitions will nearly exterminate them.

THE ROSE-LEAF "THRIPS."

This little pest, which is almost always present with us during the summer months, to mar, if it does not destroy, the leafage of our rose-bushes, is a near relative of the insect which we have been discussing. It is the *Tettigonia rosæ* of the Harris reports,*— a small, yellow-bodied leaf-hopper, with white and transparent

* Now, *Empoa rosæ* (Harris).

wing-covers and wings, and brown eyes and feet. Its life-history closely resembles that of *Erythroneura vitis*, of the grape.

Perhaps the best preventive of injury by this insect is an infusion of tobacco, prepared in the following manner: Where the tobacco stems can be procured, place some of them in a vessel of the capacity of a common pail and pour boiling water upon them until they are covered. Allow it to stand over night, and when used dilute it with five times the quantity of water and apply it to the underside of the leaves with a garden syringe, or force pump with a rose nozzle. The application should be made in the evening, or early in the morning, and, particularly, early in the season, before the injuries become noticeable except from close examination, and as soon as the young larvæ, looking like little white specks, are discoverable on the underside of the leaves. The showering should be repeated from time to time so long as the insects remain or the effects of their presence are noticeable.

I had intended asking your attention to a few other insect pests which are annually demanding heavy tribute from you, and which you are voluntarily paying,— not necessarily, for recent discoveries in economic entomology have given means which only need to be properly used in order that the burden of insect injuries shall be materially lightened; but I have already exceeded the time allotted for my paper.

May I hope that the details presented — some of which I fear may have been found dry — may not have greatly wearied you.

OUR INSECT ENEMIES AND HOW TO MEET THEM.

[Read before the New Jersey State Board of Agriculture at its Annual Meeting at Trenton, February 1st, 1889.]

It is, I believe, conceded by every intelligent person that agriculture is the greatest of human industries, as, of necessity, it serves as the basis of all others. A sparse human population might exist upon this globe without tillage of the soil, but the man would not be very far in advance of some of those vegetable organisms which are endowed with powers that enable them to seize and devour, and, it is thought, to digest animal food. All literature, science, and the arts are dependent upon it — yes, civilization itself. It was, so far as we have knowledge, the primal privilege granted to man, when he was made in the image of his Maker, ere he was driven from Eden and doomed henceforth to toil, and in the sweat of his face to eat his bread.

Are figures needed to show the importance of agriculture? Here, in our own country, so remarkably adapted by soil, climate, topography, and extent of territory to grow to perfection whatever crop may be grown in any of the temperate regions of the globe, as well as in some of the semi-tropical ones,— of our present population of sixty millions there is an aggregate agricultural population of twenty-six millions. The total value of farm products in 1886 was $3,727,000,000 — nearly three and three-fourths billions — an amount quite beyond the need for home consumption, and its surplusage — one-tenth of the amount — was sent from our shores, mainly to supply the needs of Europe.

May you not feel an honest pride in an industry that can show such results? Is it not one that should be respected by every man, in whatever pursuit he may be engaged. Nay, more. Is it not one that should be cherished and encouraged by every possible means, as the conviction is being more strongly impressed upon each careful student of political economy, that from the products of our broad territory are the less highly favored nations

of the globe to be, hereafter, more and more largely fed? Whatever, then, may militate against this interest is deeply to be deplored. Not only must it, for our individual needs and for the welfare of the nations, be sustained, but it must be enlarged. Will this naturally follow, in continued progression, with the increase of our population and the occupancy and tillage of the extended tracts of uncultivated land in our Western States and Territories? No; for vast arid regions are being already reached, where productive crops can only follow costly systems of irrigation; and not many years will elapse before the virgin soil of the West will no longer respond with the prolificacy of its first receptiveness. Nature, at the outset, prodigal of her wealth, gives up her accumulated stores of centuries for the asking; but they are not inexhaustible, and sooner or later her golden returns will cease.

It is evident to all, that in the Eastern United States this condition even now prevails. The husbandman can no longer tickle the earth with his hoe or plow and have it smile into a bountiful crop or harvest. Where, fifty years ago, forty bushels of wheat could be grown from an acre, now, with even increased labor, but twelve bushels can be taken. Grain can no longer be cultivated with profit, and other crops are in the same category.

Other causes, in addition to an exhausted fertility of the soil, have concurred in the prostration of the agricultural interests in our Eastern States, and to send up the cry so often heard, "farming does not pay." Prominent among these causes is the competition to which the eastern farmer is brought with the immense production of the fertile West — its comparative low cost of production and the low rates of transportation by which it reaches and commands the markets which he formerly controlled. The crops on which he hitherto relied, and the methods of agriculture which he and his fathers before him had remuneratively followed, must be abandoned. There must be a change of base — a new departure. Absolute necessity compels a movement all along the line, and the successful farmer of the future will be he who joins the advance, and strives to keep pace with the foremost in the march.

The fact can not be denied that a rapid advance is being made at the present time in the science of agriculture (we are no longer afraid to call science to its aid) through the investigations and teachings of our Agricultural Colleges and Experiment Stations. Well it is that the results of these investigations are being brought before our farmers very efficiently, through the Farmers' Institutes, which are being so successfully conducted in several of our States. It having been my privilege to attend a number of these institutes, it seems to me that their teaching may be summed up under these three heads: How to feed and care for farm stock; how to feed the soil (this embraces its cultivation), and how to protect and preserve for use the products of farm labor. Under these will naturally group themselves all of the prominent topics of discussion, as food and shelter and care of stock, production and preservation of manures, artificial fertilizers, rotation of crops, the products of the dairy, stock breeding, fruit growing, ensilage, and the like.

I need hardly state this truism, that all the labor, care, and money that you expend in the effort to produce the conditions calculated to give you the best possible returns, will be lost, just so far as you fail, through neglect or lack of knowledge, to secure the resultant products to which you are entitled. In many directions are you chargeable with this neglect, but suffice it for the present if I refer only to that particular one, of which, in the invitation given me to address you at this time, you virtually confess yourselves at fault, and make promise of doing better in the future, if I will point the way.

Your secretary has suggested as my topic, "Entomology in the Eastern United States; the importance of a more comprehensive knowledge of entomology to the farmer and fruit-grower, with some suggestions as to th esimplest and quickest way of getting this knowledge before those interested." This, I think, is embraced under the brief title that I have selected for my paper.

ECONOMIC ENTOMOLOGY.

The losses resulting from insect depredations in the United States are very far in excess of those sustained in any other portion of the globe. The aggregate of annual losses to agricultural products is startling when an attempt is made to estimate it, while

in exceptional years of some unusual insect abundance, the computations that have been made from time to time would seem to be almost beyond belief.

The magnitude of these losses has driven our people to seek protection from them in the study of insect pests and their habits. Hence it is that within the last fifty years a new science — that of Economic Entomology — has had its birth among us, a rapid growth, and a present development quite in advance of any of the older nations of the world. It may be defined as "the study of insects in their relations with man — of their character, habits, transformations, food-plants, enemies, diseases, etc., with a view of affording protection from the injuries of a large portion of their number, and of utilizing the benefits derived from a minor portion."

Our Eastern States gave early recognition of the value and importance to the Commonwealth of this department of natural science. The first publication issued under State authority was the "Report on Insects Injurious to Vegetation," by Dr. T. W. Harris, in 1841. The commencement of a series of "Reports on the Noxious, Beneficial and other Insects of the State of New York," in the year 1855, by Dr. Asa Fitch, under the auspices of the New York State Agricultural Society, gave a new interest and impetus to the study, and was doubtless instrumental in initiating similar investigations and publications by Mr. B. D. Walsh, in 1867, in Illinois, and by Professor Riley, in 1868, in Missouri,— in the first-named State, continued by Drs. LeBaron and Thomas, and through Professor Forbes up to the present time.

In 1878, at the termination of Mr. Glover's labors as Entomologist to the United States Department of Agriculture (commenced in 1863), an entomological division was established by the Department and organized with Professor Riley as Chief. The work of the division, generously sustained by Congress, has continued to be prosecuted with signal ability and success. Its publications, through annual reports, bulletins, and more lately, a monthly periodical, have been of a high order and of eminent service to the agricultural interests of the United States.

In 1877, a special Entomological Commission, to consist of three skilled economic entomologists, was authorized by Congress, for the purpose of investigating and reporting upon the depredations

of the Rocky Mountain locust of the Western States and Territories, and the best practicable method of preventing their recurrence or guarding against their invasions. The investigations of the commission were subsequently extended to the cotton-worm of the Southern States, and to some other insects whose widespread ravages had given them a national importance. The labors of this commission were attended with valuable practical results, and have given us a large addition to our literature in four octavo volumes and seven bulletins.

In 1880, the State of New York resumed entomological investigations, after an interval of ten years — they having been interrupted in 1870 by the impaired health of Dr. Fitch.

There is not the time in which to refer to other entomological work done more or less directly under State authority in connection with agricultural and horticultural societies and agricultural colleges, a long recital of which might be made. It is fitting, however, that I should not omit mention of the impetus which has been given to entomological research in the recent establishment, under the "Hatch Bill," of Agricultural Experiment Stations in at least twenty-eight of our States. In twenty-two of these so far as I know, an entomologist charged with the study of insect depredations and methods for their control has been appointed, and, it is believed, that the same indispensable work will be entered upon in each of the stations, as soon as competent persons can be found to meet the requirements of the position. Most heartily do I welcome this large addition to our hitherto small body of economic entomologists, and very bright are my anticipations of a greatly accelerated future progress, and of the benefit to result therefrom to the agricultural interests of our country.

Importance of Entomological Study.

Years ago, when insects were collected with no higher motive than the possession of a fine cabinet, or when their study went no further than giving them name and classification, it was customary to ridicule the pursuit as trivial, petty, unworthy of the dignity of a man. All insects, whether bees, butterflies, or beetles, were "bugs," and those who collected them were "bug-hunters."

To-day, the application of the knowledge which has been so long accumulating, to advancement in agriculture, horticulture, sylviculture, etc., has given to the study of entomology an importance which is recognized as second to no other department of natural history. It is being everywhere prosecuted with vigor, by the General Government and by the States, as we have indicated, and by private individuals, in compliance with the wide-spread demand for efficient means of protection from insect ravages — for a release from a taxation upon the products of the farm which is most burdensome, and the compulsory payment of which brings with it none of the compensations that ameliorate the payment of other taxes, in the protection that they afford to property, and the privileges and comforts that they bring to our homes; it is an entire loss.

The importance of the study of our insect enemies and their habits, may perhaps, be better seen from a few considerations, which we will present.

The Secrecy of Insect Depredations.

Probably that crop can not be named that may not be impaired one-tenth of its full value without the knowledge of insect presence or recognition of insect injury. Such secret injury is usually due to the operations of root-feeding insects, which are numerous in classes and in species, and from their subterranean life, do not fall under ordinary observation. Among these are plant-lice, the caterpillars of various moths and the larvæ of many beetles and flies, known often only to entomologists who have made a study of their early stages.

It is not an unusual occurrence that serious and evident insect injury is inflicted through a term of years, while the author of it remains unknown. An illustration of this may be found in the failure of the red clover to produce its seed, which for a long time was ascribed to the want of fertilization by bees, but was discovered a few years ago to be the result of the feeding within the blossoms upon the forming seed, by the larvæ of the clover-seed midge, *Cecidomyia leguminicola*. Certain injuries to several of our fruits causing their gnarling and deformation, which have long been a mystery to me, have found their explanation during

the past year, in the punctures made by a minute caterpillar — a *Coleophora* — which, always concealed within the peculiar case that it carries with it — if seen, as it doubtless often has been by the fruit-grower, would not be suspected of belonging to the insect world. Another new pest is baffling me and eluding my efforts for its discovery, through its secret girdling (believed to be at night) with a circle of incisions the tips of currant bushes in certain localities in New York, and causing them to break off and fall to the ground. There are cut-worms which leave their hidden retreats beneath the ground or shelter of rubbish, only after night-fall and climb into grapevines, where they cut off the clusters of the grapes, and into fruit trees, severing the stems of leaves and fruit. Numerous other insects intensify the loss that they occasion by the secrecy with which it is inflicted, and the consequent difficulty of meeting it. Of this class are the burrowers within the stems and stalks of plants or in trunks of trees, the numerous and destructive bark-borers which feed within the vital sap-wood, and leaf-miners, so minute as to find ample feeding ground in the range and concealment given them between the surfaces of a leaf.

THE SMALL SIZE OF INSECTS.

Nature often teaches us the lesson, of which we need frequently to be reminded, that size is no criterion of importance. Thus, among our insect foes, many of the most injurious are among the smallest of their class, and, hence, we have the seeming paradox — "the smaller the insect the greater its capability for harm." In confirmation of this we may cite the grapevine Phylloxera (*Phylloxera vitifolia*) which was first discovered by Dr. Fitch, in Washington county, N. Y., in the year 1854,— was introduced in France in 1863, and subsequently multiplied to such an extent as to threaten the entire destruction of that most important interest to France — grape culture. In 1879, nearly 3,000,000 of acres of infested vines had been taken up, destroyed, and the land appropriated to other uses. For several years, annual appropriations amounting to nearly $200,000 were made by the government for Phylloxera investigations, and a reward has been offered of 300,000 francs ($60,000) for the discovery of an effectual remedy.

And yet it is but a plant-louse, one of the smallest of its kind, and a mere dot — a microscopic object in several of its stages.

The diminutive size of the insect does not permit his exclusion from your crops by the ordinary means that give protection from the incursion of domestic animals that at times break their inclosures and invade your fields, although the injuries wrought by the latter may hardly admit of comparison with those caused by the former. True, ditches are sometimes dug and barriers built by western farmers to stay the marches of the army-worm and the chinch-bug in seasons of their excessive abundance, and valuable crops have been, by these means, rescued from threatened destruction. But, as a rule, the armies of destructive insects which spring out of the ground or drop upon you as if from the skies, must be fought by methods which are only to be learned from careful and continued study of the secret operations and wily ways of the species with which you have to contend.

We err when we regard all insects as small, notwithstanding that one of the definitions given by Webster of an insect is "something small or contemptible." But our best lexicographers are sometimes open to just criticism, as, for example, when Dr. Johnson has given as a definition of *net work* lest its meaning might not be perfectly clear to the simple-minded — "anything reticulated or decussated at equal distances with interstices between the intersections." True, the insect is small in comparison with our domestic animals and most of the mammals, yet there are large insects as well as small, for we have gradations among them not less marked than in other classes of animated nature. It has been computed that the average size in the animal kingdom — with the smallest known protozoan at one end of the line and the flat-back whale of the Pacific coast with its ninety-five feet of length and 294,000 pounds of weight, at the other, is to be found in the common house-fly, *Musca domestica*. All insects exceeding this in size may properly be called *large;* those only that are less in size, *small*. Does this seem surprising? Remember that there lies a vast world of living beings, the limit of which is not yet defined, which the unaided eye does not see, and which the microscope must call up to our wonder

and admiration, just as, in the other direction, each successive enlargement of the object glass of the telescope brings to our view from the depths of boundless space, suns and systems and galaxies of systems before unknown and unsuspected.

NUMBER OF INSECTS.

Insects, in number of species, exceed by far all the rest of the animal kingdom combined. They are believed to be ten-fold more numerous than all of the mammals, birds, fishes, reptiles, myriapods, crustaceans, worms, molluscs, radiates, and protozoans, united. At the latter part of the 17th century, they were estimated at 10,000 species. During the last 100 years the discovery of new species has been very rapid, and in 1881 there had been described and catalogued throughout the world 320,000 species, while many thousands were in collections awaiting name and description — 12,000 in a single collection — that of the British Museum. Judging from past discoveries, we may venture to claim that if all the species inhabiting the world were known, the number would reach *one million*.*

If, from distinct species, we descend to the consideration of individuals, figures are of no service, for the numbers that we should have to employ would be simply incomprehensible. I have seen at a glance, in a locality near Albany, within a small extent of roadway, of a single species of a snow-flea — a *Podura*, more individuals, as computed by me, than there are human beings on the entire face of the globe. A single small cherry tree of ten feet in height, infested with a plant-louse — one of a row similarly infested — was estimated by Dr. Fitch, by counting the number on a single leaf, the leaves on a branch, and the branches on the tree, to contain the amazing number of 12,000,000. Although this may strike one as a large number, yet few, if any, have any approximate idea of what a million means. Were I to count as rapidly as I could enunciate, simply naming the figures in their order and connection, omitting repetition of "hundred" and "thousand" where they occur — thus saying, "nine-seventy-three-four-eighty-one," instead of "nine hundred and seventy-three thousand four hundred and eighty-one," and con-

[* Lord Walsingham has raised this estimate to *three millions*.]

tinue thus counting for ten hours a day, it would require twenty-eight days to count a million, and consequently, eleven months of such labor (an obvious impossibility, for utterly beyond human power of endurance) to have counted the aphides upon that little cherry tree.

Rapidity of Propagation.

The rapidity of propagation shown in some insects, is also without a parallel elsewhere. Perhaps, in the aphides or plant-lice, it attains its maximum, where successive generations of living young, all of which are females, continue to be produced throughout the summer months, without the presence of the male, by a process which has been compared to, and, indeed, styled, budding. Professor Riley, in his recent studies of the hop-vine aphis, *Phorodon humuli*, has observed thirteen generations of the species in the year. Now, if we assume as the average number of young produced by each female to be 100, and that every individual shall attain maturity and produce its full complement of young (which, however, never can occur in nature), we would have, as the number of the twelfth brood alone (not counting those of all of the preceding broods), 10,000,000,000,000,000,000 (ten sextillions) of individuals. Where, as in this instance, figures fail to convey any adequate proper conception, may I ask you to take space and velocity of light as your measures? Were this brood, as above given, marshalled in line with ten individuals to a linear inch, touching one another, the procession would extend to the sun (a space which light traverses in eight minutes), and beyond it to the nearest fixed star (traversed by light only in six years), and still onward in space beyond the most distant star that the strongest telescope may bring to our view, to a point so inconceivably remote that light could only reach us from it in twenty-five hundred years. How fortunate it is for the human race, that in view of such amazing capabilities of increase in the insect world, so many counter-checks have been provided by Providence for the prevention of unrestricted development in a single direction, that all nature may still work together in harmony, when viewed in its broadest aspect.

THE VORACITY OF INSECTS.

The larval stage of many insects is apparently one of incessant feeding. It may be doubted of some if they ever sleep, or even indulge in rest unless disturbed while feeding, or during their molting periods, when time is demanded for the changes required in the casting off of a skin distended to its utmost capacity, and the formation and assumption of a new one capable of further extension. Their voraciousness and rapid growth may be shown in the statement of two facts: A certain flesh-feeding larva will consume in twenty-four hours two hundred times its original weight,—a parallel to which, in the human race, would be, an infant consuming in the first day of its existence, fifteen hundred pounds of nutriment. There are vegetable feeders,—caterpillars, which, during their progress to maturity, within thirty days, increase in size ten thousand times. To equal this remarkable growth, a man at his maturity, would have to weigh no less than forty tons. In view of such statements, need we wonder that the insect world is so destructive and so potent a power for harm.

CAN INSECT RAVAGES BE PREVENTED?

I have attempted, from a few considerations, to show the importance of insects in their relation to agricultural pursuits; that losses appalling in their magnitude are inflicted by them; and that these losses are steadily on the increase. What can be done? Can they be prevented? We answer, no, not entirely, but they may be controlled. My studies of twenty-five years have taught me that the insect does not exist, the injuries of which may not be greatly diminished when we have learned its entire life-history and its habits. Each one, when we know it fully, discloses some vulnerable point, and a particular time in one of its four stages of existence when it may be attacked to the best advantage. I assuredly speak within bounds when I say, what could not with truth have been said twenty years ago, that with our present knowledge and with the means now at our command, in the insecticides and preventives known, and apparatus and methods for their use, we can, if we will, lessen insect depreda-

tions to the extent of at least one-half of their present magnitude. What an addition this would be to the national wealth and to individual well-being!

How to Meet our Insect Enemies.

Turning now to the practical part of my paper — how may we best meet our insect foes? I will name some of the methods by which this may be done.

High Culture.— First and foremost, I would recommend high culture. Just in proportion that the vigor and growth of a crop is promoted, to the same extent there is given to it the ability to resist and overcome the effects of insect attack. While the feeble plant succumbs, the vigorous one will flourish and mature despite the drain upon it. It will have a resistant force to sustain it, just as health and a well-developed body may exclude or triumph over disease. And then, again, the weak, sickly, or diseased plant, made so either through neglect of cultivation or lack of needed fertilizing material, directly invites insect attack. The peculiar odor that emanates from it when in this condition, is at once detected by the insect, and serves to draw it from distances that seem almost incredible. Insects, that they may readily find the food-plants on which they are destined to feed and those upon which they are to deposit their eggs for the continuance of their species,— as if in compensation for a feeble, short range, and quite imperfect vision, have been endowed with a sense of smell which is marvellous in its acuteness, and is without parallel in any other class of the animal world. It is believed by some entomologists that many of our insect pests never make attack on healthy vegetation, but only on that which is diseased; as if in the economy of nature they were specially commissioned to hasten destruction and decay; and among these they would place many of the bark-borers that infest our fruit and shade trees, with which it seems almost hopeless for us to contend.

Clean Culture.— A large proportion of our insect pests survive the winter within such shelter as they may find in decaying wood, sticks, boards, or rails lying on the ground. Dead vines, stalks

(particularly if they are hollow), twisted leaves, etc., afford excellent hibernating places for the adult forms of many of the Hemiptera (commonly known as "bugs"), from which they emerge and deposit their eggs in the spring, simultaneously with the commencement of vegetation, when attack is ever most harmful. It is obvious, therefore, that much benefit will result from gathering in the autumn, all rubbish, dead vegetable matter, and other refuse material, and burning it with all the insects that it is harboring; or if this be regarded as wasteful, then so compost it, that the compost pile shall not be, as we believe it often is, a nursery for insect pests that in the injury that they inflict more than counter-balances the manurial value.

A knowledge of Insect Pests. — A favorite maxim of my school days was, "*Nosce te ipsum*" — know thyself. One equally important in later years, of broad application, but of special importance to the agriculturist, is, *know your enemies.* How can you successfully meet them, check their operations, prevent their attack, or destroy them if need be (for, fortunately, there are no laws against the killing of insects), unless you know who your foe is, when his attack is to be made, where it is to be made, and what he purposes to do. To know this is to be forearmed and in readiness for the fight. Are your insect enemies so many that you fear that you can not make their acquaintance? Do not be frightened at the seeming magnitude of the task, as if you were brought to contend single-handed, with the perhaps 20,000 distinct species which your State harbors. Some of these are your friends, others are at least harmless, while a large proportion are but comparatively injurious. In a list of 100 species, there could, I think, be named all of those which it would be to your particular interest to know and to study. These, at least, you should know by name, so that you may confer with one another in relation to them, and communicate with your entomologist or other scientist of whom you might desire information — such as the best approved remedy or preventive to be employed. The common name which every destructive species, known for any length of time, has received, would be sufficient for your use, but it would be advisable, so far as you conveniently could, to acquire also their scientific name, as

a help to you, if you purpose to add to your own observation, the study of what has been learned and written of them by others. To illustrate what I mean: Your apple trees, perchance, are not doing well — something is the matter with them — probably an insect is the cause. What insect is it? Is the apple-tree aphis infesting the buds or curling and distorting the leaves? Is the bud-worm tying up and consuming the young foliage just as it puts forth? Is the oyster-shell bark-louse pumping out through hundreds of thousands of tubes the life-blood of the tree? Is the flat-headed borer tunneling the limbs, or the round-headed borer working at the base of the trunk? Are any of the tiny bark beetles burrowing into the sap-wood, and gradually girdling the tree? Is the root plant-louse clustering on the roots? Each of these, and many others that may be cited, are secret or inconspicuous operations, which must be sought for, with a knowledge of what they are, if you would discover them in time for their arrest.

In addition to names, the characteristics of hidden attack, habits, and the different stages of life, should be known. A shriveled head of grain or discolored stalk may indicate the presence of the wheat-midge larvæ in the head, the joint-worm knotting or twisting the stalk, the Hessian fly concealed within the sheath near a joint, or the wheat-stem maggot burrowing the stalk; or the wheat saw-fly may be busily at work cutting off the nearly matured heads and dropping to the ground one-tenth of the crop. If it were generally known that the eggs of the common apple-tree tent-caterpillar could easily be detected upon the leafless trees in autumn or winter, as a broad belt of eggs from a half-inch to three-fourths inch in length, encircling the small twigs near their tips; and if, with such knowledge they were then clipped off and burned, apple orchards would never again have to suffer from such defoliation as they were last year subjected to in Eastern New York and portions of the Eastern States and parts of New Jersey.

Enlist your Children in the Study. — It can easily be done. Give them a cluster of eggs, of which to watch the hatching, the emergence of the young caterpillars, the rapidity and eagerness with which they devour the fresh food daily brought them, the

most interesting operation of shedding their skins four times (usually) during their growth, the construction of their cocoons when they have attained maturity, or their wonderful transformation to the chrysalis stage in the butterflies, and the final emergence from the pupa to the perfect-winged insect. Let them see all this, and they are made of strange material if they do not become entomologists for all future time. It will be a pleasure for them to collect insects and to study their varied and interesting habits, and to prepare collections which will adorn your homes. If consisting largely of the more injurious forms properly labelled and displayed, they would prove highly valuable for the use and instruction of your farmers' clubs, illustrating far better than figures can, the descriptions that your libraries may contain. As a guide and an aid to the children's studies put in their hands a little volume recently published by Dr. Packard, entitled, "Entomology for Beginners," in which they may find directions for collecting, preserving, and rearing insects, besides much other matter which will be of value to them and to yourselves, under the headings of "insects injurious and beneficial to agriculture;" "insect architecture;" "the structure, growth and metamorphoses, and classification of insects," etc., etc. Not only will the study be a delight to them, but it will serve, if properly pursued, as a means of mental discipline fully equal to many of the disciplinary studies of the schools. It will also place them in possession of knowledge which will better fit them to meet the demands that will be made upon the agriculturist of the future.

Procure and Study Recent Entomological Publications.— Economic entomology, has within the last few years made rapid and great advance. We, in the United States have been compelled to study insect ravages — greater here than in any other part of the world, and, as the consequence, the literature of applied entomology is far superior to that of any other country. The investigations having been made largely through appropriations from the general government or individual States, the publications have been distributed gratuitously, at the request usually of

those for whose benefit they were made. If every application can not be met, it is probably owing to the fact that the demand hitherto has not been sufficiently large to warrant larger editions. There is assuredly one publication which should be procurable by every farmer who will ask for it, viz.: The valuable illustrated report of the Entomologist of the United States Department of Agriculture, Professor C. V. Riley. Of this report, contained in the annual report of the Commissioner of Agriculture, 425,000 copies are ordered by Congress, each year, but it is feared a large proportion of these never leave Washington, except as entering into the composition of other paper. The Department has also issued two reports of the United States Entomological Commission, seven bulletins of the same Commission, and eighteen bulletins of the Entomological Division. It is also issuing, at the present time through the Division of Entomology, an interesting and instructive periodical, under the name of "Insect Life." Some of the above may be still procurable through application to the Commissioner, or to Professor Riley, or to your Representatives in Congress.

The reports of Dr. Fitch, published in the Transactions of the New York State Agricultural Society, for the years 1854 to 1870, are of special value. Six of these reports, bound in two volumes, may still be obtained of the Secretary of the Agricultural Society, at Albany.

The reports of the State Entomologists of Missouri and of Illinois are also very desirable. For these, application with inquiry might be made to Professor Riley, at Washington, and to Professor S. A. Forbes, at Champaign, Illinois.

A volume that would seem to be indispensable to the fruit-grower, is "Insects Injurious to Fruits," by W. Saunders, published in 1883,* by the J. B. Lippincott Company, Philadelphia, Pa., 436 pages, 440 figures. A recent publication of particular value to the student as an aid to classification, and prepared specially for the agricultural student, is "An Introduction to Entomology," by J. H. Comstock, Professor of Entomology in Cor-

* A second edition has since been published.

nell University, Ithaca, N. Y. The first part only of this (price two dollars) has been published. Application for it should be made to the author.

Learn of Insecticides and how to Use them.— The publications above named, and notably those of the department at Washington, will give the needed information in this direction. The recent advance in economic entomology has been largely through discoveries of insecticides, and the invention of apparatus for their easy application. Of our best insecticides in use at the present are white hellebore, Paris green, London purple, pyrethrum, kerosene, and tobacco. It is essential that one should know how, when, and in what proportions these are to be applied, the proper dilution of those that require it, and the method of emulsifying kerosene. It is also important that the relative value of wet and dry mixtures and the most economical and effective method of application should also be known. The great practical value of a reliable insecticide was years ago taught us in the discovery of the method of destroying the Colorado potato beetle, which threatened at first to arrest potato culture in our country. More recently its value has again been clearly demonstrated in the use of the arsenites (Paris green and London purple), sprayed upon the forming fruit of our apple trees for protection from the apple-worm of the codling-moth. There is no longer question but that, by a proper use of either of the above named arsenites, at least three-fourths of the apple crop can be saved from the codling-moth. Worm-eaten apples should henceforth be a discredit and a disgrace to the fruit-grower, and each worm-hole a stamp attesting to his ignorance or inexcusable neglect.

For the judicious use of insecticides, it is important that recognition should be made of two classes of insects — those that take their food by means of biting jaws, and those that feed only on the sap of plants through a proboscis inserted in the bark. The former, which includes the larger proportion of insects, can be readily poisoned by the application of the arsenites to the foliage which they consume. The latter, consisting of the Hemiptera, such as the plant-lice (Aphides), bark-lice, and all bugs properly so-called, which imbibe their liquid food from beyond reach of the poison,

are vulnerable to applications which may reach them externally, as tobacco solutions, alkaline washes, and kerosene,—the last-named closing their breathing pores and producing suffocation

Beneficial Insects should be Protected.—There are entire families of insects which consist almost wholly of species that are of direct benefit to the agriculturist, which should be known and spared from indiscriminate destruction. Of these are the *Coccinellidæ*, or lady-bugs, which have as their mission, the prevention of an overwhelming multiplication of plant-lice; the *Ichneumonidæ*, or ichneumon flies, which deposit their eggs within or upon the body of other insects, to hatch into larvæ which feed upon and destroy their host; the *Chalcididæ* or chalcid flies which have the habits of the ichneumon flies; the *Tachinidæ*, resembling our common house-flies, also of similar habits with the last two named, and several other families which could be mentioned.

The importance of these parasitic insects will be conceded when we state that it is highly probable that to parasitic attack we owe the almost entire cessation of the ravages of the wheat-midge in the United States, when all human means seemed hopeless. At the present time, fruit culture in California, and more particularly the orange culture, is most seriously impaired, through the operation of a scale insect, known scientifically as *Icerya Purchasi* Maskell, which was introduced in the year 1868 on an acacia from Australia. It has continued to increase and spread and feed on all the fruits and much other vegetation, until its arrest, by any known application, seemed impossible. In this emergency, two agents of the United States Department of Agriculture have been dispatched to Australia, to collect the parasites that prey upon the *Icerya* there and send them to California, that an attempt may be made to colonize and multiply them. Consignments of parasites have already been received, are being propagated with care, and the present outlook is quite encouraging.

Be Careful Observers of Insects.—You have opportunities for their observation which are not accorded to those in other pursuits of life. When you have become familiar with the appearance of those which are your annual visitants, you will readily detect the

advent of an unfamiliar new form. Capture it, and send it with all the information that you can obtain of its habits, to some entomologist, whose pleasure and duty it will be to tell you what it is; and if it should prove to be a new pest, he may also be able to give the directions best calculated to arrest its further spread and multiplication.

CONCLUSION.

Now that I have told you of your insect enemies—of their immense number, rapid propagation, incredible voracity, the enormous losses that they cause, and increasing injuries annually; and have also told you how you may best meet them, it may be proper to ask, "what do you propose to do in the matter?" Does the struggle that their control will require of you seem too formidable — almost a hopeless task? Do you propose to give up to the insect all that his insatiate greed and often excessive wastefulness demands, trusting that he may leave behind him enough for your wants? Will you rest on the promise that "seed time and harvest shall not cease?" Faith is well, but "without works it is dead." Continue then to pray with fervor, as often as you join in the Church's solemn Litany, "We beseech thee, good Lord, to give and preserve to our use the kindly fruits of the earth, that in due time we may enjoy them," but do not fail to supplement your prayer with the force-pump and London purple. It was a wise saying, if construed aright, that "Providence is ever on the side of the heaviest artillery." Fight the insect as you never have before, and do not sound an inglorious retreat or yield a pitiable surrender, just as the instruments of warfare and the insecticidal ammunition, with which you may wage effectual fight, have been placed within your reach. At least show the spirit of one who came to my office to learn of me how he might successfully fight the striped cucumber beetle which had troubled him greatly. "Not that I care so much about the cucumbers," said he, "but it hurts me terribly to let that little yellow-striped cuss get the better of me." Study and perseverance will bring its recompense. It will yield you a rich return in more productive crops with less expenditure of labor. I venture to say that it will often give the desired factor for the solution of that great problem which is before you, "how to make the farm pay?" Let the myriad insect

hosts feed unmolested upon your choicest products, for it is ever those that they prefer, and there is failure. Fight them energetically, scientifically, and manfully, and there is success, and a brighter future for you and your children. Do not, I beg of you, tolerate for a day longer, that inexcusable, shameful, costly neglect of the study of insect lives and insect habits.

(B)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year 1891 — fifty-six in number — giving title, place, and time of publication, and a summary of contents. A similar list of publications for the years 1875, 1876, and 1877 is appended.

The Squash Bug.* (Country Gentleman, for January 8, 1891, lvi, p. 23, c. 1, 2 — 26 cm.)

To inquiry from Kane county, Ill., answer is made that Paris green is not available against the squash-bug or any other of the bugs proper (Hemiptera). The best remedies are trapping the bugs and destroying the eggs. Trap with pieces of wood and kill the bugs found under them. Examine for egg-clusters on the underside of the leaves, and for the colonies of the newly-hatched bugs near them, and crush them. Prevent injury to the base of the stalk by applying a mixture of salt and ashes.

[Published in pp. 205-207 of this Report (viii).]

Grain Weevil Infesting Mills. (Country Gentleman, for January 15, 1891, lvi, p. 47, c. 1, 2 — 25 cm.)

For destroying weevil infesting a flour and feed store in Orange county, N. Y., which is probably *Calandra granaria* [no examples are sent], bisulphide of carbon is recommended, to be used after the manner reported by Professor Cook as having been successfully used for the purpose in a mill in Michigan. Its use in the vineyards of France against the Phylloxera, cited.

Protection from Insect Injuries. (Albany Morning Express, for January 23, 1891, p. 2, c. 5 — 28 cm.) Abstract of an Address before the Farmers' Institute at Albany, on January 22d, 1891.

Embraces the following topics: Loss from insect injuries, and their steady increase: the few insect pests known fifty years ago: the increase resulting from introduction from abroad, change of food-plants from wild to cultivated crops: importance of the study: what is being done for it by the General Government and the States: recent advance in economic entomology in the United States: our methods adopted in Europe and Australia. Means of protection are these: high cultivation, clean culture, encourage the natural enemies of insects, discriminate between beneficial and noxious insects, protect the birds,

*The capitalization, etc., of the *Country Gentleman* is followed herein in the citation from it of titles of publication.

learn of insecticides and how to use them, study insect lives and habits, and read entomological publications.

Bacon Beetle. (Country Gentleman, for February 12, 1891, lvi, p. 130, c. 3—6 cm.)

Dermestes lardarius infesting soiled clothing, in Ridgefield, Conn., is identified, with notice of its food, and reference to publications on it.

Insectivorous Birds. (Albany Evening Journal, for February 14, 1891, p. 6, c. 3—30 cm.)

Protecting the Birds. (New York Times, February 15, 1891.)

Remarks before the Assembly Committee of Game Laws, asking for such amendments and additions to the Revised Game Law as shall protect such birds as are beneficial to the agriculturist in the destruction of insect pests, and withholding protection from those which are detrimental: prominent among these last is the English sparrow.

[In MS. of Ninth Report.]

Scale Insects. (Country Gentleman, for March 26, 1891, lvi, p. 257, c. 2, 3—15 cm.)

Leaves of Oleander and Camellia, from Jacksonville, Ala., with supposed fungus, show attack of scale-insects — the former of *Aspidiotus nerii* Bouché, and the latter of a species of *? Parlatoria*. The general features of the two are given. When occurring on trees, they may be killed by spraying with kerosene emulsion or whale-oil soap solution. Infested plants may be treated with sweet oil, or kerosene lightly applied to the underside of the leaves with a sponge or piece of flannel.

[See in pp. 214, 215 of this Report (viii).]

Bark Lice. (Country Gentleman, for March 26, 1891, lvi, p. 257, c. 3—5 cm.)

To inquiry from Meadville, Pa., of an insect resembling an oat-hull in size and appearance, infesting apple trees; and also, if spraying with coal-oil in winter will kill bark-lice, — reply is made: a strong kerosene or coal-oil emulsion will kill the lice if the scales are saturated, but the emulsion can be more effectually applied at the time of the hatching of the eggs. The infesting insect can not be named from the statement made.

[A Blind Crustacean from a Well.] (Albany Evening Journal, for March 27, 1891, p. 6, c. 2—13 cm. New York Times, for March 28, 1891, p. 2, c. 5—8 cm.)

A small crustacean, sent from Oswego county, N. Y., as infesting a driven well of moderate depth, is identified as *Crangonyx mucronatus* Forbes — a blind species, occurring only in subterranean waters, and first discovered in a well at Normal, Illinois. It is found at the West, sometimes abundantly, in springs after heavy rains but does not live long in surface waters. This is its first recorded observation east of Indiana. Its presence in wells is not harmful, but rather beneficial, as tending to the purification of the water.

[Extended in MS. of Ninth Report.]

Injurious Insects. (Country Gentleman, for April 2, 1891, lvi, p. 273, c. 2, 3—43 cm.)

Abstract of a paper read at the New Paltz Farmers' Institute, treating of—the recent increase of insect pests; the increase largely in fruit insects; the principal depredators on the several fruits; generalization of methods for the destruction of sucking insects and biting insects; the best insecticides, viz., Paris green, London purple, and kerosene emulsion; their history, etc.; three recent triumphs in economical entomology; the benefits of arsenical spraying; fungicides combined with insecticides; reported bad results from London purple; strength of insecticides adapted to different fruits; lime lessens injury from the arsenites; the force pump; cost of spraying; several other means of protection from insect pests named.

Quince-Tree Borer. (Country Gentleman, for April 9, 1891, lvi, p. 294, c. 4—6 cm.)

To an inquiry for a remedy or preventive against this insect, a wash prepared as follows is recommended: A gallon of common soft soap and a pint of crude carbolic acid, thinned with a gallon of hot water, to stand over night or until it is perfectly united, and then eight or ten gallons of cold, soft water to be added.

Honey-Dew on Pear Twigs. (Country Gentleman, for April 16, 1891, lvi, p. 317, c. 1—16 cm.)

Pear twigs sent from Athens, N. Y., as infested with "honey-dew," are covered with a black substance, thought by some fruit-growers to be connected, or identical with, the apple scab. It is doubtless honey-dew, blackened by age and the association with it of the usual fungus that occurs on honey-dew infested foliage—a harmless form. The honey-dew could not have been deposited so abundantly by any known pear aphis. Probably the trees had been attacked by *Psylla pyri*. Search will be made for this insect during the following month.

Arsenic and Honey — Experiments. [Is Arsenical Spraying Harmful to Honey-bees?] (Country Gentleman, for April 16, 1891, lvi, p. 317, c. 1, 2 — 24 cm.)

Replying to inquiries: It has not been shown that honey bees have been killed or their honey poisoned by arsenically sprayed blossoms, although so asserted by Professor A. J. Cook and other apiarists. That such a result may follow is not believed by some of our best botanists. The question should be set at rest by proper experimentation: until then, caution should be exercised. If safe, it would be advantageous to spray during blossoming, for at this time the larvæ of some leaf-rollers could be reached, and not later.

Bulletins relating to spraying may, in many cases, be obtained by addressing the Directors of the Agricultural Experiment Stations. Director Atwater's "Experiment Station Record" is commended as useful to fruit-growers. Several of the most desirable Bulletins upon spraying, spraying apparatus and insecticides are named, and Station Directors' addresses given.

Entomology. (Proceedings of the 37th Annual Meeting of the Western New York Horticultural Society, January 28 and 29, 1891. April, 1891, pp. 10–17. Also, as Separates 8 pp.)

Report of the Society's Committee on Entomology, upon "Spraying with Insecticides," and "Some Garden and Orchard Insects." Topics embraced are the following: Effect of London purple on the plum: London purple on the peach: Solubility of London purple: An efficient nozzle for low spraying: Addition of lime to the arsenites: Fungicides combined with the arsenites: Spraying for the plum curculio: Spraying for the codling-moth: A new insecticidal machine: Insecticides lately recommended: Protection from the striped cucumber beetle: The apple curculio: The pear-blight beetle: The rose-bug: The Marguerite fly: The bean-weevil.

How to Control the Hop Aphis. (New England Homestead, for May 2, 1891, xxv, p. 193, c. 1 — 37 cm.)

In reply to editorial request for best methods of controlling the pest, the following points are noticed: The insect in Europe and America: Its life-history discovered: When to attack the aphis: How to kill the aphis with kerosene emulsion or with English wash: Repeat spraying as often as necessary: Preventive of aphis attack.

[See in pp. 207–210 of this Report (viii).]

Apple-Tree Insects of Early Spring. (Country Gentleman, for May 7, 1891, lvi, p. 374–5, c. 3, 4, 1 — 59 cm.)

Frequency of insect attacks this season, on unfolding buds, noticed. Insects received from Lansing, N. Y., are the apple aphis, *Aphis mali* Fabr., and the apple-tree case-bearer, *Coleophora malivorella* Riley. For the aphis, spray with the soap solution, tobacco water, or kerosene emulsion. The life-history of the case-bearer is given: its remedy is arsenical spraying, at times directed. Larvæ of the eye-spotted bud-moth, *Tmetocera ocellana* (Schiff.), associated with the above.

From Malcolm, N. Y., the bud-moth larvæ and the apple-leaf Bucculatrix, *Bucculatrix pomifoliella* Clemens, were sent: the best methods for destroying them are given. Operations against them should have been commenced earlier in the season.

From Lincoln, N. Y., are sent the bud-moth and its larvæ: also the pear-tree Psylla, *Psylla pyri* Schmidb., the presence of which is indicated by honey-dew; usually occurs on the pear; its apparent increase in our orchards; how to destroy it; its relationship to the *Aphididæ*.

[See in pp. 216–220 of this Report (viii).]

Orange Leaf Trouble. (Country Gentleman, for May 7, 1891, lvi, p. 375, c. 2, 3 — 11 cm.)

Spotted and blotched leaves received from Eustis, Florida, and reported as dropping from the tree, show no fungus attack or insect presence. The discoloration is not the orange-rust, caused by *Typhlodromus oleivorus*, but may possibly be owing to an attack of the trees by species of *Lecanium* or

Ceroplastes, the honey-dew from which may have been the cause of the soot-like blotches on the leaves. For such an attack, spraying with kerosene emulsion would be the proper remedy.

How to Kill the Rose-Bug. (New England Homestead, for May 9, 1891, xxv, p. 205, c. 1—33 cm.)

In the sandy soil of New Jersey, this beetle breeds in incredible numbers, and can not be controlled. In New England and New York it is within control: 1st, by beating into pans of water and kerosene; 2d, by spraying with kerosene emulsion, "1 part of oil to 9 of water"; 3d, on the authority of Professor J. B. Smith, by spraying with sludge-oil soap solution.

In New Jersey the beetle must be fought by the discovery and destruction of its breeding grounds.

[See in pp. 200–202 of this Report (viii).]

[The Cermatia Centipede.] (Albany Morning Express, for May 19, 1891, xlv, p. 8, c. 1—9 cm.)

In reply to an inquiry made, *Cermatia forceps* is identified as the household pest for which a remedy is asked. It is a Southern centipede which has extended northward and is abundant in Albany. Although poisonous, it will not be necessary to destroy it unless it should become very abundant. It subsists on small living creatures, and is fond of flies, and has secured a reputation as a "cockroach killer." It may be killed by scattering pyrethrum powder in its haunts.

The Apple-worm. (Country Gentleman, for May 28, 1891, lvi, p. 438, c. 2—12 cm.)

It is asked if it is necessary to spray for the apple-worm in a locality where there were no apples the last year. The failure of the apple crop in 1890 doubtless reduced the number of the codling-moth, and thorough arsenical spraying the present year might tend to lessen its injuries for years to come. The apple-worm is not dependent on the apple, but matures also in pears, plums, peaches, and apricots. It has been represented as breeding in walnuts in Europe, but this is probably an erroneous identification of the insect.

Wheat Insects. (Country Gentleman, for May 28, 1891, lvi, p. 438, c. 3—6 cm.)

Name is asked of an insect on wheat, from McGhee, Tenn. The smooth-headed variety only is infested, and not the bearded, in the same field. It is found also on scattered rye-heads. No insects were found in the heads when received, they having escaped. The species is probably the grain aphis, *Siphonophora avenæ* (Fabr.), although it also attacks bearded wheat, and has a seeming preference for rye.

Wire-worms in Corn. (Country Gentleman, for May 28, 1891, lvi, p. 431, c. 4—21 cm.)

From Gaysville, Vt., request is made for a remedy for worms piercing and destroying the kernels of corn. They are probably wire-worms. Salt,

suggested by the inquirer, would prevent cut-worm attack, but not wire-worms. The best preventive in infested fields is starving out by crops of buckwheat or pease. A good preventive is, preparing the seed corn with soft soap and plaster according to directions given: this method has been very successful. Soaking the seed corn in kerosene for twenty-four hours before planting might be tried.

Destructive to Pears. A Pest Discovered in a Catskill Orchard. (Albany Evening Journal, for May 30, 1891, p. 8, c. 1—17 cm.)

The Diplosis pyrivora. (The Sun [New York], June 1, 1891, p. 3, c. 5—9 cm.)

An insect destroying almost the entire crop of Lawrence pears and attacking other varieties is discovered in the Catskill orchards. It is an European insect, first observed in this country at Meriden, Conn., in 1881. This is its second known locality in the United States. Its life-history is given. Can not be reached by the ordinary insecticides. The danger apprehended from its spread. Picking the infested fruit and burning it, recommended.

Insect Pests. (Oswego Daily Times, for June 2, 1891, vol. 49, p. 4, c. 2—12 cm.)

Contains notice of a new case-worm or Coleophora feeding on apple leaves; the eye-spotted bud-worm, *Tmetocera ocellana*: the cocoons of the apple-tree Buccalatrix, *B. pomifoliella*; and of *Aspidisca splendoriferella* in its case; together with remedies for the several pests.

Another Formidable Insect Pest. (Oswego Daily Times, for June 3, 1891, vol. 49, p. 5, c. 2, 3—50 cm.)

The pear-midge, *Diplosis pyrivora*, discovered at Catskill, N. Y., hitherto known only at Meriden, Conn., where it was introduced about 1880. Infests the Lawrence pear and other species named; how it affects the fruit; not within reach of insecticides: its life-history; importance of its control; recommendation to pick and burn the infested fruit; other methods that may be effective against it: amount of injury done.

Melon and Strawberry Pests. (Country Gentleman, for June 4, 1891, lvi, p. 457, c. 2, 3—18 cm.)

A request from Wellham's Crossroads, Md., for a remedy for "lice" destroying melons and cucumbers, is answered by recommending the application of kerosene emulsion, pyrethrum in powder or in water, or strong tobacco water — the insect probably being *Aphis cucumeris* Forbes. The Vermorel nozzle would best apply the spray to the aphids on the underside of the leaves. Collecting and burning the dead leaves in autumn would doubtless destroy many of the eggs of the aphis.

The insect injuring strawberry plants by puncturing the stems [no specimens sent] is probably the flea-like negro-bug, *Corimelæna pulicaria* Germ. It is difficult of control from its large number of food-plants. The applications recommended for the aphis would probably kill it.

[See in pp. 212–214 of this Report (viii).]

The Peach-Tree Borer. (Country Gentleman, for June 4, 1891, lvi, p. 457, c. 3, 4 — 66 cm.)

In reply to inquiries made from Waynesville, Ohio, different methods of dealing with the insect are named and given at length, of which are, cutting out the larvæ, applying wood-ashes and water in a funnel-shaped cavity around the base of the tree, the carbolic acid wash of Mr. Bateham, the carbolic acid and Paris green wash of Mr. Hale, the Shaker peach-tree borer wash, and mounding about the base of the tree. A new "tree-protector," made of wire gauze and soon to be offered in market, is described and commended. How to "head in" peach trees to promote their health.

[See in pages 181–186 of this Report (viii).]

A Serious Danger — The New Pest that Threatens the Pear Crop. (New England Homestead, for June 13, 1891, xxv, p. 249, c. 4 — 24 cm.)

Introduction and injuries at Meriden, Conn., of the pear-midge, and efforts there for its extermination: its description, and its renaming and illustration by Dr. Riley; its distribution in Catskill, its habits, and manner of leaving the fruit: the varieties of pears that it is known to infest: its occurrence at Catskill may be through a new importation from France.

The Gartered Plume Moth. (Country Gentleman, for June 18, 1891, lvi, p. 497, c. 3 — 26 cm.)

An insect sent from [Scarsdale] Westchester Co., N. Y., as webbing the terminal leaves of the grapevine, is the one above named, in its larval stage. The moth is described, its distribution stated, and for the prevention of its multiplication, crushing it by hand in its shelter is recommended. Reference to figures and to detailed descriptions.

[A New Onion Pest.] (Albany Evening Journal, for June 19, 1891, p. 8, c. 5.)

Caterpillars sent from Canastota, N. Y., as devastating the onion fields in that vicinity, are not identical with those that appeared in Orange county, N. Y., in 1885, but an allied species, viz., *Agrotis ypsilon* (Rott.), or the black cut-worm — a common and wide-spread species but not previously reported on onions. Recommendations of means for its destruction are given.

New Strawberry Pest. (Country Gentleman, for June 25, 1891, lvi, p. 575, c. 2, 3 — 12 cm.)

A beetle from Clifton, New Brunswick, injuring leaves and blossoms of the strawberry, is identified as *Serica tristis* LeConte, not previously reported on this food-plant. Its general appearance is described, with probabilities of its larval habits.

Lady Bug and Cherry Aphis. (Country Gentleman, for July 2, 1891, lvii, p. 537, c. 1, 2 — 19 cm.)

Insects received from Pittsburg, Pa., with inquiry, are the black cherry aphis, *Myzus cerasi*, which is being preyed upon by the 15-spotted lady-bird, *Anatis* 15-*punctata*. All of the latter are brown-black or entirely black,

without their usual spots, probably as the result of their larvæ having fed on the black aphides. Other food of the insect is mentioned. A number of larvæ of Syrphus flies were also feeding on the aphides.

Beet Insects. (Country Gentleman, for July 16, 1891, lvi, p. 577, c. 4—30 cm.)

The serious injury to beets reported from Monroe Co., N. Y., so far as can be seen from plants sent, are not chargeable on any one insect. The plants show injury from a plant-bug—perhaps *Lygus pratensis:* from apparently some species of flea-beetles; and from some leaf-miner, which is probably a species of *Anthomyia.* Remedy for the above may be found in the use early and at the proper time, of kerosene emulsion. Reference to a valuable paper on Beet Insects.

[In MS. of Ninth Report.]

Apple Aphis. (Country Gentleman, for July 16, 1891, lvi, p. 578, c. 1, 2—11 cm.)

A severe attack of *Aphis mali* Fabr., recognized on apple-twigs received from Sargeantville, N. J. The injury will probably soon cease, as the insect will resort ere long to some other food-plant. Effective remedies for early in the season, are tobacco-water, soap solution, and kerosene emulsion.

The Pear-Tree Psylla. (Country Gentleman, for August 6, 1891, lvi, p. 637, c. 2, 3—41 cm.)

When and where *Psylla pyricola* was first observed in New York: new feature in its life-history: known formerly as *Psylla pyri:* notice of injuries from it: its present distribution in the State: the honey-dew excreted: the pupæ and pupal cases: the insect may be destroyed in its different stages, by kerosene emulsion spraying: flight of the winged insects.

Insects Injuring Red Raspberries. (Rural New Yorker, for August 8, 1891, l, p. 577, c. 3—13 cm.)

Caterpillar found on red raspberry at New Haven, Conn., is *Synchlora rubicoraria* (Riley). Its peculiar appearance is described and habit given of covering itself with bits of the blossoms for concealment. Its transformations, and the moth produced.

[Extended in this Report (viii), pages 129–133, as *Synchlora glaucaria.*]

Pine Beetle Injuring Linen. (Country Gentleman, for August 27, 1891, lvi, p. 700, c. 1—20 cm.)

Inquiry is made from Freyburg, Me., of an insect that had burrowed the pine shelving of a linen closet built the preceding year, riddling the boards with small round holes and extending upward through piles of linen on the shelves.

The insect, doubtless a burrowing beetle, can not be named from the brief account of its operations, unaccompanied with specimens of the insect. [It may be one of the *Ptinidæ*, the larvæ of which are small, and often with wood-boring habits.]

Foes of the Kilmarnock Willow. (Orange County Farmer, for September 3, 1891, x, p. 1, c. 2 — 6 cm.)

A scale-insect reported as blighting the Kilmarnock willows at Port Jervis, N. Y., is identified as the apple-tree bark-louse, *Mytilaspis pomorum* Bouché. Remedies recommended are spraying with kerosene emulsion at any time, or with a soap solution or tobacco water at the time of egg-hatching.

The New Dairy Pest. (Oswego Semi-Weekly Times, for September 4, 1891, ii, p. 1, c. 1 — 52 cm.)

Occurs in Oswego county, and how introduced: what the fly is: its present distribution in the State: its injuries to cattle: when most troublesome: how its increase may be prevented, and how it may be repelled from cattle.

[See in pp. 192–194 of this Report (viii).]

The Cow-Horn Fly in New York. (Country Gentleman, for September 10, 1891, lvi, p. 735, c. 2, 3 — 41 cm.)

Reference to its appearance and injuries in other States and notice of its occurrence in New York last year, and in Oswego and Steuben counties the present year. Efforts should be made to arrest its spread, and how it may be done. Reference to the literature of the insect.

[See in pp. 195–197 of this Report (viii).]

Leaf-Eating Beetle. (Country Gentleman, for September 10 1891, lvi, p. 735, c. 3 — 5 cm.)

A beetle taken on a cherry tree at Little Falls, N. Y., is *Euphoria fulgida* (Fabr.)—a beautiful insect, allied in habits to the May-bug. It is common in the Western States, but rather rare in the State of New York.

Elm-Leaf Beetle. (Country Gentleman, for September 10, 1891, lvi, p. 735, c. 3 — 6 cm.)

Larvæ sent from Red Bank, N. J., do not permit positive identification, but are probably those of *Galeruca xanthomelæna*. The remedy for it is spraying with London purple.

Grape Curculio. (Country Gentleman, for September 10, 1891, lvi, p. 735, c. 3, 4 — 16 cm.)

Grapes ruined by the puncture of some insect, at Sanford, Tenn., are infested by the larvæ of the grape curculio, *Craponius inæqualis* Say. The appearance of the injured grape is described, and also the larva and the beetle. Preventives recommended are bagging the grapes, jarring off the beetle in June, and working the ground to destroy the immature insect.

[In MS. of Ninth Report.]

Measuring Worm. (Country Gentleman, for September 10, 1891, lvi, p. 735, c. 4 — 8 cm.)

A caterpillar sent for name, from Green Grove, Pa., had spun up in a cocoon when received, and can not therefore be named. Its appearance, as

described by the inquirer, would refer it to the *Ennominæ* among the *Geometridæ*, and possibly, from a partial view of the pupa, to *Eutrapela transversata*.

Rat-tail Larva. (Country Gentleman, for September 10, 1891, lvi, p. 735, c. 4 — 11 cm.)

A rat-tail larva, from Macedon, N. Y., is one of the *Syrphidæ*, but can not be definitely named. It resembles *Helophilus latifrons*. Feeding-habits of some of the larvæ of some of the genera, and of the flies.

The Locust Mite. (Country Gentleman, for September 24, 1891, lvi, p. 775, c. 1 — 11 cm.)

The locust mite, *Trombidium locustarum* Riley is named, and its life-history briefly given, in reply to a request for the information from Adena, Ohio, of "the parasite that deposits its small red eggs near the base of grasshoppers' wings."

[See pages 179, 180 of this Report (viii).]

The Cecropia Caterpillar. (Country Gentleman, for September 24, 1891, lvi, p. 777, c. 2, 3 — 25 cm.)

A request to describe "the wonderful adornment" of a Cecropia caterpillar sent is answered by giving the varied colorational features of its spines and tubercles, to which is added — remarks upon the beauty to be seen in the insect world, in some of the larvæ particularly, which is usually overlooked.

An Interesting Caterpillar. (Country Gentleman, for October 1, 1891, lvi, p. 797, c. 3, 4 — 12 cm.)

A long white flattened cocoon attached to a piece of apple-bark, received from Gordensville, Pa., is apparently that of a Cerura caterpillar. Striking features of these caterpillars, are, the rich colors that adorn them, and the two long, slender, reversible filaments in which the body terminates.

[The moth emerging Sept. 29th, proved to be *Artace punctistriga* Walker.]

Grapevine Leaf-Hopper. (Country Gentleman, for October 8, 1891, lvi, p. 815, c. 2, 3 — 11 cm.

Leaf-hoppers infesting grapevine leaves in Kingston, Pa., are the vine-destroying leaf-hopper, *Erythroneura vitifex* Fitch. It is compared with *E. vitis*, and its injuries stated. It may be destroyed by driving it on kerosene-saturated cloths, or by spraying the larvæ with kerosene emulsion. Burning the refuse material of the vineyard is beneficial.

[Extraordinary Flight of Moths.] (Albany Evening Journal, for October 20, 1891, c. 5 — 10 cm.)

A flight of insects, found, from specimens submitted, to be *Zerene catenaria* (Drury), is reported from Medford, Pa., as occurring during the last week in September, and continuing for two nights and a day. Reference is made to a similar flight of the same species, observed at Lackawaxen, Pa., some years ago, early in October, and to large numbers on windows in

Albany, drawn to lights within, late in September. No satisfactory cause can be assigned for such assemblies of this moth. In butterflies, as in *Danais Archippus*, it is not rare.

The Squash Bug. (Country Gentleman, for October 22, 1891, lvi, p. 854, c. 4—11 cm.)

Anasa tristis (De Geer), pupa and imago, is identified in examples from Lowell, Mass., and a brief sketch of its habits and transformations given. It matures in September and October, and then passes eight months in its winter retreat.

A Destructive Potato Aphis. (Country Gentleman, for October 22, 1891, lvi, p. 857, c. 4—20 cm.)

Aphides reported from Hamburg and Kingston, Pa., as having destroyed hundreds of acres of potatoes, and injured cabbages, on the bottom lands of the Susquehanna River, can not be identified from the poor, wingless examples sent. They are not referable to any of the four species known to feed on the potato. The range of its occurrence, so far as observed, is given.

White Grubs. (Country Gentleman, for October 29, 1891, lvi, p. 875, c. 4—13 cm.)

White grubs sent for name from Red Bank, N. J., may be those of *Lachnosterna fusca* (Fröhl.); but it is impossible to identify positively any of the twenty-five or more species that belong to the *fusca* group. Writings of Dr. Horn and of Professor Smith on these species quoted.

[See in pp. 174, 175 of this Report (viii).]

Sprayed Grapes are Harmless. (Entomological News, for November, 1891, ii, p. 181—6 cm.)

Quotes an item given to the Associated Press, in which the recent seizure and destruction in the New York market, under the direction of the Board of Health, of grapes that had been sprayed with Bordeaux mixture for the prevention of fungus attacks, is pronounced unjustifiable and rendering the officers liable to prosecution for damages. There was not a poisonous amount of copper on the grapes seized, and the little observed on the stems could readily have been removed by a bath of water and vinegar.

The Pear Midge, Diplosis pyrivora in New York. (Canadian Entomologist, for November, 1891, xxiii, p. 224.)

Noticed for the first time in New York the present year, at Catskill, N. Y.; number of the larvæ in a single pear; habits of the larvæ; proposition to destroy the larvæ by blighting the blossoms.

On the Eye-Spotted Bud Moth in Western New York. (Canadian Entomologist, for November, 1891, xxiii, p. 231.)

Abundance of *Tmetocera ocellana*; habits of the caterpillar; difficulty of reaching the larva with insecticides; does it hibernate only as a larva? methods that may be available for its destruction.

On Some of our Orgyias. (Canadian Entomologist for November, 1891, xxiii, p. 232.)

Does *Orgyia definata* occur at Albany, N. Y., as it has been stated to do? Is *O. nova* identical with *O. antiqua* of Europe?

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*Do Spiders Protect Fruit-trees from Aphides? (Green's Fruit Grower, April, 1887, p. 17 — 11 cm.)

Replying to the above question:—no record appears of spiders feeding on aphides under natural conditions, while in captivity, as stated in the communication, they undoubtedly would eat them. Aphides in fruit trees are devoured by lady-bugs and larvæ of lace-wing flies before they would be found by spiders where the latter do not ordinarily occur.

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*Omitted from its proper place.

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PUBLICATIONS OF THE ENTOMOLOGIST FOR 1875-1877.

Record of Collections of New York Heterocera for the year 1873. (Twenty-seventh Annual Report of the N. Y. State Museum of Natural History, 1875, pp. 144–148.)

Contains one hundred and thirty-five species, with localities and dates of capture.

The New Apple Worm. (Albany Evening Times, for April 12, 1875, xix, p. 2, cols. 3, 4. Thirtieth Report on the N. Y. State Museum of Natural History, 1878, pp. 117–121, with additional matter, pp. 121–126. The same in Entomological Contributions, No. IV, June, 1878, pp. 5–14.)*

This entozoan, received from Middletown, N. Y., coiled in the heart of an apple, was referred to *Gordius:* what *Gordius* is and usual mode of occurrence: subsequently identified as *Mermis*, perhaps *albicans*, and probably parasitic on *Carpocapsa pomonella:* how it may parasitize the caterpillar: is its occurrence in the apple dangerous? *M. acuminata* found by Professor Comstock in an apple: *Mermis* found by Professor Riley parasitic on the apple-worm: Dr. Leidy on *Mermis acuminata* and descriptions: Leidy on other entozoa: Dr. Speyer on *Gordiacea* in Insects: Dr. Packard on *Gordius* and *Mermis*.

A New Apple Worm. (Country Gentleman, for April 29, 1875, xl, pp. 262, 263, cols. 4, 1—31 cm.)

Mermis sp., a Parasite on *Carpocapsa pomonella*, found in an apple from Orange Co., N. Y.

[Extracted from the Times article, see notice above.]

Insect on the Cabbage. (Country Gentleman, for June 24, 1875, xl, p. 392, c. 1, 2—13 cm.)

Identification of *Margantia histrionica* (Hahn.), from Charlotteville, Va., together with its habits and remedies for its ravages.

[See *First Report on the Insects of New York*, 1882, pp. 264–271, fig. 77.]

Blister Beetles. (Country Gentleman, for July 1, 1875, xl, p. 407, c. 1, 2—23 cm.)

An insect sent from Hastings, Minn., as destructive to potato leaves is identified as the black-rat blister beetle, *Lytta murina* LeConte. It is

*Entitled, On Mermis acuminata LEIDY — a Parasite on the Larva of Carpocapsa pomonella.

occasionally injurious to potatoes, but is seldom very destructive. The habits of the larva are unknown.

[Now known as *Macrobasis unicolor* (Kirby).]

Cocoons on Oats. (Country Gentleman, for July 8, 1875, xl, p. 424, c. 2—7 cm.)

The cocoons are of some parasite which has destroyed the larva in which the eggs were deposited, as narrated. The species is not determinable from the examples received.

Worm on Wheat. (Country Gentleman, for July 15, 1875, xl, p. 440, c. 2—9 cm.)

The caterpillar is that of *Leucania Harveyi*, one of the Noctuid moths which at times proves destructive to the heads of wheat in New York, Pennsylvania, etc.

[Now known as *Leucania albilinea* Hübner.]

Insects on Potatoes. (Country Gentleman, for July 22, 1875, xl, p. 472, c. 2—8 cm.)

The insects, sent from Ashfield, Mass., as sucking the juices from potato leaves, causing them to die, are *Lygus lineolaris*, one of the Hemiptera. It is almost or quite impossible to prevent their attack by external applications to the leaves as they live only on the juices of the plant.

[Now known as *Lygus pratensis* (Linn.).]

On Lycæna neglecta Edw. (Canadian Entomologist, vii, July, 1875, pp. 122, 123.)

Reasons for differing from Mr. W. H. Edwards in his belief of the identity of *L. neglecta* with *L. Lucia*, based on observations made at Center, N. Y.

[Mr. Edwards has since shown (*Papilio*, iii, 1883, pp. 85–97) that *neglecta* and *Lucia* are summer and winter forms of the polymorphic *Lycæna pseudargiolus* Boisd.-Lec.]

On Orthosia ralla Gr.-Rob. (Canadian Entomologist, for July, 1875, vii, pp. 128, 129.)

Orthosia ralla is not identical with *O. ferruginoides*, as has been stated: the points of difference given. Synonymical dicta often at fault; tendency to refer distinct species to "dimorphic forms" on insufficient grounds.

Carpocapsa Deshaiziana in Seed-vessels of Euphorbia. Read before the Albany Institute October 5, 1875. (The Argus [Albany, N. Y.], for October 11, 1875. Proceedings of the Albany Institute, ii, 1878, pp. 264–267.)

Jumping seeds exhibited, from the Alamas mountains in Sonora, contain the larvæ of *Carpocapsa Deshaiziana*, whose springing within the seeds causes their jumps. Reference to writings on it by Lucas and Professor Westwood. Three other species of jumping seeds noticed. The "jumps"

described. The insect hard to mature. The leaps of the cheese-maggot and spring-beetles. Observations on a species of Podura occurring in immense numbers at Center, N. Y.

[The jumping-seed insect is now known as *Carpocapsa saltitans* Westwood. See an account of it in the *Fifth Report on the Insects of New York*, pp. 151–154. Fig. 63.]

Cucullia lætifica *Lintner (n.s.)*. (Check-list of the Noctuidæ of America, North of Mexico, by A. R. Grote, I, November, 1875, pp. 24, 25.)

The species is described from a specimen from Bastrop, Texas, in the collection of Mr. O. Meske.

List of Catocalas occurring in the State of New York. (Twenty-seventh Annual Report of the New York State Museum of Natural History, 1875, pp. 137–140.)

Contains forty-three species, with references and synonyms.

List of New Species of New York Lepidoptera published in 1873. (Twenty-seventh Annual Report of the New York State Museum of Natural History, 1875, pp. 141–143.)

Contains eighty species, mainly by A. R. Grote, in the *Noctuidæ* and *Deltoidæ*—[the latter family united with the former by recent writers].

On Catocala pretiosa n. sp. (Canadian Entomologist, for July, 1876, viii, pp. 121, 122.)

The species is described from examples taken, at sugar, at Schenectady, N. Y. It is compared with *C. polygama*, to which it is closely allied.

Destructive Caterpillar. (Country Gentleman, for August 10, 1876, xli, p. 504, c. 2, 3—11 cm.)

A caterpillar which is eating the leaves of apple trees in a young orchard, at Manlius, N. Y., is, judging from the description given, *Notodonta* [*Œdemasia*] *concinna* (Sm.-Abb.).

Cabbage-eating Insect. (Country Gentleman, for September 7, 1876, xli, p. 565, c. 3, 4—14 cm.)

Strachia [*Murgantia*] *histrionica* (Hahn.) is identified as depredating on cabbages at Nashville, Tenn.: its distribution, its eggs, and its broods described.

The Grape-seed Fly. (Country Gentleman, for September 21, 1876, xli, p. 599, c. 1, 2—40 cm.)

Isosoma vitis Saunders is the insect infesting grapes received from New Jersey. Its operations are described and remedies for its attack given.

The New Carpet-bug Pest — Anthrenus scrophulariæ. [Read before the Albany Institute, October 17, 1876.] (The Albany Argus, for October 21, 1876. The [Schenectady, N. Y.] Daily

Union, for October 21, 1876. The Buffalo Courier, for October 29, 1876. Proceedings of the Albany Institute, 1878, ii, pp. 313–315.)

The injuries caused by a "carpet-bug" have been reported by newspapers for the two past years. It was observed in Schenectady, in July of 1876, the perfect insect (a beetle) reared from the larvæ, and identified as an introduced European species, *Anthrenus scrophulariæ* (Linn.). It feeds on other woolens besides carpets. Importance of efforts to arrest its spread. Other introduced European pests mentioned.

Insects in Flour. (Country Gentleman, for October 26, 1876, xli, p. 683, c. 3, 4—23 cm.)

Wheat flour, received from Robin's Nest, Ill., was swarming with a mite which was probably *Tyroglyphus farinæ* DeGeer [=*T. siro*. (Linn.)]. Its resemblance noted to *T. sacchari*, the mite that so frequently infests brown sugar. Its probable source in this instance. As the mite would be killed in baking, its moderate presence is not objectionable.

[Published in the *Fifth Report on the Insects of New York*, 1889, pp. 294, 295.]

Scale Insects. (Country Gentleman, for February 1, 1877, xlii, p. 69, c. 2, 3 — 40 cm.)

Injury caused to pear and apple trees, in Newburgh, N. Y., by *Aspidiotus Harrisii* Walsh [*Chionaspis furfurus* (Fitch)] and *Aspidiotus conchiformis* Gmel. [*Mytilaspis pomorum* Bouché]. Their appearance, natural history, and means of destruction.

Bark-lice. (Country Gentleman, for March 8, 1877, xlii, p. 151, c. 4—18 cm.)

Notice of Harris' bark louse and description of the oyster-shell bark-louse. The latter is double-brooded in the Southern States.

Apple-Tree Insects. (Country Gentleman, for April 12, 1877, xlii, p. 235, c. 4—13 cm.)

Oviposition in short double rows in twigs of a tree, are not identified, but are those of some tree-hopper. The oviposition of the white flower-cricket, *Œcanthus niveus* Harris, identified, with remarks on the appearance and habits of the cricket.

Insects of 1876 — I. (Country Gentleman, for May 31, 1877, xlii, p. 347, c. 2, 3—60 cm.)

Scarcity of the army-worm, *Leucania unipuncta* Haworth, in New York during the year. Unequal distribution of the Colorado potato-beetle throughout the State of New York, apprehensions of its introduction into Europe and preventive measures employed against it. Detection of the grape-seed fly, *Isosoma vitis*, near New York city, with description of the insect, its transformations, and remedies available against it.

Insects of 1876 — II. The New Carpet Bug. (Country Gentleman, for June 7, 1877, xlii, p. 363, c. 2, 3—51 cm.)

Notice of the first detection of *Anthrenus scrophulariæ* in New York, its history in the United States, its increase and ravages and remedies for it. Also, notice of a "New Potato Insect" the work of which was observed in potatoes in New York city in burrows through the tubers.

Insect on Peach Trees. (Country Gentleman, for June 7, 1877, xlii, p. 363, c. 3—12 cm.)

A caterpillar infesting the twigs of peach trees in Annapolis, Maryland, apparently a Tortricid, can not be identified from the poor material sent.

A Parasitic Insect. (Country Gentleman, for July 12, 1877, xlii, p. 448, c. 2—18 cm.)

Insects sent from Cecil Co., Md., are the larvæ of one of the *Reduviidæ*, probably *Prionotus cristatus* (Linn.). The species shows cannibalistic propensities when deprived of its usual food.

The Gooseberry Fruit Worm. (Country Gentleman, for July 12, 1877, xlii, p. 448, c. 2, 3—17 cm.)

Larvæ infesting gooseberries in Delhi, N. Y., causing them to drop to the ground, are apparently those of *Pempelia grossulariæ* Packard [*Zophodia grossulariæ* (Pack.)]: when the insect was first noticed and described; its transformations, and remedies for the attack.

Tree-Hoppers. (Country Gentleman, for July 19, 1877, xlii, p. 463, c. 4—10 cm.)

Bark from an apple-tree in Sabrevois, Province of Quebec, shows scars resulting from the egg-deposit of one of the tree-hoppers [probably *Ceresa bubalus*].

An Eastern Grasshopper. (Country Gentleman, for July 26, 1877, xlii, p. 475, c. 4—25 cm.)

Caloptenus [*Melanoplus*] *femur-rubrum* (De Geer) is very destructive to meadows in Virginia. Its habits are given. These insects are erroneously called "grasshoppers"—they are true locusts.

Blistering Beetles. (Country Gentleman, for July 26, 1877, xlii, p. 476, c. 2, 3—13 cm.)

Epicauta cinerea (Foerst.) and *Lytta* [*Cantharis*] *Nuttalli* Say, are destructive to potatoes and beans in Minnesota: their vesicatory properties and their distribution.

On a New Species of Cossus. (Canadian Entomologist, for July, 1877, ix, pp. 129, 130.)

The pupal cases of this insect were discovered five years ago, projecting from poplars, *Populus tremuloides*, at Center, N. Y., and the moth was taken in July of the present year. The moth is described as *Cossus Centerensis*.

The Carpet Bug. (Country Gentleman, for August 2, 1877, xlii, p. 491, c. 2–4 — 61 cm.)

In reply to inquiries from Utica, N. Y., the insect is described in its three stages: the fondness of the beetle for windows noticed; remedies suggested; may be drawn to flowers for its capture; localities where observed.

Grapevine Hog-Caterpillar. (Country Gentleman, for September 6, 1877, xlii, p. 579, c. 3 — 24 cm.)

The caterpillar of *Darapsa Myron* (Cramer), described; its habit of biting off clusters of grapes; liability to being parasitized by a *Microgaster;* habits and transformation of the parasite; the importance of knowing our insect friends.

A Pernicious Corn Insect — The Indian Cetonia. (Country Gentleman, for September 13, 1887, xlii, p. 585, c. 3, 4 — 8 cm.)

Description of the beetle found in Essex Co., Mass., eating into ears of green corn, as *Cetonia Inda* [*Euphoria Inda* (Linn.)]. It is also injurious to fruit, and has been unusually abundant the present year.

Aphis in Wheat. (Country Gentleman, for December 6, 1877, xlii, p. 779, c. 2 — 10 cm.)

An aphis infesting the stalks of young wheat below the surface of the ground in Kittanning, Pa., during the latter part of November, can not be identified with *Aphis avenæ*, as it differs from that in antennal structure.

Pea Weevil. (Country Gentleman, for December 6, 1877, xlii, p. 780, c. 2 — 7 cm.)

A weevil infesting the Southern black-fallow pea at Bruckner's Station, Va., is the *Bruchus scutellaris* Fabr. It was originally described as an European species, but is now widely distributed throughout the world. [Extended in the *Sixth Report on the Insects of New York*, 1890, pp. 31–33 (=127–129).]

(D)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the Contributions that have been made to the Department during the year 1891:

Hymenoptera.

Cells of a wasp in a fold of paper. From Rev. H. U. Swinnerton, Cherry Valley, N. Y.

Currant twigs containing the eggs of the currant-twig girdler, June 6th. From J. F. Rose, South Byron, N. Y.

A saw-fly larva on snow-berry from S. C. Bradt, Albany, N. Y.

Trichogramma sp., eighteen examples in alcohol; bred from an egg on pine. From Harison G. Dyar, Yosemite Valley, Cal.

Lepidoptera.

Larva of *Ceratomia Amyntor* Hübn., September 14th. From Mrs. Abram Lansing, Albany, N. Y.

Alypia octomaculata (Fabr.). From Mrs. Frederick Carman, Albany, N. Y.

Thirty examples of larvæ of Lepidoptera in alcohol; also alcohol examples in other stages; collected in the Yosemite Valley, Cal., as follows:

Papilio Rutulus Boisd. 1.
Phyciodes Mylitta Edw. 5.
Vanessa Antiopa Linn. 2.
Heterochroa Californica Butler, 2.
Orgyia cana H. Edw. 4 and eggs.
Orgyia definata Packard, 2; also eggs and female moth.
Orgyia leucostigma (Sm.-Abb.) 4 young.
Packardia elegans Packard.
Datana major Gr.-Rob., larva, 1 pupa.
Nadata Behrensii H. Edw. 2.
Clisiocampa constricta Stretch. 1.
Pheosia dimidiata Her.-Sch. 3.
Amphipyra pyramidoides Guen. 1
Examples Nos. 248, 269, 274, 275, 284, 298, undetermined and unenumerated.
From H. G. Dyar, New York.

Eggs of *Halisidota caryæ* Fitch, on apple leaf. From J. G. Linsley, Oswego, N. Y.

Larvæ of *Agrotis ypsilon* (Rott.) from onion plants, June 16th. From P. F. Milmoe, Canastota, N. Y.

Zerene catenaria Cramer, from a large flight of the moths. From A. P. CASE, Vernon, N. Y.

Tortricid pupal case projecting from a humming-bird's nest. From E. N. HOLLY, Tribes Hill, N. Y.

Larvæ of *Phoxopteris nubeculana* (Clem.), within folded apple leaves, October 10th. From JOHN S. WRIGHT, Palmyra, N. Y.

Larvæ of the bud-moth, *Tmetocera ocellana* (Schiff.), feeding in apple buds and leaves, April 27th to May 11th. From MALCOM LITTLE, Malcom, Seneca Co., N. Y.; from DWIGHT STONE, Lansing, Oswego Co., N. Y.; from FRANK MOTHROP, Lincoln, Wayne Co., N. Y.; from T. G. YEOMANS, Walworth, Wayne Co., N. Y., also the moth.

Mature larvæ of the apple-worm, *Carpocapsa pomonella* (Linn.), from calyx end of apples November 6th. From Miss S. A. LITTLE, Malcom, N. Y.

Larvæ and cocoons on birch of *Bucculatrix Canadensisella* Chamb. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

Coleophora malivorella Riley, in its hibernating case, April 27th. From DWIGHT STONE, Lansing, Oswego Co., N. Y. The same, May 19th, from T. G. YEOMANS & SONS, Walworth, Wayne Co., N. Y.

Coleophora sp. undetermined, on apple leaves. From DWIGHT STONE, Lansing, N. Y., May 27th. The same from T. G. YEOMANS & SONS, Walworth, N. Y. The same from JULIUS G. LINSLEY, Oswego, N. Y., June 14th.

Larvæ of *Oxyptilus periscelidactylus* (Fitch), among tips of grape-vine. From D. J. GARTH, Scarsdale, N. Y.

DIPTERA.

Larvæ of *Diplosis pyrivora* Riley, in pears, May 27th. From THEODORE A. COLE, Catskill, N. Y.

Exechia sp. (one of the *Mycetophilidæ*), attracted to light. From ABNER L. TRAIN, Albany, N. Y.

A Syrphid larva resembling *Helophilus latifrons*. From J. B. BRIGGS, Macedon, N. Y.

Hystricia abrupta Weid. (=*Tachina vivida* of Harris). From W. H. WARRALL, Wappingers Falls, N. Y.

The cow-horn fly, *Hæmatobia serrata* Rob. Desv. August 29th. From M. E. DRAKE, Demster, Oswego county, N. Y.

Pollenia rudis (Fabr.), as infesting a dwelling-house in April. From ANNA B. HILL, Catskill, N. Y.

Chloropisca prolifica Ost. Sack. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

COLEOPTERA.

Larva of *Dytiscus marginalis* (Linn.), June 1st. From W. C. HITCHCOCK, Tiashoke, N. Y.

Dytiscus fasciventris Say; September 14th. From W. DUDLEY DEWITT, Albany, N. Y.

Helophilus triangularis Say. From J. M. DOLPH, Port Jervis, N. Y.

Anatis 15-*punctata* (Oliv.), dark variety from *Myzus cerasi*, June 4th. From JOHN R. & A. MURDOCK, Plattsburgh, N. Y.

Epilachna borealis (Fabr.). From GEORGE T. LYMAN, Bellport, N. Y.

Byturus unicolor Say, feeding on raspberry leaves and buds, May 25th. From Mrs. J. M. COOPER, North Haven, Conn.

Larvæ (luminous) of *Photuris Pennsylvanica* (De Geer), October 2d. From HENRY C. LEE, Cornwall, N. Y.

A brilliantly luminous ? larva of *Phengodes* sp., July 21st. From Miss C. L. STILLMAN, Cornwall, N. Y.

Larvæ of *Telephorus bilineatus* Say, taken from the surface of snow, by Mr. Holdredge, of Center, Herkimer county, N. Y. From DANIEL BATCHELOR, Utica, N. Y.

Serica tristis LeConte, from leaves and blossoms of strawberry. From R. W. WETMORE, Clifton, New Brunswick.

Young larvæ of *Liggrus relictus* (Say). From W. S. LITTLE, Rochester, N. Y.

Larvæ and imago of *Lachnosterna fusca* (Fröhl.), taken from the ground December 14th — one larva with its fungus, *Cordiceps Ravenelii*. From D. B. YOUNG, Newport, N. Y.

Scarabæid cocoons, very large, taken from stems of palms from India. From Professor D. P. PENHALLOW, McGill University, Montreal, Canada.

Doryphora 10-*lineata* (Say), infested with *Cropoda Americana* Riley. From W. W. DE ANGELIS, Holland Patent, N. Y.

Gastroidea polygoni (Linn.). From BERTHOLD FERNOW, Albany, N. Y.

Larvæ of the cucumber beetle, *Diabrotica vittata* (Fabr.) in squash roots. From Professor C. H. PECK, Menands, N. Y.

Young larvæ of *Haltica chalybea* Illig. on grape. From A. M. MACY, South Livonia, N. Y.

Coptocycla auricbalcea (Fabr.). From C. B. WICKS, Albany, N. Y.

Bruchus obscletus Say, from beans imported from Jamaica. From JAMES FLETCHER, Entomologist, etc., Ottawa, Canada.

Bruchus obsoletus Say, infesting kidney beans and ovipositing March 23d. From L. W. DYER, Jefferson, N. Y.

Bruchus rufimanus Bohem., the European bean-weevil. From OLIVER E. JANSON, Stroud Green, London, Eng.

Tribolium ferrugineum (Fabr.) in rice chaff from South Carolina, numerous examples. Larvæ of *Tenebrio molitor* (Fabr.) from wheat flour. From F. E. WADHAMS, Albany, N. Y.

Nacerdes melanura (Linn.), from basement flooring in a dwelling-house. From Mrs. E. POINTER, Albany, N. Y.

Larvæ of the grape curculio, *Craponius inaequalis* (Say), in grapes, June 26th. From S. F. GETTYS, Sanford, Tenn.

Phlœotribus liminaris (Harris) — living imago in peach tree bark, May 7th; *Xyleborus dispar* (Fabr.), in peach tree, June 15th. From GEORGE C. SNOW, Penn Yan, N. Y.

HEMIPTERA.

Anasa tristis (De Geer), in pupa and imago, September 18th. From T. C. BARKER, Lowell, Mass.

Lygus invitus (Say), puncturing and scarring young pears in June. From J. F. ROSE, South Byron, N. Y.

Belostoma Americanum Leidy. From BERTHOLD FERNOW, Kingston, N. Y. The same, from FRANK F. GOODWIN, Albany, N. Y. The same, in four examples, taken at electric light, May 12th, from J. M. DOLPH, Port Jervis, N. Y.

Larvæ of *Clastoptera pini* Fitch, on terminal tips of pine, June 1st. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Larvæ of a spittle insect, *Clastoptera obtusa* (Say), June 22d, on linden: imago, June 25th. From D. J. GARTH, Scarsdale, N. Y.

Psylla pyricola Foerst., in the larva, pupa, and imago, June 1st. From P. W. KING, Athens, N. Y. The imago, from J. F. ROSE, South Byron, N. Y., and from Mrs. DORR, Glenmont, N. Y. The eggs, larvæ, and imago, from Professor C. H. PECK, Menands, N. Y.

Aphis prunι Koch, from plum trees, June 6th. From J. W. SMITH, Schoharie, N. Y.; also, from FRANK A. FAY, Bath, Steuben Co., N. Y.

Aphis sp., destructive to potatoes and cabbage. From ABRAM G. HOYT, Bradford, Pa.

? Chermes laricifolia Fitch, on leaves of larch. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Chionaspis furfurus (Fitch) on pear twigs. From P. W. KING, Athens, N. Y.

Lecanium pyri (Sch.) with young, on pear, April 16th. From A. C. TAYLOR, M. D., Scriba, N. Y.

ORTHOPTERA.

Gryllus luctuosus Serv., from Cape May, N. J. From W. B. MARSHALL, State Museum, Albany, N. Y.

The coral-winged locust, *Œdipoda phœnicoptera* Germ. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

Larvæ of *Mantis Carolina* Linn., on holly-twig. From Mrs. M. M. PATTEN, Albany, N. Y.

Ectobia Germanica Steph. From Dr. GEORGE LAWSON, Halifax Nova Scotia.

NEUROPTERA.

The Hellgrammite fly, *Corydalis cornuta* (Linn.). From C. L. SHEAR, Alcove, N. Y.

Larva of the comb-horned fish-fly, *Chauliodes pectinicornis* (Linn.). From W. C. HITCHCOCK, Buskirk's Bridge, N. Y.

MISCELLANEA.

Argyramœba simson (Fabr.). *Chlosops* sp. *Grapta interrogationis* (Fabr.). *Agrotis herilis* Grote. *Pyralis farinalis* Linn. *Coccinella sanguinea* Linn. *Phytonomus punctatus* (Fabr.). *Tenebrio molitor* Linn. *Podisus spinosus* (Dallas). *Phymata erosa* Her.-Sch. From Mrs. E. B. SMITH, Coeymans, N. Y.

Lepidopterous pupæ, undetermined, 4. *Camponotus*, many examples from a flight on August 27th. Larva of *Cimbex Americana* Leach. A Phryganid, six examples. From ERASTUS CORNING, Jr., of Albany N. Y.; taken at Murray Bay, Province of Quebec, Canada.

CRUSTACEA.

A blind freshwater shrimp, *Crangonyx mucronatus* Forbes, from a driven well. From W. B. CAMPBELL, Garrattsville, Oswego Co., N. Y.

(E)

CLASSIFIED LIST OF INSECTS NOTICED IN THIS REPORT.

Hymenoptera.

Thalessa lunator (*Fabr.*), the lunated long-sting.
Pemphredon concolor *Say*, a wood wasp.
Tremex columba (*Linn.*), the pigeon Tremex.
Rhyssa persuasoria (*Linn.*), an European long-sting.
Janus flaviventris *Fitch*, the currant-stem girdler.
Nematus Erichsonii *Hartig*, the larch saw-fly.

Lepidoptera.

Feniseca Tarquinius (*Fabr.*), the little orange butterfly.
Sannina exitiosa (*Say*), the peach-tree borer.
Sphinx quinquemaculata *Haworth*, the five-spotted Sphinx.
Eudryas grata (*Fabr.*), the beautiful wood-nymph.
Clisiocampa Americana *Harr.*, the apple-tree tent-caterpillar.
Agrotis ypsilon (*Rott.*), the black cut-worm.
Agrotis species, cut-worms.
Gortyna nitela *Guenée*, the stalk-borer.
Scoliopteryx libatrix (*Linn.*), the scallop-wing.
Synchlora glaucaria (*Guenée*), the raspberry Geometer.
Tmetocera ocellana (*Schiff.*), the eye-spotted bud-moth.
Phoxopteris nubeculana (*Clem.*), the apple-leaf sewer.
Coleophora malivorella *Riley*, the apple-tree case-bearer.
Bucculatrix Canadensisella *Chamb.*, the Canadian Bucculatrix.
Bucculatrix pomifoliella *Clem.*, the apple-leaf Bucculatrix.

Diptera.

Diplosis pyrivora *Riley*, the pear midge.
Exechia sp., a fungus gnat.
Hæmatobia serrata *R. Desv.*, the cow-horn fly.
Trypeta pomonella *Walsh*, the apple maggot.

Coleoptera.

Epilachna borealis (*Fabr.*), the northern lady-bird.
Elateridæ species, wire-worms.
Telephorus bilineatus (*Say*), the two-lined soldier-beetle.
Macrodactylus subspinosus (*Fabr.*), the rose-bug.
Lachnosterna fusca (*Fröhl.*), the white-grub.
Cyllene pictus (*Drury*), the hickory borer.
Glycobius speciosus (*Say*), the maple-tree borer.
Crioceris asparagi (*Linn.*), the asparagus beetle.
Doryphora decemlineata (*Say*), the Colorado potato beetle.
Tenebrio molitor (*Linn.*), the meal-worm.

Hemiptera.

Corimelæna pulicaria *Germ.*, the flea-like negro-bug.
Anasa tristis (*De Geer*), the squash-bug.
Lygus invitus (*Say*), the contrary plant-bug.
Clastoptera obtusa *Say*, the obtuse Clastoptera.
Clastoptera pini *Fitch*, the pine Clastoptera.
Typhlocyba vitis (*Harr.*), the grape-vine leaf-hopper.
Empoa rosæ (*Harr.*), the rose-leaf hopper.
Psylla pyricola *Forst.*, the pear-tree Psylla.
Siphonophora avenæ (*Fabr.*), the grain aphis.
Phorodon humuli (*Schrank*), the hop-vine aphis.
Aphis mali *Fabr.*, the apple-tree aphis.
Aphis cucumeris *Forbes*, the melon aphis.
Pemphigus tessellata (*Fitch*), the alder-blight aphis.
Lecanium sp., a grape-vine scale-insect.
Aspidiotus nerii *Bouché*, the white scale.
Pulvinaria innumerabilis (*Rathv.*), the maple-tree scale-insect.

Orthoptera.

Gryllus luctuosus *Serv.*, the doleful cricket.

Neuroptera.

Chauliodes pectinicornis (*Linn.*), the comb-horned fish-fly.
Chauliodes rastricornis *Ramb.*, the tooth-horned fish-fly.
Chauliodes serricornis *Say*, the saw-horned fish-fly.
Corydalis cornuta (*Linn.*), the horned Corydalis.

Arachnida.

Trombidium locustarum *Riley*, the locust mite.

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ERRATA.

Page 108, line 11, for Plate 2 read Plate 3.
Page 109, line 4 from bottom, for 172 read 173.
Page 120, line 16, for 1875 AND 1876 read 1875–1877.
Page 165, line 16, for Plate 2 read Plate 3.
Page 178, line 9, for *Vetchii* read *Veitchii*.
Page 237, line 21, for *Carolinenis* read *Carolinensis*.
Page 237, lines 21–22, for *Agelaeus* read *Agelaius*.
Page 286, line 5, for Bouché read (Bouché).
Page 293, line 10 from bottom, for Harris read (De Geer).
Page 313, line 11, for 285 read 286.

ERRATA IN SEVENTH REPORT.

Page 201, line 10, for PHYTOOMYZA read PHYTOMYZA.
Page 250, line 4 from bottom, for ventral surface read dorsal segment.
Page 279, line 17, for (Boheman) read Boheman.
Page 320, line 5, for G. F. Pierce read G. T. Pierce.
Page 357, line 1, for (C) read (B).
Page 381, line 1, for (D) read (C).
Page 384, line 16, for Harris read (De Geer).
Page 396, line 26, for Mytelaspis read Mytilaspis.
Page 400, line 25, for Tiersche read Tierische.

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