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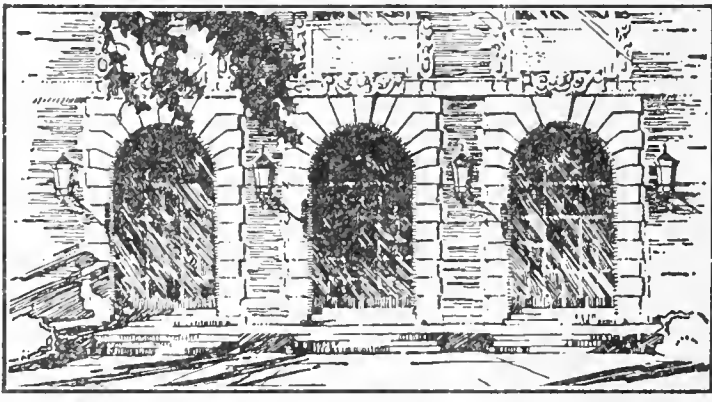
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Report of the State Court









SEVENTH REPORT

OF THE

STATE ENTOMOLOGIST

(WALSH, 1. LE BARON, 4. THOMAS, 2.)

ON THE

NOXIOUS AND BENEFICIAL INSECTS

OF THE

STATE OF ILLINOIS.

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SECOND ANNUAL REPORT,  
BY CYRUS THOMAS, PH. D.,  
STATE ENTOMOLOGIST.

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1878.

BIOLOGY

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## INTRODUCTION.

CARBONDALE, JACKSON CO., ILLINOIS, }  
December 29, 1877. }

To Hon. D. B. Gillham,  
President of the State Board of Agriculture.

DEAR SIR:—Sec. 2 of the act of the legislature of Illinois, entitled “An act in relation to the State Board of Agriculture,” and approved May 25th, 1877, makes it the duty of the State Entomologist to report annually instead of biennially, and that this report be made to the State Board of Agriculture instead of directly to the Governor of the State as, formerly. At least, such is my interpretation of said act so far as it relates to the State Entomologist, and this view is held by His Excellency, the Governor, as I infer from the fact that he has informed me, in answer to my letter of inquiry in reference to the subject, that my report should be made to the State Board of Agriculture.

In compliance, therefore, with said act I have the honor to present herewith my second report as State Entomologist, and first annual report to the State Board of Agriculture of the State of Illinois.

This will form the seventh in the series of reports by State Entomologists, viz: One by Mr. Walsh, four by Dr. Le Baron, and two by the present incumbent. The title I adopted for my last report is as follows: “*Sixth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois.*” This form, I think, should hereafter be retained, changing only the number; the reports will then be uniform in style. I numbered my former report “Sixth” in order to include the one made by Mr. Walsh, which had been omitted in the numbering adopted by Dr. Le Baron, which applied only to those made by himself.

I am happy to be able to state to you that during the past year, as was the case in 1876, the agriculturists of our state have generally been less troubled than usual by injurious insects, and as a general rule crops have been more than ordinarily abundant; and even where there are exceptions to this general statement but a comparatively small percentage of the loss has been occasioned by insects. In some parts of the State, particularly in the southern section, the Hessian fly made its appearance last season in limited numbers, and unless the farmers generally adopted the precautionary measures necessary to counteract them, which is very doubtful, we may expect, if the

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season is in the least favorable to them, that they will be more numerous next season (1878), and probably do considerable injury to wheat in the sections where they are most abundant.

Some of the farmers delayed sowing until late, in order to allow the flies of the summer brood to perish before the wheat should be up. As the latter part of autumn and the winter, so far, have been quite mild, in fact unusually so, it is not certain that this precaution will prove as beneficial as usual. It has been suggested by some of the farmers who have been watching them that many of the pupæ (the flax-seed state) have transformed to the perfect insects which have been killed, hence the warm winter has been unfavorable to them. There is something very reasonable in this suggestion, which I hope to investigate.

The Corn-Worm, or larva of *Heliothis armigera*, appeared in Southern Illinois in limited numbers last summer, but so far as I can learn did no very serious injury. The chrysalids appear to be quite numerous in the fields, and unless destroyed by excessive cold or by wet weather will probably do more injury in 1878 than in the past year.

The Stalk-Borer (*Gortyna nitela*) has been more than usually injurious in a few localities; and, as it is one of those species which work silently and out of view, it may have done more damage than it has received credit for.

The Oak Tortrix (*Argyrolepis quercifoliæ*), a small caterpillar which rolls up and injures the leaves of oak trees, has been quite abundant the past season, doing great damage to the oak forests in the northern and northwestern parts of the State.

So far as I have been able to ascertain, the canker worm has been less abundant the past season than for some years previous thereto. I am informed that in some large orchards, where quite numerous in 1875-6, it appeared in greatly diminished numbers in 1877. So far as this very injurious species is concerned, economic entomology has performed its mission, having furnished a thorough remedy, and there is no reason why orchards should longer be troubled by it, except the neglect of orchardists to apply the remedy. I wish I could say the same thing in reference to several other species which have so long baffled all attempts of science and ingenuity to find a specific against their attacks; such, for example, as the "Little Turk" or Plum Curculio, which still remains master of the situation, although every part of its history, from the egg to the perfect or imago state, has been carefully studied, and horticulturists have tried every mode of defense and attack which ingenuity has so far been able to devise. Still we do not give up the hope of finding some means of counteracting it and protecting that most excellent fruit—the Plum.

The general impression appears to be that the Oyster-shell Barklouse, which has so long infested the apple trees in various parts of the State, is at last on the decrease. If this be true—and it is certainly so in some sections—it is probably owing chiefly to two causes: the improved culture in the nursery and orchard, not only as to care and cultivation, but also in selecting the hardier varieties, which are best adapted to the climate, and, secondly, to the increase of the insect parasites which prey upon the species. I might also add the fact that our horticulturists are devoting much more time to the study of their insect enemies and insect friends than ever before, and the



knowledge thereby gained is turned to profit not only in fighting their enemies to greater advantage, but also in protecting their little friends. Even since I came into office instances have come under my observation where persons engaged in tree culture have waged an exterminating warfare against their very best insect friends, under the impression that they were fighting their enemies; yet these little friends at the very time they were so ruthlessly slaughtered were busy at work destroying bark-lice. The spread of entomological information is rapidly correcting such mistakes as this, and learning our farmers and horticulturists to distinguish their friends from their foes.

While the Oyster-shell Bark-louse appears to be on the wane, our other most common species known as Harris's Bark-louse, and distinguished by its milk-white color and dark red eggs, appears to be on the increase and spreading to other trees besides those to which it has heretofore been confined. The Maple Bark-louse (*Lecanium acericola*) appears to be rapidly increasing in the northern and central portions of the State.

That terrible scourge, the Chinch-bug, which in 1874 inflicted so much loss upon the farmers of Illinois, has not since appeared in our State to any considerable extent. I have received notice of slight damage done during the past season in but one or two limited localities. In some parts of our neighboring State—Iowa—it did considerable injury to wheat and also, I presume, to corn. The losses occasioned by this single species are scarcely appreciated by the farmers of this State. As will be seen from estimates given in this report, and made from two entirely different stand-points, and wholly different data, the loss on corn alone in 1874 amounted to about 75,000,000 bushels, or, counting it at 30 cents per bushel, to 22,500,000 dollars. Making all proper allowances for errors there still remains a loss by insects that is absolutely startling. A loss which should arouse our farmers to the importance of devising some means of preventing this heavy drain upon their productive energies. That a very large percentage of it may be prevented by proper precaution and vigorous efforts I am thoroughly convinced. I have repeatedly pointed out the means by which this may be done, but in order to make the remedy effective there must be a combined effort. Chinch-bugs never appear in such vast numbers as they did in 1874, except where two favorable years for their increase occur in succession. Therefore, during the first of these years a little observation will suffice to reveal the danger to be apprehended in the second; the intervening winter, as hereafter shown, is the time to apply the remedy.

As I predicted in the spring of 1876, no serious injury was done by them that year, and a similar prediction proved true in reference to 1877. If 1878 should prove to be a dry season more danger is to be apprehended, but still not to the extent experienced in 1874. The probabilities are that it will not prove injurious for a year or two.

The strawberries and other small fruits have suffered slightly in some localities from the attacks of various insects, but no general destruction of any one of these fruits occurred during the past year.

The Corn Plant-louse occurred in considerable numbers at a few points, in a few instances causing sufficient injury to attract the attention of farmers; but I cannot learn that it was very generally distributed. The Wheat Plant-louse is increasing in Southern Illinois.

## ENTOMOLOGICAL WORK OF THE YEAR.

The long continuation of the incursions of the destructive Rocky Mountain Locusts into the border States of the West having caused great alarm and uneasiness in these States, an investigation into the history and habits of these insects was determined upon in order to see if any means of counteracting them could be devised. I felt satisfied from what was already known in reference to them that there was no real danger of their penetrating into Illinois; but, as many of our citizens, especially in the northwestern part of the State, notwithstanding the assurances I had given, still apprehended danger, I concluded to assist in the investigation, with special reference, so far as our State is concerned, as to the probability of their incursions being extended to the country east of the Mississippi. The result of the past year has triumphantly vindicated my prediction, and has proved the correctness of the theory first advanced by Mr. Walsh, our first State Entomologist, that the middle of Iowa was and would continue to be the eastern limit of their range. The eastern limit of their range as indicated by him as early as 1866, and subsequently more definitely mapped by Prof. Riley, proved to be the limit of their movements eastward in 1877. This limit, as definitely ascertained by the United States Entomological Commission, is about as follows: Commencing at the south end of Lake Winnipeg, in British America, the line runs southeast to the Lake of the Woods, thence south by way of St. Paul, Minnesota, to Pierce county, Wisconsin; thence almost directly south to Poweshiek county, Iowa; thence southwest to Worth county, Missouri, through which State it passes in an almost south direction to the extreme northwest corner of Arkansas; thence south to Houston in Texas. As this line has not been crossed in the past twenty years, it is reasonable to conclude that so long as the climatic conditions of the northwest remain the same as at present it will form the eastern limit of their movements.\*

This investigation necessarily required me to be absent from the State occasionally during the Summer; therefore, in order that observations in reference to insects found in our own State might not be neglected, in addition to Miss Nettie Middleton, who has from the first been my office assistant, I employed Prof. G. H. French, of Irvington, as general assistant, and Miss Emma A. Smith, of Peoria, as special assistant for the northwest part of the State. The work done by the latter two will be shown by their respective papers contained in this report, and by what is hereafter stated.

I think I can say truly and without undue boasting, that more work has been done during the year which has just closed, in reference to Economic Entomology in Illinois, than was ever done before in a single year.

As more useful work can be done in Natural History by directing attention to specific subjects than in any other way, we adopted this method during the past season.

I continued my investigations of the Plant-lice (*Aphidæ*), having published a preliminary paper on them in the Transactions of the

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\* I propose, during 1878, to investigate the climatic condition of the Northwest with reference to this subject, if I can find time.

Illinois Horticultural Society of 1876. Many new species were found and have been described and much important matter obtained, but the work in this line being still incomplete from want of opportunity to study certain important species, and finding that the material on hand can not well be published in one report, this will be held over for my next report.

Another important object kept constantly in view during the past year has been the investigation of the insects injurious to corn, in fact this has been the chief field work of the season; and although the number of new facts ascertained has not been as great as I had hoped, yet much useful information has been obtained, and much corroborative testimony in reference to what entomologists have heretofore published has been collected. A considerable portion of the report is therefore devoted to a description of the habits, history and characteristics of the species which injure this useful cereal, and to the suggestion of such remedies as are most likely to prove beneficial. In connection with this investigation Prof. French has made a special study of the various Cut-worms which often prove so injurious both in the field and garden; his paper on these insects is included chiefly in that part of the report relating to corn insects. As relating to the same subject, Miss Smith has made a somewhat special study of the Stalk-Borer (*Gortyna nitela*), which likewise proves injurious both to field and garden crops. She has also made a special study of the Maple Bark-louse and Oak Tortrix. Her papers on these species will also appear in the present report.

The "Manual of Economic Entomology," commenced in my former report, has been continued in this; the portion given here relating wholly to the *Lepidoptera* or Butterflies and Moths, and has been prepared chiefly by Prof. French.

I have devoted considerable attention to the history of, and statistics in reference to, the Chinch-bug. What I have to present in reference to this species will be found in that part of the report relating to corn insects.

Miss Middleton's work, in part at least, will be apparent to those who see the insects already placed in the museum of the State Agricultural Society at the capital. Nearly all of these specimens, as well as the much larger number not yet arranged, were prepared and spread by her. She has also assisted me in my microscopic observations of the Aphides, and has discovered and described several new species.

A considerable time during the fall and winter has been devoted to determining species and arranging the collection for the Society's museum, in which work I have been assisted by Prof. French and Miss Middleton. Sixty boxes have been filled and are now arranged in the places prepared for them. These contain 1771 specimens belonging to 368 species, all of which (excepting about half-a-dozen species) are natives of Illinois. They have been arranged with reference to the kinds of plants they injure and their economic importance. It is the intention to make the wall display for popular use, showing our injurious species and also the species that are beneficial in destroying those that are injurious. We have endeavored to carry out this intention so far as possible; and have therefore given the common names of the insects and the names of the plants injured, etc. In ad-

dition to the wall display there is to be a cabinet in which the specimens will be arranged systematically for the purpose of aiding in determining species.

The few boxes of Mr. Walsh's collection saved from the great fire have fallen into my hands as State Entomologist, as they belong to the State. I have had, necessarily, to use some of these in arranging the collection for the museum, but in all cases the name given by Mr. Walsh has been retained, and each specimen so used has been marked with "Walsh," or a "W." This plan will be rigidly carried out in the further arrangement of the collection, even to the original short pins which he was so much in favor of; not a name will be changed even where it may be considered erroneous (but Mr. Walsh made very few such mistakes), or where it may have become obsolete; new labels will be prepared, but the name will in all cases be copied exactly as found on his original label, which will be carefully preserved, attached to the specimen to which Mr. Walsh attached it.

In addition to the work mentioned, you will see by reference to the transactions of the Illinois Horticultural Society for 1876, that I furnished the material for eighty-five of its pages, consisting of an account of our Plant-lice, and a paper on the value of birds as insect destroyers.

In this connection I may as well mention the fact that I laid before the Horticultural Society of Northern Illinois, during their session at Franklin Grove, in the latter part of December, 1876, the draft of a bill for the better protection of our insect-eating birds, in order to receive the Society's approval of it before presenting it to the Legislature. The following copy from the proceedings of that meeting will show their action in reference to it, and also the contents of the bill:

"Prof. Thomas also forwarded the following text for a bill, which was also read; and this, together with the essay, was approved by a vote of the Society, and the Secretary instructed to forward the bill to some member or members of the General Assembly, with the request of the Society that it be enacted into a law."

A BILL for an Act to amend chapter 61 of the Revised Statutes of 1874, entitled "Game."

Be it enacted by the People of the State of Illinois, represented in the General Assembly, That chapter sixty-one of the Revised Statutes of 1874, entitled "Game" be amended by the addition of the following section:

Section 16. The County Court, in counties not adopting township organization, and the Board of Supervisors in counties adopting township organization, be and the same are hereby authorized, whenever such Court or Board may deem it expedient to do so, to extend the time during which it shall be unlawful to destroy birds, as set forth in said statute. And the provisions of said statutes as to penalties, and in all other respects, so far as applicable, shall apply as fully and completely to any such destruction of birds during such extended time as they now do to such destruction during the time or times as limited in said first section of said statute."

"Accompanying the text for a bill was a request from Prof. Thomas that the Society endorse the bill by resolution, if they agree to it, and forward it with such endorsement to some member or members of the General Assembly."

This letter was also read by the Secretary.

"Mr. Galusha moved that a consideration of the proposition of Prof. Thomas be made the special order of business for to-morrow at nine o'clock, which was agreed to."

The transactions for the next day, which was the second day of the meeting, show the following action:



"The special order was taken up, and the Secretary read the letter and text of the bill from Prof. Thomas respecting the destruction of birds.

The Secretary was requested to draw up a resolution indorsing Prof. Thomas' plan, which he did as follows :

' Resolved, That this Society heartily indorse the proposition of Prof. Cyrus Thomas, our State Entomologist, and urge our Senators and Representatives in the State Legislature to enact the bill presented into a law.'

The resolution was then unanimously adopted, and the Secretary instructed to send a copy of the bill and resolution to such members of the General Assembly as he deemed proper."

This was presented to various members of the Legislature and brought before that body, but because of the opinion that it fell under that clause of the constitution prohibiting local legislation, it failed to become a law. How a law which is general and as applicable in one portion of the State as another, can be considered local I must confess I fail to see ; that it might only operate in one or two sections is true, but it does not follow that it is a local law on this account.

I very much regret its failure, because by a law of this kind the important and much discussed question : "The Value of Birds as Insect Destroyers," might be tested practically on a scale sufficient to determine the point satisfactorily to every one. I trust some law of the kind may yet be passed that we may be enabled by actual test to determine the real value of birds as aids in keeping in check injurious insects.

As bearing upon the question of the value of birds as insect destroyers, I present here a summary of investigations made by Prof. Samuel Aughey, of Lincoln, Nebraska, and furnished the U. S. Entomological Commission. These investigations were commenced in 1865 and continued up to 1877, and relate to the food of birds and particularly to their locust-eating habits. Usually the stomachs of not less than four specimens of each species were examined, and in some instances of twenty or more. No attempt was made to distinguish between the injurious and beneficial insects, except to determine the number of locusts (grasshoppers). The list gives first the common name of the bird, then the scientific name, the number of specimens of the species examined, the average number of locusts, and the average number of other insects found in the stomach :

Robin—*Turdus migratorius*.

No. specimens, 6. Average No. Locusts, 46. Other insects, 14.

Wood Thrush—*Turdus mustelinus*.

No. specimens, 3. Locusts, 23. Other insects, 4.

Hermit Thrush—*Turdus Pallasii*.

No. specimens, 1. Locusts, 19. Other insects, 16.

Olive-backed Thrush—*Turdus Swainsonii*.

No. specimens, 2. Locusts, 27. Other insects, 8.

Wilson's Thrush—*Turdus fuscescens*.

No. specimens, 2. Locusts, 37. Other insects, 29.

Cat Bird—*Mimus Carolinensis*.

No. specimens, 5. Locusts, 32. Other insects, 9.

Eastern Blue-Bird—*Sialia sialis*.

No. specimens, 3. Locusts, 22. Other insects, 9.

- Ruby-crowned Kinglet—*Regulus calendula*.  
No. specimens, 1. Locusts, 29.
- Tufted Titmouse—*Lophophanes bicolor*.  
No. specimens, 4. Locusts, 66. Other insects, 4.
- Long-tailed Chickadee—*Parus atricapillus*.  
No. specimens, 9. Locusts, 54. Other insects, 6.
- Slender-billed Nuthatch—*Sitta carolinensis*.  
No. specimens, 4. Locusts, 23. Other insects, 4.
- Titlark, or Wagtail—*Anthus ludovicianus*.  
No. specimens, 3. Locusts, 49. Other insects, 5.
- Golden Warbler—*Dendroica aestiva*.  
No. specimens, 7. Locusts, 11. Other insects, 25.
- Black-throated Green Warbler—*Dendroica virens*.  
No. specimens, 5. Locusts, 24. Other insects, 21.
- Black Fall Warbler—*Dendroica striata*.  
No. specimens, 4. Locusts, 32. Other insects, 7.
- Prairie Warbler—*Dendroica discolor*.  
No. specimens, 8. Locusts, 15. Other insects, 17.
- Golden-crowned Thrush—*Seiurus aurocapillus*.  
No. specimens, 3. Locusts, 37. Other insects, 15. (Large number Locust eggs.)
- Red Start—*Setophaga ruticella*.  
No. specimens, 7. Locusts, 23. Other insects, 16.
- American Barn Swallow—*Hirundo horreorum*.  
No. specimens, 7. Locusts, 20. Other insects, 19.
- Cliff Swallow—*Petrochelidon lunifrons*.  
No. specimens, 8. Locusts, 31. Other insects, 14.
- Bank Swallow—*Cotyle riparia*.  
No. specimens, 5. Locusts, 21. Other insects, 22.
- Purple Martin—*Progne purpurea*.  
No. specimens, 10. Locusts, 26. Other insects, 17.
- Brotherly-love Vireo—*Vireo philadelphicus*.  
No. specimens, 4. Locusts, 9. Other insects, 13.
- White-rump Shrike—*Collurio ludoviciana*.  
No. specimens, 3. Locusts, 32. Portions of birds.
- Pine Grosbeak—*Pinicola enucleator*.  
No. specimens, 5. Half locust eggs. Half seeds.
- Red Tail Linnet—*Aegiothus linaria*.  
No. specimens, 4. One-fourth locust eggs. Three-fourths seeds.
- Snow Bunting—*Plectrophanes nivalis*.  
No. specimens, 6. One-fourth locust eggs. Three-fourths seeds.
- Chestnut-collared Bunting—*Plectrophanes ornatus*.  
No. specimens, 6. Locusts, 14. Seeds.
- Bay-winged Bunting—*Poæcetes gramineus*.  
No. specimens, 5. Locusts, 13. Seeds.
- White-throated Sparrow—*Zonotrichia albicollis*.  
No. specimens, 5. Locusts and other insects average, 35. Seeds.
- Cardinal Grosbeak—*Cardinalis Virginianus*.  
No. specimens, 4. Locusts and other insects, 22.
- Bobolink—*Dolichonyx oryzivorus*.  
No. specimens, 6. Locusts and other insects, 16. Seeds.
- Yellow-headed Blackbird—*Xanthocephalus icterocephalus*.  
No. specimens, 21. Locusts, 43. Other insects, 19.



- Meadow Lark.—*Sturnella magna*.  
No. specimens, 9. Locusts and other insects, 29. (Locust eggs and grain.)
- King-bird—*Tyrannus Carolinensis*.  
No. specimens, 8. Locusts and other insects, 60.
- Pewitt Fly-catcher—*Sazarius fuscus*.  
No. specimens, 9. Locusts, 36. Other insects, 20.
- Least Fly-catcher—*Empidonax minimus*.  
No. specimens, 4. Locusts, 20. Other insects, 29.
- Night Hawk—*Chardeiles Virginianus*.  
No. specimens, 7. Locusts, 51. Other insects, 11.
- Yellow-billed Cuckoo—*Coccyzus Americanus*.  
No. specimens, 10. Locusts, 40. Other insects, 15.
- Hairy Woodpecker—*Picus villosus*.  
No. specimens, 6. Locusts, 39. Other insects, 32.
- Downy Woodpecker—*Picus pubescens*.  
No. specimens, 4. Locusts, 41. Other insects, 22.
- Yellow-bellied Woodpecker—*Sphyrapicus varius*.  
No. specimens, 5. Locusts, 26. Other insects, 23. Seeds.
- Red-headed Woodpecker—*Melanerpes erythrocephalus*.  
No. specimens, 6. Locusts, 37. Other insects, 43. Seeds.
- Golden-winged Woodpecker—*Colaptes auratus*.  
No. specimens, 8. Locusts, 33. Other insects, 25. Few seeds.
- American Barn-Owl—*Strix flammea*, var. *Americana*.  
No. specimens, 1. Locusts, 39. Insects, 22. Pt. mouse.  
" " 2. Insects, 47. Pt. mouse.
- Red or Mottled Owl—*Scops Asio*.  
No. specimens, 8. Locusts, 34. Insects, 31. Birds and mice.
- Burrowing Owl—*Speotyto cunicularia*.  
No. specimens, 9. Locusts, 51. Insects, 24.
- Marsh Hawk—*Circus cyaneus*.  
No. specimens, 6. Locusts, 52. Insects, 55.
- Swallow-tailed Kite—*Nauclerus parficatus*.  
No. specimens, 3. Locusts, 64. Insects, 26.
- Sparrow-Hawk—*Falco sparverus*.  
No. specimens, 10. Locusts and other insects, 36. Mice, gophers, etc.
- Swainson's Buzzard—*Buteo Swainsonii*.  
No. specimens, 4. Locusts and other insects, 63. Mice, gophers, etc.
- Wild Pigeon—*Ectopetas migratoria*.  
No. specimens, 6. Locusts and other insects, 11. Much grain.
- Common Dove—*Tenaedura Carolinensis*.  
No. specimens, 6. Locusts and other insects, 5. Much grain.
- Common Wild Turkey—*Meleagris gallapavo*.  
No. specimens, 6. Locusts, 43. Other insects, 18. Seeds and grain.
- Sage Cock—*Centrocercus urophasianus*.  
No. specimens, 4. Locusts, 47. Other insects, 3. Sage leaves.
- Southern Sharp-tailed Grouse—*Pediocetes phasianellus*.  
No. specimens, 10. Locusts and other insects, 26. Birds and seeds.

- Prairie Hen, *Pinnated* Grouse—*Cupidonia cupido*.  
No. specimens, 20. Locusts and other insects, 59. (Eighth-tenths locusts.)
- Quail—*Ortyx Virginianus*.  
No. specimens, 21. Locusts and other insects, 40. Seeds.
- Killdeer Plover—*Ægialitis vocifera*.  
No. specimens, 9. Locusts and other insects, 49. Few grains.
- King Plover—*Ægialitis semipalmata*.  
No. specimens, 11. Locust and other insects, 59.
- Piping Plover—*Ægialitis melodia*.  
No. specimens, 4. Locusts and other insects, 58.
- Mountain Plover—*Endromias montanus*.  
No. specimens, 16. Locusts and other insects, 57.
- Wilson's Phalarope—*Steganopus Wilsonii*.  
No. specimens, 8. Insects, 58.
- American Snipe—*Gallinago Wilsonii*.  
No. specimens, 11. Locusts and other insects, 62.
- Red-breasted Snipe—*Macrorhamphus griseus*.  
No. specimens, 6. Few locusts, mostly insects, 59.
- Least Sandpiper—*Tringa minutilla*.  
No. specimens, 8. Locusts and other insects, 45.
- Baird's Sandpiper—*Tringa Bairdii*.  
No. specimens, 5. Locusts and other insects, 44.
- Great Marble Godwit—*Limosa fedoa*.  
No. specimens, 6. Locusts and other insects, 43.
- Great Telltale—*Totanus melanoleucus*.  
No. specimens, 6. Locusts and other insects, 49.
- Lesser Telltale—*Totanus flavipes*.  
No. specimens, 5. Locusts and other insects, 42.
- Spotted Sandpiper—*Tringoides macularius*.  
No. specimens 6. Locusts and other insects, 41.
- Upland Plover—*Actiturus Bartramius*.  
No. specimens, 22. Locusts and other insects, 54. (Two-thirds of them locusts.)
- Long-billed Curlew—*Numenius longirostris*.  
No. specimens, 10. Locusts and other insects, 64. Some seeds.
- Sand-hill Crane—*Grus Canadensis*.  
No. specimens, 4. Locusts and other insects, 101. Some seeds. (one-half locusts.)
- Fresh-water Marsh Hen—*Rallus elegans*.  
No. specimens, 7. Locusts and other insects, 64. Some seeds.
- Mud Hen—*Fulica Americana*.  
No. specimens, 9. Locusts and other insects, 54. Mollusks.
- White Brant—*Ansiner hyperboreus*.  
No. specimens, 8. Locusts and other insects, 62. Shells and grass.
- Wild Goose—*Branta Canadensis*.  
No. specimens, 9. Locusts and other insects, 73. Mollusks and grass.
- Mallard—*Anas Boschus*.  
No. specimens, 10. Locusts and other insects, 48. Mollusks.
- Pintail—*Dafila acuta*.  
No. specimens, 7. Locusts and other insects, 46. Mollusks.

winged Teal— <i>Querquedula carolinensis</i> .		
No. specimens, 9.	Locusts and other insects, 42.	Mollusks.
(One-sixth locusts.)		
Summer Duck— <i>Aix sponsa</i> .		
No. specimens, 9.	Locusts and other insects 39.	Seeds and
Mollusks. (One-third locusts.)		
White Pelican— <i>Pelecanus trachyrhynchus</i> .		
No. specimens, 5.	Locusts and other insects, 41.	Cray-fish,
fish and frogs. (One-half Locusts.)		
Ring-billed Gull— <i>Larus Delawareensis</i> .		
No. specimens, 6.	Locusts and other insects, 25.	Frogs, Cray-
fish, Fish. (One-third Locusts.)		
Franklin's Rosy Gull— <i>Larus Franklinii</i> .		
No. specimens, 10.	Locusts and other insects, 32.	Cray-fish,
Fish and Frogs. (Two-thirds Locusts.)		
Least Tern— <i>Sterna superciliaris</i> .		
No. specimens, 8.	Locusts and other insects, 35.	Cray-fish,
Fish and Frogs. (One-half Locusts.)		
Black Tern— <i>Hydrochelidon larifarinis</i> .		
No. specimens, 6.	Locusts and other insects, 54.	Snails, etc.
(Two-thirds Locusts.)		
Total number of specimens	-----	622.
Number of species	-----	90.

I have made it a point to communicate freely during the season, and whenever occasion required, to our agricultural papers, in reference to such insects as have come prominently into notice during the year by their abundance or injuries. I have also endeavored to answer calls made upon me by agricultural, horticultural and other similar associations for lectures on the subject of Entomology. In this way many who are deeply interested in this matter are brought to an examination of the subject who could not otherwise be induced to pay attention to such diminutive objects as insects.

As illustrating the immense loss sometimes occasioned in a single year by these diminutive pests I here present some statistics in reference to their injuries in 1874, which were originally prepared for a lecture to the Illinois State Horticultural Society, which are in a form to be easily understood and which are calculated to startle our farmers by their magnitude.

The loss on a single crop—corn—has been selected, as it sustained the greatest injury and is the chief production of the northwestern states. As the year 1874 was very dry, and crops suffered very materially on this account, I have endeavored to eliminate this factor by selecting adjoining states,—which, though suffering from drouth, were not materially affected by chinch-bugs or grasshoppers,—as a means of comparison. The crop estimates are from the reports of the U. S. Agricultural Department for the years mentioned.

## COMPARISON OF THE CORN CROPS OF THE NORTHWESTERN STATES FOR 1874 AND 1875.

	1874.	1875.	Loss.	Loss per cent.
Illinois .....	113,579,000	280,000,000	146,421,000	.52
Indiana.....	74,624,000	95,000,000	20,376,000	.21
Kentucky. ....	48,514,000	60,200,000	11,686,000	.19
Missouri.....	46,049,000	128,000,000	81,951,000	.64
Nebraska.....	3,500,000	28,000,000	24,500,000	.87
Kansas.....	16,065,000	76,700,000	60,635,000	.80
Iowa.....	115,720,000	160,000,500	44,280,000	.28

As Kentucky and Indiana suffered nearly or quite to the same extent by drouth as the other States mentioned, but were not troubled to an unusual extent by insects, we may take their loss as fairly representing the per cent. of loss by drouth; these give an average of twenty per cent. Deducting this from the loss per cent. in the other States, we have the following as the actual loss occasioned by insects:

Illinois.....	32 per cent—or,	89,600,000 bushels.
Missouri.....	44 “ “	56,320,000 “
Nebraska.....	67 “ “	18,760,000 “
Kansas.....	60 “ “	46,020,000 “
Iowa.....	8 “ “	12,800,000 “
Total loss in these States by insects.....		223,500,000 “

Which at 30 cents per bushel amounts to \$67,050,000 as the loss on a single corn crop in these States.

As will be seen elsewhere in this report the per cent. of loss on corn in Illinois in 1874, as ascertained by this method, corresponds almost exactly with another estimate made on a wholly different basis.

In arranging the cabinets of specimens, the catalogue of Mr. Crotch has been used for the *Coleoptera*, or Beetles, the works of Mr. Edwards for the butterflies, and those of Mr. Grote for the *Noctuidae*.

On behalf of myself and assistants I take pleasure in acknowledging our indebtedness to the following persons for aid received from them in the way of specimens, information, etc.: Prof. Forbes, Prof. Riley, Mr. J. Duncan Putnam, and to the various officers and members of the State Agricultural and Horticultural Societies, the editors of the *Prairie Farmer*, and agricultural editor of the *Inter Ocean*, and various other persons.

I am also under obligations to Mr. Fisher, Secretary of the State Board of Agriculture, for the use of books and other favors, to the Secretaries of the State Horticultural Societies of Illinois, Kansas and Indiana, for the proceedings of their respective societies, and to the various railroads of our state for passes.

As heretofore, I have everywhere found those interested in agriculture, horticulture, education and science, ready and willing to co-operate heartily in this important work. In fact there is a rapidly increasing desire in our State to obtain information in reference to the science of entomology.

I cannot close without expressing my thanks to His Excellency the Governor, the other State officers and yourself, for the many favors received from them and you.

I trust this report may prove acceptable to the board of which you are President, and useful to the farmers and horticulturists of Illinois, for whose benefit it has been prepared.

I remain yours, very respectfully,  
CYRUS THOMAS, *State Entomologist*.

# NOTES ON CORN INSECTS,

OR INSECTS INJURIOUS TO INDIAN CORN.

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In order to answer fully the question, "How can farmers best protect the corn crop from the ravages of injurious insects?" it would be necessary to introduce much more than what belongs strictly to Entomology. The relation of this to other crops cultivated in the immediate vicinity at the same time, the rotation of crops, the massing of this crop on continuous areas, the modes of cultivation, methods of harvesting, etc., etc., would all have to receive consideration in a full discussion of the insect question. That it will be impossible to properly discuss these several points in a single paper, even were I competent to do so, is apparent. I can therefore only allude incidentally to these collateral questions, confining myself chiefly to the direct methods of combating the insect enemies of the corn crop. But while I shall endeavor thus to limit the scope of this paper, I will not feel myself restrained from alluding to some general facts, which, I think, have a very important bearing upon the relation of insects to farm products.

First of all, I desire to call attention to the importance of this subject, for I am well satisfied that not only are our farmers and citizens generally unaware of its great importance, but even the most enlightened and progressive of our agriculturists do not fully appreciate this matter. If I assert that a little insect, less than a grain of wheat, has cost the State more in a single season than the hog cholera ever did in two years, the reader, if a farmer and aware of the vast havoc this terrible disease has recently made among the swine, would be strongly disposed to doubt the assertion. Yet I emphatically affirm that such is the fact; and I might even go further and assert, without exceeding the truth, that the loss in corn alone from this tiny insect has, in some seasons, far exceeded our greatest loss in any year by hog cholera. And now, as I desire to bring this matter directly home to our farmers in a plain and practical manner I will submit some statistics, which, though based to a certain extent upon estimates, are by no means mere guesses.

Soon after entering upon the duties of my office I addressed circulars to most of the counties in the State in reference to the injury caused by the chinch-bug in 1874, when, as all are aware, it was so destructive to crops in our State. Although the responses were not as general as I desired, yet a sufficient number was received to form a



basis for, at least, an approximately correct average. From these I select the following as illustrations, not all the worst cases, as will be seen by inspecting the list, but taken at random, and including those reporting from "no loss" up to a loss of nine-tenths the crop. The circulars were generally addressed to County Superintendents, and by them were in some cases submitted to the best posted farmers of the county.

I give first the substance of the answers in reference to the amount of damage done:

Cumberland County—The writer says the damage was very great; of his own crop three-fourths were destroyed.

Cass County—No damage done.

Edgar County—Damage to all crops about one-eighth.

Edwards County—Crops damaged (but amount not stated.)

Franklin County—Fully one-half the crops destroyed.

Effingham County—Two-thirds the corn crop destroyed.

Hardin County—Damage considerable (amount not stated.)

Marion County—Nine-tenths of the corn destroyed.

McDonough County—One-third the corn crop destroyed.

Menard County—Crops damaged (amount not stated.)

Piatt County—One-twentieth of all crops destroyed, corn less injured than other crops.

Schuyler County—Damage heavy, on all crops amount estimated at \$150,000.

St. Clair County—Damage fully 60 per cent.

Washington County—Loss on all crops one-fourth.

Now let us take these statements, and by comparing them with the estimated average crop of corn as given by the Secretary of our State Agricultural Society in his circular of August 10th, 1876, see the amount of the loss, and from this ascertain the loss throughout the State:

Counties.	Loss per cent.	Average corn crop in bu's.	Loss in bushels.
Cumberland.....	$\frac{3}{4}$	1,413,720	1,060,290
Cass.....	0	3,133,284	
Edgar.....	$\frac{1}{8}$	3,876,110	484,574
Edwards, (estimated).....	$\frac{1}{4}$	529,450	132,382
Effingham.....	$\frac{2}{3}$	2,386,600	1,591,066
Franklin.....	$\frac{1}{2}$	1,729,504	864,752
Hardin, (estimated).....	$\frac{1}{4}$	390,885	97,721
McDonough.....	$\frac{1}{3}$	6,640,370	2,213,456
Marion.....	9-10	1,996,890	1,797,200
Menard, (estimated).....	$\frac{1}{4}$	3,266,720	816,680
Piatt.....	1-20	4,692,400	234,620
St. Clair.....	6-10	3,788,882	2,273,328
Schuyler.....	1-10	4,089,830	408,983
Washington.....	$\frac{2}{3}$	913,440	608,960
Totals.....		38,848,085	12,584,012

From this we see that the loss on 38,848,085 bushels,—the average crop in the counties named,—was 12,584,012 bushels or 32 per cent.

If we simply add the per cent. without reference to the amounts and divide by the number of counties named, we have a loss of something over 38 per cent.; but the other is the correct method. If we



take the average crop of the entire State as estimated by the Secretary—339,608,973 bushels—we find that a loss of 32 per cent. amounts to the enormous sum of 108,674,871 bushels, which at 30 cents per bushel gives \$32,602,461, a sum sufficient, it would seem, to startle every farmer in the State. But since it is not likely that we will ever have a season in which a full crop will be realized in all parts of the State, and as the acreage was less in 1874 than now, in order to arrive at a correct estimate of the loss that year we should take as a basis the actual acreage then in corn and an average actual yield throughout the State. The acreage of corn as given in the Auditor's report was 7,797,850, at 30 bushels to the acre (which is 5 less than the Secretary's estimate,) this gives 233,935,500 bushels as the yield the farmers had a right, under ordinary circumstances, to have expected for that year. Thirty-two per cent. of this is 74,859,360 bushels, which at 30 cents per bushel amounts to 22,457,800 dollars,—the loss on the corn crop alone in Illinois in 1874 by the Chinch-bug.

In order to test the result thus obtained we have fortunately another method of calculation depending on an entirely different basis. If we take the amount of corn produced in the State in 1874, which was the year of drouth and chinch-bugs,—and 1875—which was a good crop year, and ascertain the difference, this will show the loss occasioned by all causes. If we can find any means of eliminating the per cent of loss occasioned by drouth, we will then be able to give a somewhat close estimate of the loss occasioned by the chinch-bug. By reference to the annual reports of the National Department of Agriculture for 1874 and 1875, the corn yield for these years will be found as follows:

Year	No. of Acres.	Bushels corn produced	Average yield per acre
1875.....	8,163,265	280,000,000	34.3
1874.....	7,421,055	133,579,000	18.
Difference.....		146,421,000	16.3

Without taking the difference in acreage into consideration, the loss per cent, taking the crop of 1875 as the basis, would be 53. But this method fails to eliminate the increased production of 1875 occasioned by the increased acreage. Let us therefore take the number of acres planted in 1874,—7,421,055,—and multiply it by 16.3 the difference between the yield per acre in 1874 and 1875. This gives a total loss of 120,963,196 bushels in 1874; but this includes the loss from drouth as well as the loss occasioned by the chinch-bugs.

It is fair to presume that the corn crop suffered about as much from dry weather in Indiana and Kentucky in 1874 as in Illinois. The loss on this crop in these states may therefore be taken as a basis for an estimate of the loss from the same cause in Illinois. I select these states because, although suffering from drouth, they were not seriously troubled by insects, yet doubtless suffering to a certain extent from them.

The corn crops for the years 1874 and 1875 as estimated by the statistician of the Agricultural Department were as follows:

	1875	1874	Loss.	Loss per cent.
Kentucky .....	60,200,000	48,514,060	11,686,000	.19
Indiana .....	95,000,000	71,624,000	20,376,000	.21

From this we see that the average per cent. of loss was 20. The estimated difference of the corn crops of Illinois in 1874 and 1875 by the same authority, is 146,421,000 bushels or 52 per cent.

Subtracting 20 per cent. for loss by drouth we have remaining 32 per cent., exactly the same percentage obtained by the former method. But in this estimate the difference in acreage is not taken into consideration which will lower this result about 5 per cent. But these two entirely different methods of arriving at the loss are sufficiently near to each other to show that we are something near the correct amount. They indicate the loss on the corn crop of Illinois in 1874, at 30 cents per bushel, as about \$20,000,000.

Twenty millions of dollars is a very large sum to draw from the pockets of our farmers without any return, when they have undergone the labor and sweat of a summer to obtain it; yet this amount was actually taken from them in a single season by the damage done by the chinch-bug to the corn crop alone. A sum exceeding four times the State tax of 1876, and equal to two-thirds of the entire State, county, city, town and district taxes; a sum exceeding twice the assessed value of all the hogs in the State; a sum which would have paid an army of more than 100,000 persons for six months for fighting these pests. And yet there are many who look upon this entire subject almost without concern, but behold with terror and alarm the ravages of the hog cholera, as well they may. But the loss in corn is by no means the full measure of the damage sustained by the farmers from this one little insect pest. If we add to this the loss on wheat, oats and other crops, thus swelling the sum by millions more, we may begin to appreciate the importance of taking some active measures toward combating these tiny foes which our agriculturists are too apt to overlook, and to consider as unworthy of serious attention. Nor can our estimate of the loss occasioned by these insects be thrust aside as imaginary and unworthy of consideration, as it is not only based upon the same kind of evidence as that from which agricultural statistics are usually made up, but it is tested by two independent methods based upon independent data. I appeal therefore to our farmers to look at this matter seriously, and in the proper light, and then say whether it is not time to take active measures to put a stop to this immense loss, this heavy drain upon their labor?

But the Chinch-bug, though doubtless the worst, is by no means the only insect foe with which the farmer has to contend; the Wire-worms, though hidden from view beneath the soil, are busy at work at the roots of his crops; the Army-worm now and then appears, as if by magic, and marches its myriads in review before him, mowing down his corn, wheat and timothy as they move; the Cut-worms let no opportunity for annoying him escape; now and then the Hessian fly and wheat midge appear like an epidemic blasting his bright hopes of a rich harvest; the Potato beetles, Corn-worms and a host of others follow in the wake.

The cholera enters suddenly his herd of fattening swine and cuts down a dozen of his finest porkers, worth perhaps \$150 or \$200. He feels the loss severely, and properly appreciates any effort made to find out the cause and devise a cure, but at the same time the insects in his 200 acres of corn have lessened his crop five or six bushels per acre without arousing him to any effort to devise a remedy or prevent the loss, although double that occasioned by the cholera. Why this difference? Simply because the loss in one case is so marked and apparent that it cannot be overlooked, while in the other it is less apparent and not brought so palpably to his notice.

But the question arises, can anything be done to counteract these evils and prevent these losses? I answer, yes; not because I have a sure and perfect remedy at hand to propose, but because there are facts staring me in the face which warrant me in giving this answer, or at least in asserting that they can be greatly lessened. The simple fact, known to all, that there was a time when these evils did not exist in the same ratio they do now is proof of itself that it is possible to bring about conditions in which these evils will not exist to the extent they now do.

In order to remedy an evil we must first fully appreciate it—on this point I have already spoken; next, we must ascertain as clearly as possible the nature of this evil, which, when applied to our insect enemies, means that we must learn to know them and to understand their history and habits.

To this part of the subject, so far as it relates to the corn crop, I will now direct attention, giving brief descriptions in plain language of the various species that operate on the corn crop in Illinois, dwelling briefly on the less important species, but giving somewhat fully the history of those which are most destructive, following each with an account of the remedies heretofore proposed, and adding such as I have to suggest from my own observations and investigations.

#### WIRE-WORMS—(*Larvæ or Grubs of Elaters or Snapping Beetles.*)

The cold days of winter having passed away and spring having opened with all its exhilarating influences, the farmer prepares his ground and plants his corn with a strong hope of a rich harvest. But scarcely is the seed deposited in the ground before the lilliputian enemies begin their work of destruction. Having waited the allotted time for the appearance of the shoots above the soil, he passes through his field for the purpose of ascertaining the condition of the embryo crop. Every few steps he finds a hill missing where replanting is necessary; this is ascribed to some climatic influence, as the cold nights, moisture, drought, etc., or possibly to a few crows, blackbirds or other birds which have been seen in the fields, when, in all probability, a careful examination would show that hidden insect foes are the real culprits.

This is by no means a fancy sketch, as any one may see by looking over the reported condition of crops, as given in the monthly reports of the National Agricultural Department. The spring and early sum-

mer reports are full of such expressions as the following which I select at random from that part of the monthly report now before me relating to Illinois: "Corn comes up unevenly." "Corn in many instances remains dry in the hill where planted, without sprouting." "Corn does not come up evenly." "Corn was injured by cold weather." "Corn not half up." "Corn is coming up badly," etc. Yet the county next to the one complaining of dryness reports the season favorable, as does the one adjoining that complaining of cold, showing that something besides the climate was at work.

The severed blade or shoot reveals the presence of the Cut-worms when these are the guilty culprits, but when the effect has been caused by insects injuring the planted grains, the germs or roots, the presence of these foes is not so apparent, and hence the weather has the blame to bear.

Among the chief insect pests of this cereal which attack it at this early stage, are the well-known Wire-worms, therefore we begin our list with them.

Although the article on these worms in my former report is somewhat full, yet the importance of the subject and the fact that it is by no means exhausted, will justify me in dwelling a little more at length upon their history and habits than would otherwise be necessary; especially as their attacks in this country appear to be directed more commonly against the corn crop.

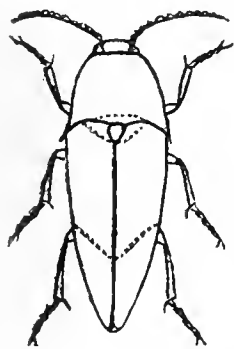


FIG. 1. ELATER.



FIG. 2. WIRE-WORM.

For the benefit of those who may obtain this report but have not a copy of the former, the following extract from the descriptive part of the former article is inserted here.

"The worms are the larvæ or grubs of a group or family of beetles, known to entomologists as Elaters (*Elateridæ*), but recognized generally by the common names, "Skip-jacks," "Snapping-bugs," "Spring-beetles," "Click-beetles," etc. They are known to every one who has felt sufficiently interested in the smaller works of creation to notice insects, by the curious method they adopt to recover their upright posture when they chance to fall upon their backs. Their legs being too short to assist them in turning over, nature has provided them with another means of regaining their proper position. This is operated by a sudden jerk or spring, accompanied by a clicking sound, hence the common names, each of which has reference in some way to this operation.

"This group of insects is quite extensive, more than 500 North American species have been determined, about one-tenth of which are found in Illinois. As the larvæ of all these species are Wire-worms, it is evident that there must be several different kinds, which, though strongly resembling each other in general appearance and character, differ in detail and habits. A large number of them are found in the ground, where they feed upon the roots of grasses and grass-like plants; others reside under the loose bark of diseased and decaying trees, and



in decaying stumps, feeding as has generally been supposed, upon the putrid wood, but possibly on penetrating roots or fungus growths.

"A close examination of specimens of various sizes, and those taken from different situations, even where there is but little variation in size or general appearance, reveals some very marked differences. Most of them show an impressed or indented line along the middle of the back, but in some this is wanting. The surface is generally finely punctured or covered with minute impressed points; but sometimes is quite smooth. But the most marked difference is to be found in the form and structure of the last segment.

"In some specimens, the last segment is simply conical, obtusely rounded at the tip, without divisions, notches or punctures; in others the form is the same, but in the back, near the base, are two conspicuous punctures; others have this segment simply conical and pointed, ending in a single sharp spine. Others have the tip flattened and rough, with its edge showing three or five tooth-like points or angular projections. These four different forms have the segment much longer than wide, and the worms to which they belong are slender and cylindrical, being very narrow in proportion to their length. Each is roundly notched at the end; some simple, with smooth margins and the sides of the notch prolonged into sharp spines, which are usually curved upwards. Others have the back of the segment flattened and rough—the lateral margins elevated, with three or more teeth on each side.

"While these differences indicate specific, and probably generic characters, in the perfect insects, and probably some difference in larval habits, yet, practically, they are of but little value, as all the species which reside in the ground have the same general manner of life, as far as known.

"The time and place when and where the female deposits her eggs has not, as I am aware, been observed; but they are doubtless deposited in the ground, at the roots of grass and other plants; the known habits of the larva and the attenuated and tapering abdomen of the perfect insect would indicate that such is the case. Dr. Fitch informs us that he once observed a female *Elater* (*Ludius brevicornis*) at the root of a recently set cabbage plant, where she sunk herself down into the earth the whole length of her body, her swollen abdomen showing she was on the point of depositing her eggs. Having captured and confined this female, she deposited 126 eggs, which were of a broad oval form, very small, measuring only three-hundredths of an inch in length, smooth, glossy, and of an opaque whitish color.

"The worms, as before stated, are very slender, the smaller species scarcely exceeding a knitting-needle in diameter, yet half an inch or more in length; while the larva of our largest species is as thick as a goose quill and two inches long. The smaller and ordinary species which reside in the ground are mostly cylindrical, while the larger species are slightly flattened. They are of equal size throughout, the head and last segment being narrowed, the cross sutures between the segments are but slightly impressed, and the body generally smooth and glossy, of a pale yellowish color when young or immediately after moulting, but usually tawny or brown, especially on the back; the mandibles are black. The body is composed of twelve segments be-

side the head ; the first, second and third, immediately behind the head, each bears a pair of four-jointed, tapering legs, which are tipped with a single claw ; on the underside of the last segment is a tubercle, which is used as a kind of terminal foot, and which is perforated for the termination of the alimentary canal.

“As corn is usually the first thing planted in this country on land broken up from the sod, it is the crop oftenest attacked by the Wire-worms and the one in regard to which we hear most complaint. In England, oats being the crop which usually follows, is the one that suffers most ; and it has been observed there that the danger was greater the longer the land was in grass.

“Wheat is subject to their attacks, and is sometimes greatly injured by them.

“Potatoes suffer severely from them in England, and we hear of the same thing in various parts of the United States. They are also quite fond of turnips, in fact more so than of any other root crop, but in this country this crop does not appear to be often injured by them.

“In attacking corn they not only eat the roots and penetrate the subterranean stem of the young plant, but eat into the kernel before it has germinated, thus destroying it.”

The following facts in reference to their history in Illinois, taken chiefly from the old numbers of the *Prairie Farmer*, are of sufficient interest to be at least brought together here. They help to complete our knowledge of the habits of these troublesome pests, and by combining and comparing them with more recent data, enable us, now and then, to determine some hitherto unknown law by which these insects are governed. From such historical notes the reader can also learn something in reference to the remedies which have been used and the results ; and perhaps thereby save himself trouble and expense in trying experiments which have heretofore proven valueless.

In the June number 1845, page 136, I find the following, apparently editorial, in reference to the Wire-worms:

“They are more destructive upon corn and beans because the small quantity of seed planted enables them to concentrate their efforts for greater destruction. We have taken out, this season, more than twenty from one hill of beans—five or six of them having bored their way into a single kernel. Grain so perforated will sometimes come up ; but will present a woful and pock-marked appearance and more generally come to nothing.

“We have tried soaking in saltpetre, but without much success. They will endure a considerable quantity ; and a little too much destroys the germinating power of the seed. \* \* \* Copperas water is also strongly recommended, but this is liable to the same objection with saltpetre.”

In volume XI—1851, page 209, I find the following statement :

“On taking possession of a piece of ground five years ago, for a garden,—now in this city, (Chicago), but then out upon the prairie—we found it infected with Wire-worms. They were present by thousands in every part of the soil, and the question was, how to get rid of them. Two years after we procured some refuse salt and sowed at the rate of three and a half bushels per acre, in the fall of the year. On working the ground the following summer the Wire-worms had taken themselves away, save a few stragglers which have been gradually



leaving ever since, till now there is scarcely a solitary resident left. This would seem to say salt them."

The conclusion arrived at by the writer does not necessarily follow, as it is almost certain from the facts mentioned that the year the salt was sown concluded the preparatory states of the insects, and they were, either that or the following season, transformed into beetles; and the ground being constantly in cultivation they sought less disturbed localities in order to deposit their eggs. It is not likely that three and a half bushels of salt to the acre could have seriously affected the worms.

The following in reference to tarring, from the same volume, page 254, is perhaps worthy of some attention as it may be useful to farmers in sections badly infested by Wire-worms who cannot afford to adopt the starving process recommended in my former report:

"I have had some experience in tarring seed corn, for the last thirteen years. The plan I pursue is the same as published in the *Albany Cultivator* for March 1835, which is this: Seed corn should be first soaked, say twelve hours, in water heated to near the boiling point (?) to saturate the grain and induce early germination, then having put half a pint or more of tar in an iron dish, with a quart or two of water, heat it till the tar is dissolved, or incorporated with the water, when the whole may be turned on to the already soaked seed, which is then to be well stirred. \* \* Then take corn from the water, and mix it with as much gypsum or ashes as will adhere to the grain, and put six or eight kernels in a hill. \* \* To soak seed corn in water, made a little more than blood warm, for only five minutes, would not swell it sufficiently to insure its germination, and the tar effectually varnishes over each kernel so that no more moisture can come to the corn, and consequently most all of the seed would not come up. I speak from knowledge for I have seen whole fields fail to come up from not being sufficiently soaked before tarring."

EZRA TUCKER, Peoria, Illinois.

In reference to tarring and other methods of treating seed corn before planting, in order to prevent it being attacked by worms and other vermin, there is much conflicting testimony and but little that is really satisfactory, but in order that our farmers may have before them the various views on this subject I add the following records of experience taken chiefly from back numbers of the *Prairie Farmer*.

It often happens that remedies applicable elsewhere are wholly inapplicable here; especially is this the case in England, hence experience in that country is of far less value to us than experience in Illinois. For this reason I have endeavored wherever it is possible to do so to give facts relating to experience in our own State.

In 1860 there was considerable discussion among our farmers in reference to the advantages of soaking seed corn in solutions of chloride of lime and of copperas. The following records of experience on this point are presented:

*Prairie Farmer*, May 10, 1860:

"Dr. Chamberlain, of Bureau county, gives the following directions for the use of chloride of lime and copperas in the preparation of seed corn, which we publish in answer to inquiries: 'Pour enough water to cover a quantity of corn adequate to plant twenty acres, and put therein one

pound of chloride of lime and two pounds of copperas; let it stand from twelve to eighteen hours before planting.'"

In the next number of the same paper (May 17, 1860) I find the following from Mr. R. M. Graves:

"I soaked evergreen sweet corn in a solution of chloride of lime,  $\frac{1}{2}$  oz., copperas,  $\frac{1}{4}$  oz., and two quarts of warm water, eighteen hours; rolled it in ashes, and planted immediately in sandy soil. Four days after I find every kernel but one like the sample enclosed (dead). The one is sprouted one-fourth of an inch."

The following anonymous communication on this subject is found in the same paper, Aug. 9, 1860:

"The following is my experience in soaking corn for seed in a solution of chloride of lime and copperas:

*The first trial* was with one bushel of corn; lime and copperas dissolved in boiling water, then added sufficient to cover the seed corn, thus reducing the temperature to about 120 degrees; soaked 12 hours, poured solution off, and let corn stand 24 hours longer with additional stirring. By this time most of the kernels showed signs that the sprout was just ready to burst forth, and indeed some had started. Planted just after a rain on a cloudy day; the result was about four days the start of dry corn planted the same day.

*Second trial*.—Corn to replace that dug by mice and destroyed by worms; solution as above; corn soaked 16 hours and planted immediately, wet; ground moist; weather warm; dry corn planted same day, same manner, same ground; no observable difference in coming up.

*Third Trial*—Corn soaked 18 to 20 hours; planted immediately; dry corn planted same day; weather hotter than second trial, ground drier; soaked corn about one and a half days the advantage. The conclusion of the matter in my estimation is, that it *don't pay*. *Mice and worms will take it just as quick as dried corn.*"

In addition to what has already been stated in reference to tarring seed corn, I add the following:

*Valley Farmer*, April 1859:

"After the corn is carefully selected and shelled, make a solution of 3 oz. nitre in 4 gallons of tepid water, in which soak one bushel corn for 12 hours; then drain off the water, give the corn a good coat of tar, then sprinkle over some leached ashes or slacked lime, stir well and plant immediately,—three inches deep,—leave no clods on the hills; the nitre is a preventive against various insects, worms, etc. The tar forms a coat around the grain and preserves the germ in cool, damp weather. The ashes adhering to the grain will promote the growth of the plant. I have prepared seed corn in this way, and procured a good stand without replanting a hill, while my neighbors would have to furrow out their grounds and plant over again. S. L. B."

I think it probable that the tar and ashes have much more to do in preventing worms from attacking the seed than the nitre; but the soaking is necessary in order to insure germination.

Mr. D. C. Moore—*Prairie Farmer*, Vol. 6, (1860) page 52, gives his experience on this point as follows:

“One year ago last May I planted  $4\frac{1}{2}$  acres of corn on good ground in the usual way (dry seed). The Black-birds, Wire-worms, and some unknown thing which would dig the hill all up in the night, took at least one-third of the corn. I replanted and it shared the same fate. I planted a third time with no better luck. Last spring I saw in the *Prairie Farmer* an article on soaking seed corn in tar water. I put a teacup full of tar to half a bushel of corn, put in water milk-warm, stirred it until it formed a good coat on each kernel, rolled it in ashes and planted on the same ground I had planted the year before, and now there are not twenty stalks missing in a field of  $4\frac{1}{2}$  acres. The birds were more numerous than last spring.”

While this experiment is valuable in some respects it is not entirely satisfactory, for the worms may by this time have passed into the cystalis or perfect state and hence would not have injured corn planted in the ordinary way. To be satisfactory it must protect the corn when the worms are known to be present in injurious numbers.

The following by S. D. Jones, Farmer City, Illinois, will be found in the *Prairie Farmer* March 4, 1876:

“Last spring I planted a field of corn which was the second crop after breaking an old meadow. The Wire-worms attacked the corn before it came up and made clean work of it, in places, all over the field; some places for nearly an acre the corn was entirely destroyed by them, while in others in the same field the corn came up and looked well. We went to work with our hoes and replanted the vacant places. The ground being warm and in fine condition I supposed the corn would be up in a very few days, but to my sad disappointment there was not one hill in fifty that came at all. When I examined for the cause, I found from four to six Wire-worms in each hill, which had entirely destroyed the germ and heart of the grain before the plant got through the ground. I thought I would not give it up yet, though it was getting late in the season, so I procured some early corn called ‘Kankakee yellow,’ and put it to soak in copperas water in the evening, and let it soak till morning. I then poured the water off and went to replanting the same ground again. Nearly every hill came up in a few days, grew finely and made good, sound corn. I am fully convinced that seed corn soaked as above directed, will prevent Wire-worms and many other insects troubling it. The only difficulty is it may be some trouble to plant with a corn planter while damp.

“In the spring of 1874 a neighbor of mine saturated his seed corn with kerosene oil.

“My experience is also that fall plowing is a great preventive both of the Grub and also of the Wire-worm.

“In the fall of 1874 I commenced to plow a stubble field of twelve acres, I had it about half broke when winter set in, consequently the other half was not plowed till spring. The part broken in the spring was at least one-fourth destroyed by the Wire and Grub-worms while the other part was scarcely touched.”

Having recently received from Mr. D. T. Milligan, of Shelby county, specimens of Wire-worms working on the grains of planted corn,

I am enabled to describe them so far as this can be done from the larva, but am still unable to determine the species.

Length about one inch, some of the specimens slightly less; width about eight-hundredths of an inch or one-twelfth the length; the underside somewhat flattened, with slight infolding of the margin, thus forming a little groove along each ventral margin; upper side convex; width uniform from the head to near the extremity of the last segment. The head depressed toward the front; antennæ, three-jointed; the last joint small and suborbicular, with a hair-like process at the tip; back of each jaw are two longitudinal shallow impressed lines. The first segment behind the head is considerably longer than either of the three following. The last, or anal segment, is slightly elongated, the length being to the width at the base about as three to two; the sides curving regularly to a blunt point in the form of a gothic arch; near the tip each margin has two slight rounded indentations rather minute; the latter half slightly flattened and sparsely punctured above, no lateral pores present on the upper side near the base; the anal proleg rather small, circular and embraced in the usual parabolic line or ridge which extends back not quite half the length of the segment. A few scattering, brownish hairs chiefly along the sides, about eight to each segment. Head and last segment more hairy than the rest of the body. The hind margin of the penultimate segment and to a slighter degree of the others, with that part which overlaps the following, denticulate. Color light yellowish-brown, paler beneath and at the sutures; the head, first three and last segments rather darker than the rest, the front of the head brown; the anterior boundary of the dark portion of each segment back of the fourth being a minute, slightly raised line. Stigmata brown and small, situated in the anterior part of each segment. Jaws black. The minute spines on the basal joint of the legs in two rows. There is a very narrow but distinct pale yellow line along the middle of the back on most of the segments back of the head.

In some respects this worm is very similar to the larva of the Wheat Wire-worm (*Agriotes mancus*—Say) described by Dr. Horn and figured in the Canadian Entomologist vol. 4, page 4, but it differs in the following respects: our species is considerably larger, has fewer hairs on the body segments, and lacks the pores on the upper side of the last segment—though it is proper to remark that these pores, though figured, are not mentioned in the description. It is therefore more than probable that our species, which may be called the "Corn Wire-worm," is closely related to the Wheat Wire-worm.

Of the species of this family of beetles found in Illinois the following may be mentioned as most commonly met with. As they have no common names I am compelled to use the scientific names only.

*Alaus oculatus*—Linn.

A large black species measuring from one inch and a quarter to one inch and a half in length; having on each side of the thorax a large velvety black, eye-like spot surrounded by a white line; the elytra marked to a greater or less degree with white downy spots.

The larva is a long, slender, smooth, sub-cylindrical worm, two inches or more in length when fully grown; of a creamy yellow color, tinged with reddish brown on the back; head and back of one or more



of the front segments, dark brown; last segment black, with a semi-circular notch at the tip. Resides in rotten wood, as logs, stumps, etc.

*Orthostethus infuscatus*—Germ.

Length from one inch to an inch and a quarter, narrowing and tapering behind to a point; each posterior angle of the thorax extending backward in a sharp spine; elytra not striated. Uniform dark brown covered with minute, closely pressed, yellow hairs; underside black or very dark brown.

*Adelocera impressicollis*—Say.

A small species not exceeding three-eighths of an inch in length; width about one-fourth the length; hind angles of the thorax acute; but not extending backward in the form of a spine; elytra finely striated, the raised intermediate spaces punctured. Color almost uniform reddish-brown, head and thorax slightly paler than the elytra; sparsely covered with golden hairs.

*Adelocera discoidea*—Web.

Length about the same as the preceding species, but a shade narrower; thorax near the hind margin slightly narrowed, posterior angles scarcely acute. Black, with a broad golden border along the sides and front of the thorax; elytra uniform dull black, striæ minute and indistinct, sutural margin raised so as to form a ridge when closed.

*Cryptohypnus abbreviatus*—Say.

This is a small species not exceeding a quarter of an inch in length; width about one-third the length; thorax with very shallow, scarcely perceptible, punctures, and a median, impressed, longitudinal line. Elytra striate, the grooves very slender and not, or very indistinctly, punctured, interspaces flat and smooth; tapering but slightly on the basal half, rounded at the tip. Head and thorax black; rest brown.

*Elater linteus*—Say.

Length varies from five-sixteenths to slightly more than three-eighths of an inch; width about one-fourth the length; the posterior tapering more directly to a point than the two preceding species. Elytra very distinctly striate, punctured in the striæ but not in the intermediate spaces; without hairs or nearly so; posterior angles of the thorax extending backward in the form of sharp spines. Head and thorax deep black; elytra ochre-yellow, with the sutures and immediate tips black.

*Elater sanguinipennis*—Say.

Similar to the preceding in size, form and carvings, except that the thoracic spines are slightly shorter, and the striæ of the elytra are finer; interstitial lines punctured. Body smooth, without hairs.

Head and thorax deep, glossy black; elytra uniform, glossy, pale reddish-brown; underside deep black.

*Elater hepaticus*—Melsh.

Length three-eighths of an inch; width one-fourth of the length; thorax a shade broader than the elytra, the latter (elytra) not tapering so directly and rapidly to a point as in the preceding species but maintaining nearly the same width for two-thirds their length; thoracic angles extending backward each in the form of a short spine; elytra regularly and distinctly striate, about eleven striæ on each elytron, and punctate, the raised interspaces with minute shallow punctures. Of an almost uniform dark brown color, head and thorax almost or quite black, elytra slightly paler towards the apex, partially covered with scattering hairs; legs pale reddish-brown.

*Elater obliquus*—Say.

This is a pretty little species, only about .16 of an inch long; quite narrow; thorax smooth and shining; elytra with very short hairs; thoracic angles spinous as in the preceding species; elytra tapering somewhat regularly to a point. Head black; thorax brownish-yellow with the transverse middle portion dark brown; elytra black except an elongate-elliptical yellow spot at the base of each extending from the outer anterior angle obliquely inward nearly to the suture and nearly half the length; underside pale brown. Antennæ very distinctly serrate. The yellow spots on the elytra, shorter in some specimens than in others.

*Elater nigricollis*—Herbst.

Same size as *E. linteus* and resembling that species in form and color, except that the elytra are generally lighter, approaching a creamy-white. The tips of the elytra in some specimens are pale brown, and the thorax dark brown. But the three species *E. linteus*, *E. sanguinipennis* and *E. nigricollis* graduate into each other by almost imperceptible shades of difference so that it is extremely difficult to separate them.

On one species marked in my cabinet as *E. nigricollis*, which approaches very near to *E. sanguinipennis*, I find two specimens of a minute oval, seed-like mite—either identical with or closely allied to *Uropoda umbilica*.—Pack.

*Monocrepidius lividus*—DeG.

Length about, or very slightly over, half an inch; width the usual proportion; elytra tapering backward nearly regularly to a blunt rounded point, distinctly striate; striæ with minute punctures, intermediate spaces not punctured; hairs minute and equally distributed, thoracic angles distinctly spined; fourth joint of the feet bilobed. Of a uniform livid or flesh color, the minute yellow hairs giving it a slight ashen hue; legs pale yellow.

This closely resembles *Melanotus communis* hereafter described, but

may be distinguished from that species by the absence of the fissures in the posterior margin of the thorax found in the latter.

*Ludius attenuatus*—Say.

Length four-fifths of an inch; head small and thorax much narrowed anteriorly, the lateral margins rounded; elytra tapering somewhat regularly to the pointed tip; antennæ very distinctly serrate; the region around the scutel deeply indented; elytra minutely punctured throughout, striæ almost entirely obsolete. The color is usually described as "reddish-brown except the terminal oblique third of the elytra which is black;" but the specimens marked by Mr. Walsh and those I have collected are as follows: Head black, antennæ dark brown; thorax purplish-brown; elytra black; underside reddish-brown. Surface smooth shining. [See Fig. 1.]

*Agriotes mancus*—Say.

"Clypeus truncated; body punctured; thorax with an impressed line behind the middle; posterior angles slightly excurved.

"Body black, punctured, with short hair; head with large, profound, dense punctures; clypeus elevated, emarginate each side near the antennæ, and truncated before; antennæ and palpi, rufous; thorax with an impressed line behind the middle; punctures numerous, profound, equal to those of the head, but not so dense; posterior angles prominent, very slightly excurved, carinate above, posterior edge slightly bidentate near the middle; an elevated abbreviate line on the posterior margin near the lateral carina; scutel entire at base; elytra have the punctures of the striæ oblong and approximate; interstitial lines with minute punctures furnishing hairs; feet reddish.

"Length seven-twentieths of an inch. Inhabits Missouri."

The specimens found in this State have usually been assigned to *A. pubescens*, but the two species can scarcely be considered as distinct.

*Melanotus incertus*—Lec.

This species and all belonging to this genus have the claws pectinate or comb-like, but it requires a rather strong glass to observe this character.

Length from a half to six-tenths of an inch; widest across the latter part of the thorax where it is equal to about one-fourth the length; the elytra taper regularly and straight to the tips, distinctly and somewhat sharply grooved, punctured in the grooves, the intermediate spaces flattened and sometimes with a few nearly obsolete punctures; body covered with closely appressed yellowish hairs; antennæ distinctly serrate, each joint tipped with two or three hairs. Thoracic angles extending obliquely backward in the form of short triangular spines. Color uniform brown or dark-brown, varying in some specimens almost to black.

*Melanotus depressus*—Melsh.

Exactly like the preceding except that it is smaller and that the thorax in this species is very minutely punctured, almost smooth,

while in the previous species it is very distinctly punctured. Length varies from three to four-tenths of an inch.

*Melanotus fissilis*—Say.

This species has had the misfortune to receive a number of names, as *Cratonychus brevicollis*, Herbst; *Melanotus cinereus*, Weber; *M sphenoidalis*, Melsh, etc. Of a uniform reddish-brown color, covered with short, pale yellowish hairs, which give it a dark ashen hue when living. Head convex, rounded on the front edge; antennæ pale-red, short, serrate. Thorax convex, not contracted near the posterior spines; spines obtuse; a distinct cleft or fissure just inside of each spine at the base. Elytra striate, and regularly punctured. The tarsi hairy and claws pectinate. Length about three-fifths of an inch.

Common throughout the state, especially where there are groves, and in the timbered sections.

The specimens marked with this name in Mr. Walsh's collection I am satisfied do not belong to this species.

*Melanotus communis*—Schon.

Closely resembles the last, and is not easily distinguished from it except by the size, which is not always a safe guide in this group. It is rather a lighter brown than *fissilis* and the thorax has a longitudinal indentation in the middle, deepest in the anterior half. Length about half an inch.

Common, but does not appear to be so abundant in the southern portion of the State as *fissilis*.

*Limonius griseus*—Beauv.

Very similar in form, color and general appearance to *M. fissilis*, but the claws are simple, not being furnished with the minute, comb-like teeth seen in that species. Length about half an inch; width scarcely more than one-fifth the length; thorax scarcely as broad as the front of the elytra; elytra striate, grooves punctured, interspaces convex, tapering but slightly until near the blunt apex. Dark brown; head very hairy; hairs of the thorax parting in the middle and bending toward the sides.

As will be seen by these descriptions, as a general rule, the species are not easily distinguished from each other, being very similar in size, color and other respects. When to this difficulty is added the fact that they remain for several years—three at least—in the larva state, we cannot wonder that so few species have had their history traced. I think most of our injurious species are those of comparatively small size. But knowledge of the history of our species, so far as it relates to connecting the worms with their respective beetles, although important in some respects, will probably aid us but little in devising remedies; our attacks must be directed against the worms.

As the notes here given on these insects are intended only as sup-



plemental to the article in my former report, I will close them with some extracts from correspondence in reference to the operations of these insects in 1877; and some statements by Curtis, the great English economic entomologist, respecting their history and habits in England.

The following from correspondence received during 1877 indicate the localities in which they are known to have been more or less troublesome during that year:

"The Wire-worms have done considerable harm. They cut the grain of corn out; sometimes six are found in one grain. They are yellow, one inch long, and jointed."—G. G. French, Shobonier, Ill.

"There are a few Wire-worms in the corn, but not in sufficient number to do any material injury. A few nearly every year."—Lorenzo Rank, Oswego, Kendall county.

"The Wire-worms were quite destructive in localities in this county. In the vicinity of Barr's Store, eight or ten miles northwest of here, several farmers were obliged to plant corn the second time on account of them. At Chesterfield, ten or twelve miles southwest, some corn was planted the third time. Were most destructive on new plowed ground, the first and second year after turning sod."—S. D. Conley, Carlinville, Macoupin county.

"The Wire-worm is, next to the Cut-worm, the worst insect we have in corn. They hold on much longer from the time the corn is up till it is hard roasting ears. They work up from the root as high as the ear on the stalk. They often ruin our crop here."—V. R. Faught, Evanston, Hancock county.

It is possible that the work of some other species of insect is included here. The statement of Mr. Conley that they were worse soon after turning the sod is just what is to be expected, and indicates the propriety of turning the sod, if possible, one year previous to cultivation in such crops as are subject to their attacks.

I am still decidedly of the opinion that starving them out by refraining from planting for a year and repeatedly stirring the ground is the only sure remedy. One great advantage of this plan is that it not only tends to destroy these worms, but also the White Grubs, Cut-worms and numerous other species that reside in the ground in the larva state and are not easily reached by topical applications or other means. It is not difficult for farmers to test this remedy on a small scale where these insects are troublesome, and it is certainly worthy of a trial. Where they are very numerous, and the nature of the soil will justify it, it would be well to spread unslaked lime over the surface and turn it under as deeply as possible before rain falls upon it. If this could be done, consistently with the nature of the crop to be grown, very early in the spring, this would probably be the best time; otherwise it should be done late in the fall. I am not aware that this remedy has been tried—lime has again and again been used, and generally without favorable results—but the use of unslaked lime in the manner indicated, and in as large quantities as the land will bear, has not, so far as I can learn, been tried. To be of any value it must be applied freely and well turned under.

According to Curtis, when the Wire-worm reaches its full size it descends a considerable depth in the earth, where it forms an oval cell of the surrounding particles of soil, not lining it with silk; it then

casts its skin again and becomes a pupa or chrysalis, generally, in England at the end of July or beginning of August; the time here is probably a few weeks earlier. The chrysalis is long and narrow, bearing a strong resemblance to the perfect insect, but is of a paler color, usually yellowish or yellowish white. They remain in the pupa state, so far as observed, from two to three weeks, but it is probable some species remain in this state over the following winter.

The same author, in the summary with which he closes his article on these worms in his "*Farm Insects*," makes the following statements in reference to their habits and the remedies used to counteract them:

"Very hazardous to re-sow where they have destroyed a crop unless the soil be plowed repeatedly.

"They are most to be dreaded in dry seasons, yet they cannot exist without some moisture.

"Affected plants are known by the dying off of the outer leaves.

"They cut into the stem above the roots and sometimes separate the stalk.

"Gardens suffer exceedingly; lettuces often fall a sacrifice to them.

"On light lands they do most mischief from the beginning of March to June.

"Lower parts of fields bordering on marshes most infested.

"Rye grass most dangerous with clover for encouraging Wire-worms.

"Gravelly and sandy soils most infested; strong loam and clay most free from them.

"Wheat sown in dry weather most likely to suffer.

"By constantly disturbing the insects it is probable they may be driven from a locality.

"A summer fallow and burning the rubbish recommended after clover and grasses; it kills the eggs and starves the worms; but fallows must be kept very clear from grasses and weeds. Nothing more dangerous than to leave strips and patches of grass or lays in plowed fields.

"Feeding land close with sheep will prevent the eggs from being laid. Folding oxen and sheep in the spring may also keep the beetles from coming out of the earth. Harrowing and hard rolling in March and April strongly recommended. Top dressings of lime useful before rolling.

"Domestic fowls and numerous small birds eat a large number of them.

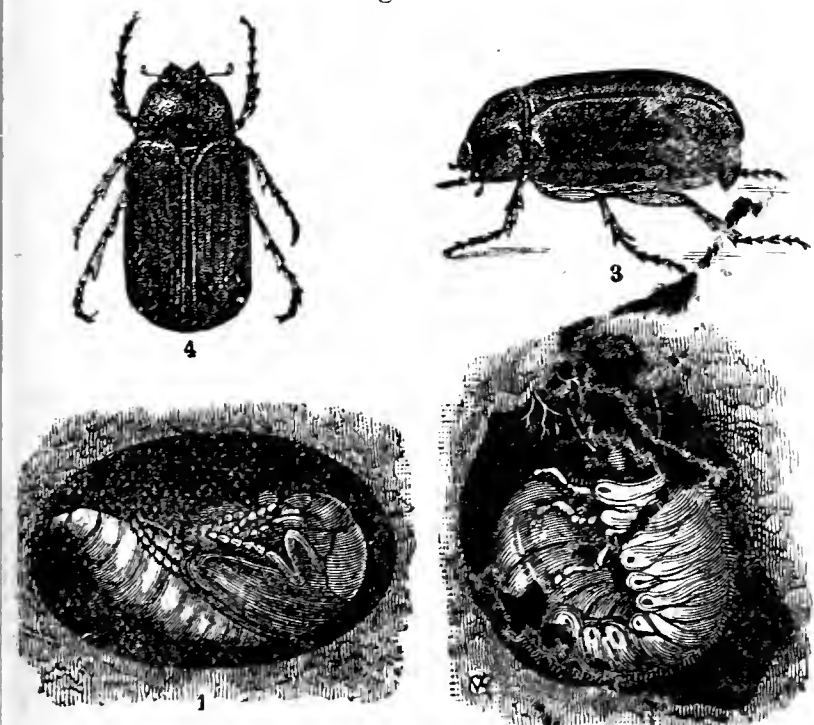
## WHITE GRUBS.

The worms known by this name are the larvæ of certain beetles usually designated as "May Beetles."

They belong to the family *Melolonthidæ* or leaf-chafers, and chiefly to the genus *Phyllophaga*.

MAY-BEETLES—(*Phyllophaga*.)

Fig. 3.



The name "White-grub," as commonly used, is somewhat indefinite, as the larvæ of quite a number of species are similar in form, color and habits. As it is difficult to describe these in such a manner as to enable the ordinary reader to determine them, the annexed figure of the more common species—the dark May-beetle (*Phyllophaga fusca*) in the larva, pupa and perfect state is given.

As a somewhat full account of the various species, and notice of the remedies recommended, are given in my former report, I add here only

PHYLLOPHAGA (LACHNOSTERNA) FUSCA, Frohl; QUERCINA, Kn.:—1, pupa in its earthen cell; 2, larva; 3, 4, beetle, side and back view.

notes relating to their operations on corn in parts of our State, received since that report was written:

*H. M. Russell, Urbana, Ill.*, in letter dated July 6, 1877: "Three years ago the summer was very dry here, and the Grub-worm injured the corn very materially on high grounds—the common white Grub with brown head, such as to all appearances are found about old rotten logs, and about in rich ground. These grubs eat off the main root near the top of the ground, killing the stalk and causing it to fall over. Some fields were almost wholly destroyed; nearly every field about this section, wherein was any high ground, suffered more or less. Knolls suffered most. I have seen fields in which were knolls and low lands where almost every hill on top or knolls was dead, and as the ground receded there was less destruction, until in the low ground hardly a hill was touched. The damage was done after the corn got some size, and considerable of the damage was done after laying by."

*Wm. A. Griffin, New Windsor, Mercer Co.*, in letter of July 9, 1877: "Last year, and for several years before, the Grub-worm did considerable damage. Have heard of no trouble this year."

*Prof. T. J. Burrill, Industrial University*, in letter of Nov. 24, 1877: "Except when *Leucania unipuncta* (army worm) visits us in great numbers the white Grub-worm (*Phyllophaga fusca*) does corn, grass, etc., the most damage."

THE CORN-CURCULIO—(*Sphenophorus zææ*)—Walsh.

This curculio, which was first described by Mr. Walsh, is oblong-oval and sub-cylindrical, the length about one-third of an inch exclusive of the snout, the width about two-fifths the length. It is of a brownish-black or black color, the punctures being more or less filled with pale yellow or grayish powder, the thorax having on the middle a diamond-shaped polished space. The snout is about one-third the length of the body and very slender.

The larva is unknown, but the beetle occasionally does considerable injury to corn by puncturing the young plant near the ground, and riddling it with little holes. They extend their operations even below the surface of the ground. This, as a matter of course, exhausts the plant and causes it to wither and die. I am inclined to think this species will be found most abundant and injurious in moist situations, and Riley remarks that he has found it in great numbers on the lake beach at Chicago.

If it should become very troublesome at any time it is possible that it may be driven off by applications of lime or guano.

*Spec. char. Imago.*—Color black, often obscured by yellowish matter adhering to the hollow places, which, however, can be partially washed off. Head finely punctured towards the base, with a large dilated puncture between the eyes above. Snout one-third as long as the body, of uniform diameter, as fine as a stout horse-hair and curved downwards. Before the middle of the thorax a polished diamond-shaped space, prolonged in a short line in front and in a long line behind, and on each side of this, an irregularly defined polished space somewhat in the form of an inverted Y; the rest of the thorax occupied by very large punctures, which fade into finer and sparser ones on the polished spaces. Wing-cases with rows of still larger punctures placed very wide apart in the usual grooves or striæ; the sutural interstice, that between the second and third striæ, and that between the fourth and fifth striæ wider than the rest, elevated, and occupied by very fine punctures; a small elongated-oval polished spot on the shoulder, and another near the tip of the wing-case. Beneath, polished, and with punctures as large as those of the thorax. Comes very near *Sphenophorus truncatus*, Say, but the snout is not "attenuated at the tip" and has no "elongated groove at base above;" and, moreover, nothing is said in the description of that species of the very large and conspicuous punctures found in the elytral striæ of our species.

Length about three-tenths of an inch exclusive of snout.

THE ROSE-BUG—(*Macrodactylus subspinosus*)—Fabr.

This beetle, which is fully described in my former report, is about one-third of an inch long, rather slender and sub-cylindrical in form. The antennæ, as in the May-beetles, are short, with a distinct club at the end composed of three plates or leaves opening like the leaves



of a book; the tip of the abdomen is exposed, the wing-cases not coming down behind to cover it. The claws of the feet are notched or split at the tip like the point of a pen; and the joints of the feet are long. It is covered with buff-colored scales which give it a yellowish brown color, but if these are rubbed off, the head, thorax and under-side will appear black and the wing-cases brown. The larvæ are grubs, which, when not feeding, lie with the body curved. They reach full size in autumn, when they are about three-quarters of an inch long and about an eighth of an inch in diameter; of a yellowish-white color, with a tinge of blue toward the hinder extremity, which is thick and obtuse; they have three short legs situated on the first three segments behind the head. They reside in the ground, feeding on the tender roots of plants.

It is in the beetle state they prove most injurious, eating the blossoms and leaves of shrubs, trees and other plants. When very abundant they occasionally extend their operations to corn. But this is not habitual with them, and, so far as I can ascertain, no complaint in this respect has ever been made against them in Illinois.

GRASSHOPPERS OR LOCUSTS.

As but one species of these insects—the Rocky Mountain Locust (*Caloptenus spretus*), which has so far not visited our State—is known to be very injurious to corn, I have no occasion to enter into a general account of our species at this time.



FIG. 4. CALOPTENUS SPRETUS, Female.

In my former report I gave a short account of the depredations and habits of this western species; much has also appeared in the papers and other periodicals in reference to it, and before this is printed an exhaustive account of its history and habits, and a full statement of all that is known in reference to it, will be given to the public by the United States Entomological Commission. For the benefit of our agriculturists I give here a full description of this species as compared with the two closely allied species (*C. atlantis*) and (*C. femur-rubrum*.)



FIG. 5. CALOPTENUS FEMUR-RUBRUM, female.

It is therefore unnecessary for me to take up the subject at this time, except to give such descriptions and illustrations as will enable the farmers of Illinois to distinguish our closely allied native species—the common Red-Legged Locust (*Caloptenus femur-rubrum*) and Lesser Locust (*Caloptenus atlantis*)—from the migrating and more destructive western species (*Caloptenus spretus*.)

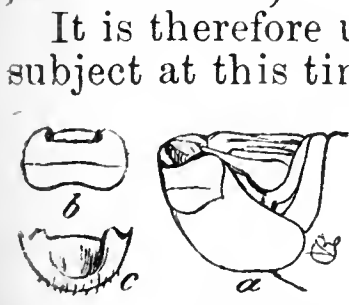


FIG. 7. Tip of male abdomen of *femur-rubrum*, letters have same reference as in Fig. 6.

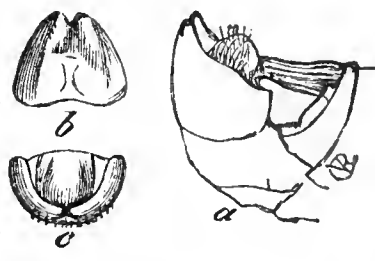


FIG. 6. Tip of the male abdomen of *spretus*; a lateral view of the terminal segments; b under side of terminal segment; c upper side of same.

ing and more destructive western species (*Caloptenus spretus*.)

THE ROCKY MOUNTAIN LOCUST—(*Caloptenus spretus*)—Thos.

*Female.* The face nearly perpendicular, sloping under toward the breast very slightly. The vertex between the eyes the same width as the frontal costa just above the ocellus; that portion in front of the eyes more or less distinctly channeled, and deflexed at an angle of about 40 degrees from horizontal. Eyes nearly straight in front, about semi-circular behind. Antennæ quite slender, reaching little if any beyond the tip of the pronotum. Pronotum, with the sides of the anterior lobes parallel, the posterior lobe expanding rapidly backward; median carina thread-like, but always distinct on the posterior lobe, usually obsolete on the anterior lobes; lateral carinæ obtuse but distinct on the posterior lobe and usually so on the middle one but becoming obsolete toward the front; posterior lateral margin, perpendicular from the humeral (entering) angle one-third the way down, then curving forward to the posterior lateral angle which is obtuse and rounded; the (entering) humeral angle is sharply defined, and in this respect differs from *C. femur-rubrum* and *C. atlantis*; the apex is obtuse-angled (about 100°) rounded at the point; posterior lobe minutely and shallowly punctured throughout; the anterior lobes smooth with few or no punctures except along the lower margins of the sides. Elytra and wings extending beyond the tip of the abdomen from one-fourth to one-third their length; the elytra are of nearly uniform width throughout, slightly curving upward at their extremity; wings a little shorter than the elytra, very thin and delicate; nerves and nervules very slender. Abdomen, and in fact the whole insect rather more slender than usual in this genus; but this appearance is partly due to the elongated wings; cerci very small, triangular or tooth-shaped, not extending across the segment on which they rest; valves of the ovipositor quite prominent, especially the upper pair which are more than usually exerted, sharp at the tips and deeply excavated above. The posterior femora usually extend to or about to the tip of the abdomen.

*Color.*—Reddish-brown with fuscous spots. Head and the pronotum back to the posterior sulcus reddish-brown, varying in depth of color in individuals; the face is sometimes of a lighter and brighter red than the pronotum, sometimes darker, assuming a dark purplish hue; the posterior lobe of the pronotum is generally a pale olive-brown, its lighter color contrasting somewhat distinctly with the darker shades of the anterior portion. Some individuals exhibit much lighter colors than here described, varying from a dark-brown to a dull yellow. The dark line on the side of the head and pronotum, usually so conspicuous in the closely allied species, is generally obliterated in this species by the dark-brown color; but it usually appears distinctly in specimens which have been immersed for some time in alcohol, and is also manifest in the pale individuals, but is broken up by pale spaces and lines, and is rather narrow; the eyes shining-black; elytra ash-brown, more or less tinged with reddish-brown at the base and fading toward the apex; in the middle field, commencing near the base, where this field comes to a point, is an irregular row of



fuscous dots, usually single to where the thin portion commences, now and then a double dot appearing; from this point to the apex they decrease in size and distinctness, and spread over the entire width; as a general rule the inner field is marked with a few fuscous dots, in some individuals a few quite distinct are seen, in others they are very minute and dim, and not unfrequently they are entirely wanting. Wings transparent, with a very slight yellowish tinge at the base; nerves and nervules of the costal area and apex black, rest pale. The abdomen is generally a glossy brown, with the posterior margins of the segments pale; venter yellowish or pale brown; sternum pale brown or yellow; anterior and middle legs usually rufous, but varying from reddish-brown to pale honey-yellow. Posterior femora with the disk reddish-brown, sometimes showing dim outlines of oblique bands; the inner face and lower carina yellowish, the latter usually tinged with red; the upper carina and upper portion of the inner face yellowish, marked with three large black spots or partial bands, one at the base, the other two equally spaced in the middle area; apex or knee black, or with a black crescent each side. The posterior tibiae vary in color from a bright coral-red to pale yellow, and in some cases to bluish.

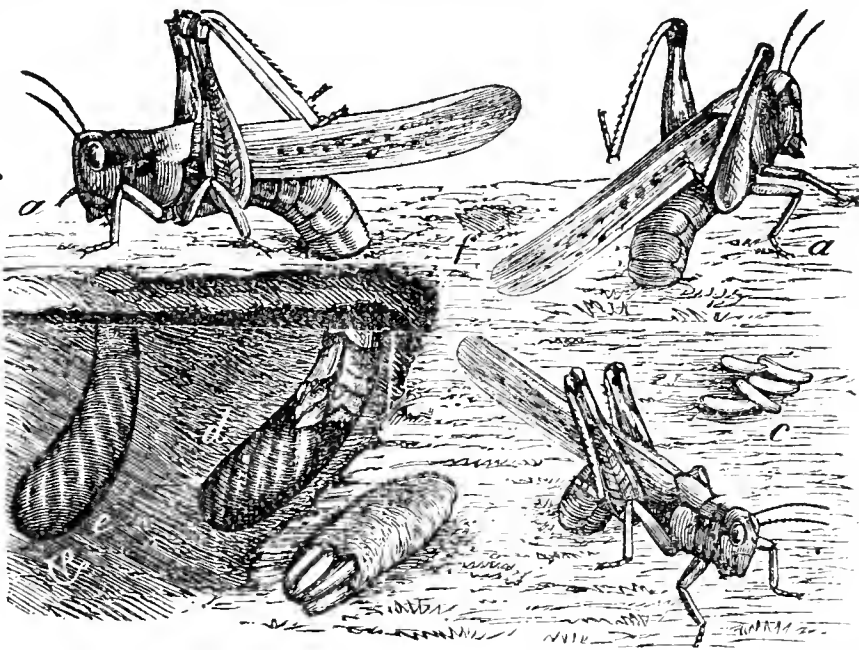


FIG. 8. *Caloptenus spretus*. *a a* females in the act of depositing their eggs; *b* an egg-pod with one end open showing the eggs; *c* eggs separated from the pod; *d* and *e* show the egg-pods in their usual position in the earth; *f* shows where a pod has been deposited and the hole closed.

*Male*.—Differs from the female as follows; Is somewhat smaller and shorter, but the wings are about as long as those of the female; the abdomen is enlarged or widened posteriorly and strongly curved upward at the apex; the last ventral segment being elongated, rounded and narrowed upward like the prow of a boat, and is distinctly notched at the tip, the lips or lobes somewhat tubercular in form. This part of the apical segment is covered with minute scattering hairs. This notch forms one of the chief characteristics of the species, at least the most important one in distinguishing it from *femur-rubrum*. The super-anal plate or triangular piece above the anal opening, is sharply bicarnate longitudinally; the tooth-like appendages at the base, above, are narrow and slender. The cerci are somewhat longer than the width of the preceding segment, are broad and flat throughout, the width equaling two-thirds the length, not suddenly narrowed or constricted, moderately curved upwards and inwards; roundly narrowed and depressed at the apex. The prosternal spine (in both sexes) is sub-quadrate and large at the base, but distinctly transverse, robust and decidedly conical, gradually lessening to a blunt point.

*Dimensions.*—Female. Length to tip of elytra, 1.15 to 1.43 inch, usually about 1.30; length of elytra beyond the tip of the abdomen, 0.15 to 0.38 inch; usually 0.22 to 0.27 inch. Male. Length to tip of elytra 1.15 to 1.40 inch; usually 1.20 to 1.30 inch; length of elytra beyond the tip of the abdomen, 0.20 to 0.38 inch; usually 0.25 to 0.33 inch.

THE LESSER LOCUST—(*Caloptenus atlantis*)—Riley.

The species most closely allied to *spretus*, or the Rocky Mountain locust, is *C. atlantis*, Riley, or the "Lesser Locust," which the author describes as follows: "Length to tip of abdomen, 0.70 to 0.85 inch; to tip of the closed wings, 0.92 to 1.05 inches. At once distinguished from *femur-rubrum* by the notched character of the anal abdominal joint of the male, and by the shorter, less tapering cerci; also, by the greater relative length of the wings, which extend on an average nearly one-third their length beyond the tip of the abdomen in dried specimens; also, by the larger and more distinct spots on the wings—in all which characters it much more closely resembles *spretus* than *femur-rubrum*. From *spretus*, again, it is at once distinguished by the smaller size, the more distinct separation of the dark mark running from the eyes on the prothorax, and of the pale line from the base of the wings to the hind thighs; and also by the anal joint in the male tapering more suddenly, and by the two lobes forming the notch being less marked. From both species it is distinguished not only by its smaller size, but by the deeper, more livid color of the dark parts, and the paler yellow of the light parts, the colors thus more strongly contrasting.

"Just as the typical *femur-rubrum* is at once distinguished from the typical *spretus* by the characters indicated, so *atlantis*, though structurally nearer to *spretus*, is distinguished from it by a glance at its much smaller size, and darker, more marked coloring. The contrast is all the greater in the living specimens of *spretus* that at all approach it in these respects."

I find the male, as seen in Illinois, varies in length to the tip of the elytra as follows: 0.97, 0.95, 0.98, 0.95, 0.96, 0.84, 1.05, 0.93—averaging 0.954.

THE RED-LEGGED LOCUST—(*Caloptenus femur-rubrum*)—Deg.

This is our common Red-legged Locust, and has been so often mentioned and described in scientific and agricultural publications that I will simply refer to the differences between it and two other species (*spretus* and *atlantis*).

*Female.*—As compared with *spretus* the only very marked difference between the females is the shorter wings of this species, yet there are other slight differences observable when a large number of specimens are compared. The eyes in *femur-rubrum* are slightly more prominent; the head, pronotum and sides of the thorax are usually some shade of olive-brown, varying from pale to almost black; the black

line behind the eyes is quite broad, seldom broken up, and is distinct in the darkest specimens. The humeral (entering) angles of the posterior margin of the pronotum are more rounded and not so sharply defined as in *spretus*; the median carina is usually more distinct on the anterior lobes, while the lateral carinae are rather more obtuse and not so well defined; the punctures on the posterior lobe are more distinct. The wings extend but slightly beyond the extremity of the abdomen, usually less than one-tenth their length. In this species and *atlanis* the intercalate vein is present in the elytra, (notwithstanding the assertion of Stal to the contrary) dimly and imperfectly it is true, but it can be clearly distinguished for more than half the length of its course. In *spretus* it is wanting, its place being marked by the line of union between the two rows of cells. The fuscous spots or dots are not so conspicuous or widely spread over the apical portion of the elytra, and the elytra are narrower and straighter. As a very general rule the external face of the posterior femora is black or brown, the lower margin and lower half of the inner face bright coral red; when these colors are well defined there is a yellow space or stripe between the red and black; but these markings are subject to considerable variation, the red being sometimes entirely wanting, the external face dark and the lower margin yellow, sometimes the dark is replaced by a pale olive. The tibiae are most generally bright red, but this character is not without its exceptions. Usually there is a pale ray extending from the base of the wings to the posterior coxa, but is occasionally wanting in dark specimens and is generally absent in *spretus*. The prosternal spine is not so distinctly quadrate at the base as in *spretus*, tranverse, flattened behind and not regularly conical, but somewhat sub-cylindrical to the broadly rounded and very blunt apex.

*Male.*—The most constant difference between the species is found in the form of the last ventral segment of the male; in *femur-rubrum* this segment, although strongly curved upwards, as in *spretus*, is not so distinctly narrowed toward the end but rounded, and instead of being notched toward the end is squarely truncate, presenting a sharp, horizontal and almost semi-circular margin (see fig. 7). Below the tip, on the posterior face of the segment, is a rather large, tranverse, gash-like indentation. The cerci are about the same length as those of the male *spretus*, and about the same width at the base. The little tooth-like appendages at the base of the super-anal plate are elongate and slender as in *spretus* and are sinuate.

In addition to the characters mentioned in the original description of *atlanis* I would call attention to the following differences between it and *spretus* on the one side and *femur-rubrum* on the other.

*Female.*—As compared with the female of *spretus* the wings are shorter extending but very slightly beyond the tip of the abdomen, not differing perceptibly in this respect from *femur-rubrum*; the elytra are narrower, curved upward very slightly at the apex, very few spots or dots on the apical portion and these minute and dim; the inner field is almost always immaculate; the posterior half of the intercalate vein apparent. The wings pellucid, but when living have, next the base, a bluish-white tinge; a larger portion of the nerves and nervules dark. The black stripe on the side of the pronotum nearly always ap-

parent even in the darkest individuals; head and anterior lobes of the pronotum with the velvety appearance so marked in *spretus*, but here dark or olive-brown without the reddish tinge so common in that species; the pale, oblique, metathoracic ray usually apparent but often obliterated.

There are no reliable characters by which to distinguish it from the female of *femur-rubrum*; the posterior lobe of the pronotum is usually less conspicuously punctured, agreeing in this respect with *spretus*.

*Male*.—Differs from *spretus* in being smaller, pronotum rather more constricted and sub-cylindrical; eyes more round and prominent; the notch at the tip of the last segment less distinct, sometimes almost obliterated; more of the nerves of the wings dark.

From the male of *femur-rubrum* it differs in usually having longer wings, in some individuals they are as long, proportionally, as in any specimen of *spretus*, in others little or no longer than in *femur-rubrum*; in the more slender form and smaller size; in having the apical segment of the abdomen narrowed and notched at the tip; in having the cerci broad throughout and shaped as in *spretus*; in having the tooth-like appendages at the base of the super-anal plate shortened and broadened, and with a longer union at their base.

It is evident from these characters that *atlanis* is an osculant form, intermediate between *spretus* and *femur-rubrum*, partaking largely of the characters of each, and in a few respects differing from both. The female approaches very near *femur-rubrum*, scarcely showing varietal differences from the female of that species; while on the other and the male approaches much nearer *spretus*, as shown by the character of the terminal segment of the abdomen, the form of the cerci and the length of the wings.

#### CHINCH-BUG—(*Blissus leucopterus*)—Say.

This is, beyond all question, the most formidable insect with which the farmers of Illinois have to contend. Although diminutive in size, and possessing no other weapon of destruction than its tiny, slender, tubular mouth, it makes up by numbers for lack of individual capacity for extensive injury. It is already so well-known that it would seem scarcely necessary for me to give more than a brief description here, but as young farmers are yearly added to the agricultural army it is best to keep the facts before the public, hence we repeat here much that has been written heretofore. I give a brief account of the history of the species in Illinois, notes on its operations in 1874, and some account of its habits and the remedies suggested. It was first described by Mr. Say, in 1831, as follows:

“*Lygæus leucopterus*.—Blackish, hemelytra white with a black spot. Inhabits Virginia. Body long, blackish, with numerous hairs; antennæ rather short, hairs; second joint yellowish, longer than the



third, ultimate joint longer than the second, thickest; thorax tinged with cinerous before, with the basal edge piceous; hemelytra (elytra) white, with a blackish oval spot on the lateral middle; rostrum and feet honey-yellow; thighs a little dilated. Length less than three-twentieths of an inch."

Nineteen years afterwards Dr. LeBaron, not aware that the species had previously been described, named it *Rhyparochromus devastator*, and gave the following description in the *Prairie Farmer* of September, 1850:

"Length  $1\frac{2}{3}$  lines or three-twentieths of an inch. Body black, clothed with a very fine grayish down not distinctly visible to the naked eye; basal joint of the antennæ honey-yellow, second joint the same, tipped with black, third and fourth joints black; beak brown; wings and wing-cases white; the latter are black at their insertion, and have near the middle two short, irregular black lines, and a conspicuous black marginal spot; legs dark honey yellow, terminal joint of the feet and the claws black."

Although the history of this species as an injurious insect has received considerable attention from entomologists, yet it cannot be considered as fully known. But it is unnecessary for us to examine this except so far as it relates to Illinois.

According to Dr. Fitch, it was first noticed about 1783, as a depredator upon wheat in North Carolina. It was very destructive in that State in 1809; in 1839 it was excessively numerous in Virginia and North Carolina.

Mr. Say in connection with the description made in 1831, which I have quoted, remarks that he "took a single specimen on the Eastern shore of Virginia." As he was at this time residing at New Harmony, Indiana, and about this time paid special attention to collecting the *Heteroptera* of Southwestern Indiana, the inference is very strong that it was then unknown in that section. Whether it is a native of the State is uncertain, in fact, I think it a matter of doubt; still, as Dr. Fitch found one or two specimens in New York, and Dr. Harris one or two in Massachusetts, and as the first recorded appearance of the species in our state was in the northern portion, it may be that it is native, existing in very limited numbers except when years favorable to its development occurred.

The first record of their operations in Illinois which I have been able to find is in the *Prairie Farmer* of October, 1845, as follows:

"CHINTZ BUGS.—An insect so named is at work as we learn by a farmer in Knox county, eating up the wheat and doing extensive damage. They appear in myriads, defying all endeavors at extermination."

It was also observed the same season in Will, Tazewell and some other counties in large numbers. From the December number, 1845, of the same paper, we learn that they did considerable damage to wheat and corn in Tazewell county in 1840, which is their first appearance in injurious numbers in the State of which we have any account. It is stated that they appeared first in the neighborhood of



FIG. 10. Chinch-bug.  
The line below shows  
the natural length.



Nauvoo, and were called "Mormon lice" because it was supposed the Mormons had introduced them. That they were so called is true, but the first record of their appearance that I can find is that given above.

The article in which this fact is mentioned—written by Mr. J. Hadley—is interesting in this connection, and as it has been overlooked in all subsequent notices of this species, I will quote it here:

"I find in the October number of the *Farmer* a notice of Chinch-bugs in Knox county, and a request that some friend there would send you a sample of them. As I have more of that kind of *varmint*s on my farm than I want, I have taken the liberty to send you a few of them for inspection, or dissection, as you please, and also to give you a short history of their depredations on my farm and the northern part of this county. They first were found here about the middle of June, and could be found in any wheat field by just removing a little earth from the roots of the wheat, where they commenced their depredations. When they first made their appearance they were about one-third as large as those I send you. Some of them were red, with brown spots, and some of a dark brown color. In about two weeks they get their full growth (which is the size of those I send you) and all assume one color, which is a dark brown. They deposit their eggs in the ground, from half an inch to an inch deep, and in about six days these little red and brown fellows are hatched out; they have silver colored wings with a dark brown spot on them. They make very little use of their wings, as their principal mode of moving is on and in the ground. I think there must have been five or six generations of them on my farm this fall. I had to give up harvesting my corn in consequence of their being so numerous and of an offensive smell; they smell very much like the common bed bug. I think there were a million of them on some corn stalks in my field, being literally covered from the ground to the top. I have been informed that the same kind of bugs were in this county about five years ago and did considerable damage to wheat and corn. They have done much mischief here this summer in some wheat fields. They have nearly destroyed two or three acres of my fall wheat, and are yet going on in their work of destruction. They work entirely on the root of it now, but in the summer and early fall they devoured (?) roots, stalks and leaves, in fact everything that was green."—November, 1845.

Accompanying this letter to the *Prairie Farmer* were specimens of the insects complained of, a cut of which is published with the letter. Although this figure is not quite up to the requirements of the present day, it is a tolerably good likeness of the species, and as the editors say "is the first portrait of him ever given to the world."

As will be seen by the following extract from the June number, 1846, of the same paper, these insects were abundant in some sections of the State that year, also in 1844.

"*The Chinch Bug*.—Mr. David Newsome writes us of the devastation committed by this insect in Sangamon county. He says: 'During last September a year, I observed millions of whitish flying insects upon the vegetation where I was seeding wheat. After seeding time was over I saw no more of them. About the 15th of next June myriads of small streaked-backed bugs made their appearance upon the

wheat at the ground; they increased in size very fast. In whatever condition they found the wheat the growth of it stopped. The stalks and heads shrunk and turned white. They did not disturb oats, clover or timothy. So soon as the sap was extracted from the wheat, they went upon the standing corn in numbers without limit. They were upon the stalks from the ground to the tassel, and there continued till every particle of sap was extracted. They then went upon the prairie grass, upon the weeds, or upon any plant that had any substance in it, till all was dried up. They injured early sown wheat to some extent. When winter set in they went into winter quarters—under *corn shocks, clods, rails*, etc. On looking for them through the winter they were always on hand cheap. As soon as moderate weather set in this spring, they were found alive and well. They are now on the green wheat but have not yet commenced eating.”

Here we have recorded, for the first time, an account of their method of hibernating or passing the winter, and their usual hiding places during this season. To Mr. David Newsome, therefore, must be given the credit of this discovery; as his observations have been overlooked by subsequent writers on this subject, I take pleasure in resurrecting the fact and bringing it before the public.

They were also observed in 1846 in Cass county. In 1847 they appeared in Lyons county, Iowa. In 1848 did considerable injury in Lake county, Indiana; but I cannot find that they appeared in injurious numbers at any place in Illinois either in 1847 or 1848.

Although no record of complaint is found in 1849, yet their appearance in such large numbers in 1850, which was excessively dry, would indicate that they must have commenced multiplying in 1849, and this supposition is confirmed by an editorial in the *Prairie Farmer*, August 1851, which states that the counties of Will, De Kalb, Kendall, Kane, Du Page, McHenry and perhaps others, have been afflicted by these insects for two or three years; 1851 not being included, as they did not make their appearance that year, “the amount of water having been favorable to their destruction.”

The following account by Dr. LeBaron, of Kane County, published in the September number, 1850, of the *Prairie Farmer*, is the first scientific account of its habits and of its preparatory states, placed on record; as the work in which it is found is very rare, and Dr. LeBaron's modesty prevented him from quoting it in his article on this insect in his second report, I repeat it here (except the descriptive part already quoted).

“MESSRS. EDITORS:—My attention having been recently called to the destructive insect commonly known as the Chinch-bug, I send you a few observations thereupon, which, in addition to what has already been published, will go to make up the history of this destructive species.

These insects have prevailed the present season throughout this and the adjoining counties in ruinous profusion. The season has been excessively dry, which has probably been favorable to their multiplication. I find by reference to the back numbers of the *Prairie Farmer* that they have been equally destructive in other sections of the country in former years.

"They make their appearance in the latter part of June, confining their depredations at this period to Spring wheat. So rapid is their multiplication that in the course of a few days from the time of their first appearance, whole fields are overrun by them, every straw being more or less infested.

"They belong to the suctorial division of insects, and do their damage by imbibing the juices of the plants which they infest.

"The sucking instrument, as in other insects of the kind, consists of a slender, four-jointed beak, which, when not in use, is bent back under the body and rests upon the breast. Upon that side of the beak which is undermost when at rest, is a narrow groove in which is contained an extremely fine, bristle-like lancet, which is capable of being disengaged from its sheath and used as an instrument for puncturing the straw. When a flow of sap has thus been produced the lancet is returned to its sheath, and the whole instrument is used for the purpose of suction. Collected in dense clusters, chiefly about the lower joints of the straw, with their suckers partially inserted into it, or applied to the punctures previously made, these little insects appear to repose in luxurious contentment. Meanwhile the grain, being deprived of its necessary nutriment, becomes wholly blasted or much shrunk, whilst the straw turns white prematurely and at length crinkles down beneath the lancets of this infinity of phlebotomists.

"When the wheat becomes too much dried up to afford them nutriment, they leave the wheat field and may be seen at this time running upon the ground in all directions in search of appropriate food. Next to wheat they usually attack oats, then corn, and lastly timothy or herds-grass; and if none of these are at hand, they will subsist upon some of the wild grasses. The Indian corn is so rapid and vigorous in its growth that it is not usually much injured; yet I have seen this season whole fields blackened with them, and large patches of corn blasted and prostrate, as if a fire had run over them.

"They migrate from one field to another by running over the surface of the earth. Nevertheless, when they are obliged to move to a distance the perfect or winged individuals readily take to flight, and they have been seen flying in dense swarms.

"They are seen in about equal numbers in their different stages of growth. The younger specimens are found especially abundant in the earth to a depth of an inch or more, about the roots of the grain, from which it may be inferred that the eggs are deposited in this situation, though I have not as yet succeeded in discovering them.

"These insects present, in the course of their development, the following characters: The youngest individuals are vermilion red, the thorax or anterior part of their bodies inclining to brown, and with a white band across the middle of the body, comprising the two basal segments of the abdomen. As they increase in size they become darker, changing first to brown, and then to a dull black, the white band still remaining. The antennæ and legs are varied with reddish. In their final or perfect state they acquire white wings, varied with a few black spots and lines.

"So sudden is the invasion and so rapid the progress of these insects that it is scarcely probable that any preventive or remedy for their devastations will ever be discovered. Yet it is an admirable provision of nature that those creatures which multiply at certain

seasons in alarming profusion, do as suddenly and often as unaccountably disappear. The common method by which the excessive increase of such creatures is kept in check, is by the appropriation to each of them of some parasitic insect, which multiplies co-extensively with them, and by preying upon them restrains their increase within moderate limits. The migratory locust, for example, and the Hessian fly, and most kinds of caterpillars, are known to be infested by parasitic insects. It is devoutly to be wished that nature may have provided this, or some other remedy, against the indefinite extension of the ravages of the present species, whose origin and progress seem to be so wholly removed from the reach of human control."

I find no record of their appearing in injurious numbers after this until in 1854. Dr. Asa Fitch, the able entomologist of New York, in his second report remarks that "The Chinch-bug has now multiplied and extended itself over all parts of Illinois and the adjacent districts of Indiana and Wisconsin and has become a most formidable scourge. The dry seasons which have recently occurred have increased it excessively. In passing over northern Illinois, in the autumn of 1854, I found it in myriads. In the middle of extensive prairies, on parting the grass in search of insects, the ground in some places was found covered and swarming with Chinch-bugs. The appearance reminded me of that presented on parting the hair on a calf that had been poorly wintered, when the skin is found to be literally alive with vermin."

From this time forward until 1858 they were more or less numerous and injurious in various sections of the State. In 1855 they were very abundant and injurious in Mercer, DeKalb and some other counties. According to Mr. Williams, of Geneva, Wisconsin, as quoted by Dr. Fitch, this insect made its appearance there in 1854, coming apparently from the south, doing considerable injury in 1855.

A writer in the *Valley Farmer* for September, 1857, whose letter is dated Pleasant Vale, Ill., July 20, says: "These insects (Chinch-bugs) have made their appearance the present season in this section of country, and from present indications they are going to prove very destructive not only on wheat and oats, but to the great staple of our western country, Indian corn. I had a patch of ten or eleven acres of all wheat, which is enclosed on three sides with corn. I cut the wheat between the 13th and 18th of this month (July), and during the time of cutting I observed a few bugs running over the ground, but did not suspect that there were or would be enough to do any harm. On the next morning after I had finished cutting I was passing along the edge of one piece of corn next to the stubble, and behold! What a sight there met my eyes! The corn was blackened with these pestiferous insects from the ground to the height of two or three feet, not only on one stalk but on every stalk in the hill. I did not count them but I am well convinced that there are thousands on every stalk.

\* \* \* I have resorted to every source within my limits for some information with regard to destroying or checking the ravages of these insects and as yet have found nothing proposed except fire, which would undoubtedly be an infallible remedy, if we had some mode of applying it."



In 1858 they were quite troublesome in several sections of the State as shown by numerous letters in the *Journal and Farmer* (P. F.) for that year. Some of these communications give evidence of closer observation of the habits than previously, and show a general advance in the knowledge thereof. The following from a communication by Chauncey Ray, dated Rockford, Sept. 27, 1858, and published Oct. 7, suggests some valuable remedies: "We have had them (Chinch-bugs) for eight or nine years past. Some seasons doing a great deal of damage and others but little. They will winter in stubble, old corn stalks, under any thing that is convenient, and come out when it is warm enough for vegetation to start, but do not lay eggs before the middle of June. From my experience with them, I find it best to clear the land of old corn stalks and all kinds of rubbish, plow under deep the stubble of the small grain. Where small grain is sown, roll it as soon as sown and again when it is four or five inches high. This prevents their getting under the stool to lay the eggs, as that is where they do lay them. To prevent them from going from the small grain into the corn I leave a vacant strip twenty-five or thirty feet wide between them, prepare that for a crop about the middle of June and sow it with corn or oats. That makes a hiding place and fresh feed for them, where they will remain until the corn planted is out of the way of them."

In the issue of December 2, 1858, of the same journal is a communication from O. B. Nichols, Clinton county, Ill., which contains some valuable suggestions:

"My plan to keep clear of them is this: In the fall I plow under all the weeds and grass that I can get to with the plow. I have my fields so arranged that I can turn in my sheep and cattle to eat the weeds and grass out of the fence corners before I sow my wheat, and in the balance of my fields I turn on during winter, and if I have any fence corners that I cannot feed out, I take a torch and the boys follow with buckets of water and tin cups, and I burn up the grass and weeds. I feed all my corn fodder and straw to my cattle and other stock whether they need it or not. I leave nothing on the place after the first of May for them (the bugs) to harbor in. I have never known them to winter in timothy or any tame hay, but if you want to raise an extra crop of bugs, leave a few bottoms of prairie haystacks and piles of corn fodder and straw until June, and my word for it, you will have them."

The following year (1859) in the *Prairie Farmer* of January 27, my first article on these insects appeared, in which I suggested that "it is probable that burning the stubble and straw, and pulling the corn and burning the stalks when dry, would assist in preventing their ravages, especially in the prairies. It may be that the habit of cutting and shocking corn has assisted in causing their increase by thus affording better winter sheltering places."

The following from the *Editor's Memoranda*, July 29 of this year shows that they were still troublesome in parts of the State: "From what we learn from correspondents and read in our exchanges, we judge the ravages of these bugs are extended, and though their appearance in most cases was too late to affect the wheat crop seriously, they are mowing down the corn alarmingly."



During 1860, so far as I have been able to ascertain, our State was comparatively free from this pest. In 1861 it is reported in considerable numbers in some of the northwestern counties by Dr. Shimer, though no complaints of its depredations are recorded in the *Prairie Farmer*; but the spring of 1862 being dry it made its appearance in considerable numbers in some sections, cutting short the wheat crop and doing some injury to the corn. In 1863 our state appears to have been exempt from its ravages. In 1864 Iowa crops suffered largely from its attacks, and adjoining portions of Illinois experienced some injury from it also. The damage in 1865 to wheat was considerable in some sections, but the season being wet the insects were destroyed.

It was this season, if I recollect rightly, that Dr. Shimer read a very interesting account of this species before the Northern Illinois Horticultural Society. I am sorry to say I have, so far, failed to secure a copy of this paper—from which I would gladly quote, as the Doctor has long been one of our best practical Western entomologists, and has never received that credit from entomologists to which his observations and writings justly entitle him.

As I learn from a quotation in the *American Entomologist*, Vol. 1, page 172, he states that "on May 16th, 1865, a bright, sunny, summer-like day, the atmosphere was swarming with Chinch-bugs on the wing at Mt. Carroll, in northern Illinois. They were so numerous, alighting on the pavements in the village, that scarcely a step could be taken without crushing them under foot. In a few days they had all disappeared."

The following account given by an Illinois farmer, as published in the proceedings of the N. Y. Farmer's Club, June, 1866, and quoted in "Report Ent. Soc., Prov. Ontario, 1871" probably applies to this year or 1864. "In passing by a field of barley where the Chinch-bugs had been at work for a week, I found them moving in solid column across the road to a corn-field on the opposite side, in such numbers that I felt almost afraid to ride my horse among them. Some teams were at work mending the road at this spot, and the bugs covered men, horses and scrapers till they were forced to quit work for the day. The bugs took ten acres of that corn clean to the ground, before its hardening stalks checked their progress. Another lot of them came from a wheat field adjoining my farm into a piece of corn, stopping now and then for a bite, but not long. Then they crossed a meadow 30 rods into a 6 acre lot of sorghum and swept it like a fire, though the cane was then scarce in tassel. From wheat to sorghum was at least 60 rods. Their march was governed by no discoverable law, except that they were infernally hungry and went where there was most to eat. Helping a neighbor harvest in one of the few fortunate fields, early sown, we found them moving across his premises in such numbers that they bid fair to drive out the family. House, crib, stable, well-curb, rees, garden-fences,—one creeping mass of stinking life. In the house as well as outside, like the lice of Egypt, they were everywhere; but in a single day they were gone."

During 1866 and 1867 our State appears to have been entirely free from the depredations of these insects. In 1868 and 1869 they appeared in limited numbers in southern Illinois but their development was cut short by the wet weather.

I find no complaints of damage recorded in 1870, but as the summer was dry over a large area, and they appeared in immense numbers in 1871, it is more than probable that they began to increase in the latter half of the season.

As Dr. Le Baron has noticed somewhat fully in his second report their operations in 1871, it would be unnecessary for me to do more than advert to it were it not for the fact that this second report does not appear to have been generally distributed and is rarely seen. The following quotation will suffice to show the extent and severity of this visitation :

"Some idea of the loss caused by the depredations of this insect, in this and neighboring States, may be realized when we learn that over a belt of territory one hundred miles wide, commencing in the western part of Indiana, and extending more than four hundred miles west, embracing an area of more than forty thousand square miles, the great staple of spring wheat was reduced to not more than a quarter of an average crop, and in many places wholly destroyed ; and that over the same territory barley was less than half a crop, and oats not more than three-quarters of their usual amount.

"The center of this belt appears to have been a little north of the center of the State, being about on a line with the junction of Iowa and Missouri, and taking in a corresponding part of southern Iowa and Nebraska and of northern Missouri and Kansas. South of this belt winter wheat takes the place of spring wheat and barley, and the Chinch-bugs, though present in considerable numbers, ceased to commit any very serious damage. North of this belt, also, notwithstanding that spring wheat constitutes a leading crop, the bugs became gradually less numerous, and a tolerable crop of this grain was harvested. And yet all through northern Illinois and the southern part of Wisconsin, these insects were numerous enough to damage the crop to some extent, and to excite the most serious apprehensions for the succeeding year.

"In order to obtain as correct an idea as possible of the amount of loss sustained by the agriculturist from the depredations of this insect the past year (1871), both in this and the northwestern States, I have made the following calculations based upon the statistics of the Department of Agriculture, with a reasonable estimate of the proportional damage caused by this insect to those crops upon which they depredate. All such calculations must necessarily be only approximately correct, and very loose and extravagant conjectures have sometimes been indulged in upon the loss caused by Chinch-bugs in former seasons of their prevalence. It has been my intention to keep within reasonable bounds, and by giving the figures in the case, I give others the opportunity to review my estimates.

"Taking the returns of the Department of Agriculture, for the years 1869 and 1870, for our guide, we may assume the present annual yield of wheat in the State of Illinois to be 30,000,000 of bushels, of oats 40,000,000, and of barley 3,000,000.

"The area seriously ravaged by these insects, comprised as we have above stated about the middle third of the State. This section would bear its full proportional third of the wheat and oats, and at least one-half of the barley raised in the whole State. This would give as the product of that part of the State ravaged by Chinch-bugs

10,000,000 bushels of wheat, upwards of 13,300,000 bushels of oats, and 1,000,000 bushels of barley. The proportion of these crops destroyed by Chinch-bugs, we have put at three-quarters of the wheat, one-half of the barley, and one-quarter of the oats. This will give as the amounts actually destroyed by these insects, 7,500,000 bushels of wheat, 500,000 bushels of barley, and in round numbers, 3,300,000 bushels of oats.

"If we make a cash estimate of this loss, by putting the price of wheat at one dollar a bushel, barley at fifty cents, and oats at twenty-five cents, we shall have an aggregate loss of upwards of eight and a half millions of dollars in the central third of the State of Illinois.

"In this estimate we have made no account of the injury done to corn throughout the State, nor of the damage to small grains north of the central belt. Here the calculation becomes much more indefinite, but I believe it will be generally admitted to be a low estimate if we add, for this purpose, one-quarter part to the above aggregate of loss. This will make the total loss caused by Chinch-bugs, in the State of Illinois, in the year 1871, upwards of ten and a half millions of dollars. If we assume an equal amount of loss for the two States of Iowa and Missouri combined, and another equal amount for the four States of Indiana, Kansas, Nebraska and Wisconsin, we shall have a total loss in one year, in the northwestern States, of upwards of 30,000,000 of dollars, from this one species of insect."

The fears excited by their abundance this year in reference to the fate of the crops in 1872 do not appear to have been realized, as the State was again comparatively exempt. In 1873 they commenced to increase again, causing considerable injury in some parts of the State. The following letter of complaint from a Southern Illinois farmer, published in the *Prairie Farmer* of October 18, 1873, is of interest in showing the various views as to the habits and characteristics of the species:

"I have, as a farmer, suffered from the ravages of the Chinch-bug for twenty-eight years; it has steadily increased in numbers. While at first it only injured oats and spring wheat, it now swarms in our cornfields and injures seriously the fall wheat. This summer it has attacked our meadows and pastures. In its early advent it appeared to spread from field to field by crawling over the borders, attacking hill after hill, or going from stalk to stalk of the growing crop; it now flies boldly and in swarms from one locality to another. Some years ago it was claimed that to sow a strip of buckwheat or Hungarian grass between the small grain fields and corn would keep them off the latter—at any rate, to not plant corn adjoining small grain would exempt the corn. Now, this is no protection, for they fly long distances and work on our crops from spring until late in the fall. I have seen corn not more than six inches high destroyed by them. Years ago it was generally thought, where I then resided, that we would have to stop raising spring wheat to get clear of them, as it was then the only crop they seriously injured; now we would have to make our land a desert to starve them out. In discussing the question at our club meetings it is strongly insisted by good farmers that the way is to make a general and combined burning of all trash in fields and

fence rows in the fall, and in the spring rake and burn clean all corn stalks, that it would at once abate, and finally eradicate them."

This brings our brief historical sketch of the species up to 1874, which is undoubtedly one of the most memorable in its history in the Northwest, and in reference to which I herewith present some original data not heretofore published.

Immediately after entering upon the duties of my office as State Entomologist, in 1875, I sent to the various counties of the state the following circular in reference to the Chinch-bug :

"DEAR SIR—Please do me the favor to answer the following inquiries, as far as you can, in regard to your county :

1st. Did the Chinch-bug do any damage to crops in your county last year ?

2d. Has it appeared any previous season within ten years, and if so when ?

3d. Did more than one brood appear last year ? If so give the dates at which each was seen ?

4th. What remedies and what preventive measures, if any, have been used ; and what the result ?

5th. Give an approximate estimate of the amount of damage done by them in your county in 1874."

6th. State what you can in regard to their migrations."

Quite a number of replies were received from those to whom these circulars were sent, from which I make the following quotations :

MONTICELLO, ILL., July 6, 1875.

\* \* \* The Chinch-bug did considerable damage to the small grain,—oats and wheat,—not so much to the corn, it having grown out of their way. It was quite abundant in 1872, 1873, and 1874, doing considerable damage in localities, especially to the oats and wheat. There were at least *two* broods last year, the latter in September, which appeared on the corn. They put in an appearance early in the season this year, but the extreme wet weather has given them an effectual quietus." \* \* \*

C. J. PITKIN, *Supt. Schools, Piatt County.*

EDGEWOOD, Ill., June 25, 1875.

"Answer to 1st question, yes.' To 2d question, 'yes;' more or less every year. \* \* \* Two broods appeared last year, first May 12th, and the second about Aug. 16th. We can check the first brood by plowing a narrow strip around the field and keeping it well pulverized by harrowing and rolling, then plow one or two furrows in this dusty strip. Do this every day or two—they cannot travel through dust very well. But with the last brood can't do anything, for the eggs are deposited everywhere."

SAMUEL BARTLEY, *Effingham County.*

MACOMB, Ill., June 9th, 1875.

"Answer to question 1. The Chinch-bugs did a great deal of damage here in 1873-4.

Question 3. There were at least three broods.



Question 5. Wheat and Oats were damaged at least three-fourths, Corn perhaps one-third."

J. M. DUNSWORTH, Jr.

The following letter is inserted in full, as it is a summary of the opinions of the members of an Agricultural Association, given after due consultation :

"BELLEVILLE, ILLINOIS, August 16th, 1875.

"After full discussion, and interchange of views by the members of the Farmers and Fruit Growers Association, the following answers were agreed upon in regard to the Chinch-bug.

1st Quest. Yes; to all crops including wheat, corn, oats and hay; corn being damaged at least sixty per cent.

2d Quest. It has been in the country for forty years, visiting different sections, principally the southern, but the greatest loss has been sustained within the past three years, since which time its depredations have been general.

3d Quest. It is believed that there are two broods; the first appearing in June, the other in the early part of August; but investigations have not been so careful, as to make our statement positive.

4th Quest. No general efforts have been made to exterminate the pest or prevent its ravages, unless burning the stubble fields, and in some few instances the sowing of strips of oats by the sides of the corn may be regarded such, and some good has no doubt resulted from both.

5th Quest. In estimating the damage done during the year 1874, that was increased by the unusually dry and hot weather, it would be safe to say that wheat was damaged 20-100, corn 60-100, oats 50-100 and hay 20-100, making a total of \$1,725,000.

6th Quest. In regard to their migrations, it may be said that they are seen in the first warm days of spring, generally on the wing, as if seeking suitable food, after coming from their places of concealment and protection during the winter; another migration occurs soon after the wheat is cut off; when they enter the oat and especially the corn fields, preying upon them until in the fall, when they are again seen in the air in their flight to the woods looking for suitable winter quarters, or coverts under the brush and trash in the fields or fence corners.

As a basis for the estimated loss I would say that the following figures are correct :

No. of acres in wheat for 1874.....	148,141
" " " " corn " " .....	66,142
" " " " oats " " .....	23,456
" " " " meadows " " .....	13,000

EDWARD WM. WEST,  
*Recording Secretary for St. Clair County.*

"PARIS, ILL., June 11, 1875.

"They appeared last season and the season before. There were three distinct broods; one quite early, perhaps the first of May; they were flying when first seen. The second, a brood of young, perhaps



it was the first or middle of June when they commenced to work; and a third brood came about the time corn was silking.\* No successful remedies have been tried; the most good was accomplished by plowing a ditch around the wheat field and drawing continually therein a large log. Some used a common roller where the bugs had to cross the road." (?)

HARDIN COUNTY, May 28, 1875.

"First brood was seen a short time before early wheat harvest, say last of May to last of June. Injured all wheat some, late wheat was much damaged.

"Second brood was seen when late corn was filling or in roasting ear, probably 1st to 15th August. Damaged all corn some, but late corn most. Nothing was done to prevent their damaging wheat. Some ditched with plow to prevent them from passing out of wheat into corn fields; this did but little good. Some killed them by rubbing them with their hands on the corn stalks; some scalded them on the outside rows to prevent them going into the corn.

M. ROSE, *County Superintendent.*

GREENUP, CUMBERLAND COUNTY, ILL., June 13, 1875.

"1st. The Chinch-bug did *very great damage* to the crops of this county last year, more perhaps than in any season for many years.

"2d. I think our county has not been entirely exempt from their ravages for any season within *twenty* years, and every season for at least five years it has done serious injury.

"3d. Many broods appeared last year. So soon as the weather became warm and settled in the spring, those that hibernated appeared in swarms, but just when the first brood commenced to hatch I do not know. They began to leave the wheat fields about the twentieth of June, and in about three weeks more they temporarily ceased their work of destruction on the corn; but I am of the opinion that after their first grand exodus from the wheat fields no more universal broods appeared. I think that from the middle of July till frost, and even after frost, bugs could be found in every stage of development at any time.

"4th. Few remedies, and those primitive and inefficient, and hardly any preventive measures have been used. Some farmers—myself among the number—plowed ditches and dragged heavy logs for days together, but the results were seldom encouraging. Some have ceased to sow wheat and the cultivation of Hungarian grass has been almost abandoned. A gentleman living in this county has invented what he calls a "Chinch-bug Trap." I am not altogether without faith in his device, and mean to give it a trial and will report results. If the trap proves to be a success the name of Lemman H. France will be enrolled among the benefactors of his race.

"5th. I am not prepared to answer this question; but I will make a careful inquiry, and then give you an estimate that I will try and make reliable. I may say, however, in a general way, that the annual

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\* As the last brood passes the winter in the perfect state and appears in the spring, there were really but two broods during the year.

damage done us by the Chinch-bug exceeds, by many times, the injury done us by all our other insect foes combined. Last year my own wheat crop was almost entirely destroyed, and my corn crop shortened fully three-fourths, though my corn was quite as good as the average of the county.

"6th. I have not observed their habits with sufficient care to enable me to state much in regard to their "migrations," but I am of the opinion that even with the perfect insect they are confined to very narrow limits. I have never known corn to be seriously damaged that was 80 rods from wheat, oats or Hungarian grass. The wingless ones will crawl 40 rods, at least, through weeds, flax or buckwheat, and they seem to go with unerring instinct in the right direction. Myself and some of my neighbors sowed no wheat last fall, and I have seen but few bugs this spring; but they are said to be in the wheat in myriads, and fears are entertained that they will commence migrating to the corn."

T. C. KILLIE.

The following communications from Professors Washburn and Ross, of Ewing College, Franklin County, are of sufficient interest to justify their introduction here :

EWING COLLEGE, ILL., June 4, 1875.

"3d. There were three broods in 1874. The first appeared in very great quantities about the last of May. The second in still greater quantities about the first of August. The third brood appeared about the middle of September. R. Richeson, Esq., says that a small brood was produced in April, an unprecedented event in the history of the Chinch-bug.

4th. Various measures have been used to check their ravages, but none have proved very successful. Some of the farmers in this vicinity burned their woodlands early in the spring to destroy the bugs that were hibernating in the leaves. We suppose they destroyed many but a vast number escaped that were harbored elsewhere. Ditching has proved most effectual in checking their migrations before they reach the winged state. Loose, well-pulverized dirt is left in a ditch about 18 inches wide by one foot in depth. This dirt being on the sides of the ditch and becoming hot and dry causes the bugs, in attempting to cross, to accumulate in large quantities in the bottom of the ditch. Then a smooth, straight log is dragged along in the ditch, which destroys them by thousands.

6th. Their migrations in the creeping state scarcely ever exceed 80 rods. These migrations are made in quest of food, as they do not go in any uniform direction. In their winged state they seem to scatter, seeking suitable places for depositing their eggs. If in this state they move in any general direction, it seems to be the result of prevailing winds.

After considerable care and attention, with the aid of our very observing and intelligent friend R. Richeson, Esq., who has been studying the Chinch-bug for many years, we are enabled to give the above answers which are respectfully submitted.

Prof Ross will supplement the above by giving some interesting facts connected with the history of the Chinch-bug."

“EWING COLLEGE, June 9, 1875.

“\* \* \* The increase in the devastating Chinch-bug may be accounted for in this way :

“There has been a constant increase in their numbers for the last twenty years. When we consider that our low prairie lands being drained and cultivated, our forests cleared up, our low-lands and swamps and marshy plains, converted into rich meadow lands and grass fields, there results from this an untold destruction of myriads of the Batrachian family—especially of the many varieties of frogs. The frog does no harm to the farmer; he lives upon beetles and insects of various kinds and he is known to consume the Chinch-bug with avidity, and his general destruction by the drying up of his ponds, pools and reservoirs of water and converting them into grassy plains has resulted in the multiplication of the myriads of the Chinch-bug by furnishing the latter grasses to eat and killing their natural enemies, the former. Another enemy of the Chinch-bug, is the birds. There has been for many years a gradual decrease in the Dentirostres and Conirostres, the Perchers, and also of the Rasores—the latter family especially are great destroyers of the various insects.

“Can we wonder then at the increase of the very beings created for their sustenance. If these are facts, and they certainly are, our remedy consists in the propagation of the enemies of the Chinch-bug.

“Recent observations prove that wet weather is very unfavorable to the Chinch-bug; and that a dry spring and summer are highly conducive to their development and multiplication. In Amherst county, Virginia, in 1832-3-4, there were vast numbers of them appeared in the spring, but wet weather and frogs kept them from doing any damage.

“In 1855 the Chinch-bug appeared in Franklin county in vast quantities, destroying much of the corn-crops, and the great numbers left in shock-fodder were supposed to kill many horses that died in the following winter and spring.

“In the spring of 1855 they hatched out in vast quantities in the wheat fields, prematurely ripening and badly damaging it, especially the late wheat. After harvest they immediately emigrated to the adjoining corn-fields, and great efforts were made to destroy them by hot water, chemical preparations and ditching—the latter proving most successful. The time of hatching their eggs is, in the first brood, about the first of June, the second brood about the first of August. If copious showers of rain fall at either of those periods much damage is done—both to the eggs hatching and the old Chinch-bug. This I am very confident of from a late experience.

“Within the last week we have had two heavy showers of rain. Before either of them fell, I examined very carefully the eggs, deposited about twelve or fifteen days ago. They were very abundant on nearly every stalk of wheat, always deposited within one or two inches of the ground, in the sheath close to the stalk. There were probably an average of 50 eggs on the stalk. This evening, four days after the first examination, with a good microscope of twenty-five diameters at hand, I examined the same field of wheat, at the same place of my first examination. I found but few old bugs, some of the eggs had hatched out, but by far the greater number of eggs were

washed down from their places, distorted in shape, sunken into the soil and many decomposed,—probably not more than one in ten of the first I saw had developed into a young bug. I examined many stalks and found no eggs at all. I could easily tell the eggs that were spoiled. Abundant evidence is at hand in proof of their destruction in the egg state by rain.

“Mr. Richeson has made the following careful observations: In 1859 Perry county, and the west side of Franklin county, had no rains about the time of the first hatching of eggs about June 1. The eastern part of Franklin, and the contiguous sections of Saline, Hamilton and Jefferson counties had abundant rains at this time. That year the Chinch-bug badly injured the crops of Perry, while excellent crops were made in the other counties. The same observation was made in Bond county in 1864-65. No rains occurred at this particular time and they were forced to send much stock to this county (Franklin). The following year, 1866, plenty of rain fell about the first of June in Bond county, and a double crop was made.

“The egg of a Chinch-bug is at first of a bone color, afterwards, of a reddish color, when the bug embryo can be seen as a red speck in the center through the transparent covering. At first he has a white stripe across him, afterwards he turns to a grayish-brown color. About the first of July he sheds his outer covering and appears as a winged insect. Then begins his routine of population, depositing his eggs and producing an August brood.

“His winter quarters are old rail fences, corn stalks, houseroofs, logs, leaves, etc. In spring, they feed on the nearest living vegetation, even before permanently leaving their winter quarters.

“They have been taken from ice, by thawing it, and when slightly warmed would manifest signs of life, crawling about as in spring. They thus appear to be able to endure cold or heat.

“With the abundance of rain falling this spring farmers may look for a good corn and oat crop. It is scarcely probable that any serious injury can be done by them now, especially by the first brood.”

G. C. Ross.

Numerous descriptions of the young or larva have been given, but that by Prof. Riley in his recent report is perhaps the most complete, and as it leaves nothing to add, being taken from fresh specimens and including the egg, I copy it here:

“Egg.—Average length .03 inch, elongate-oval, the diameter scarcely one-fifth the length. The top squarely docked and surmounted

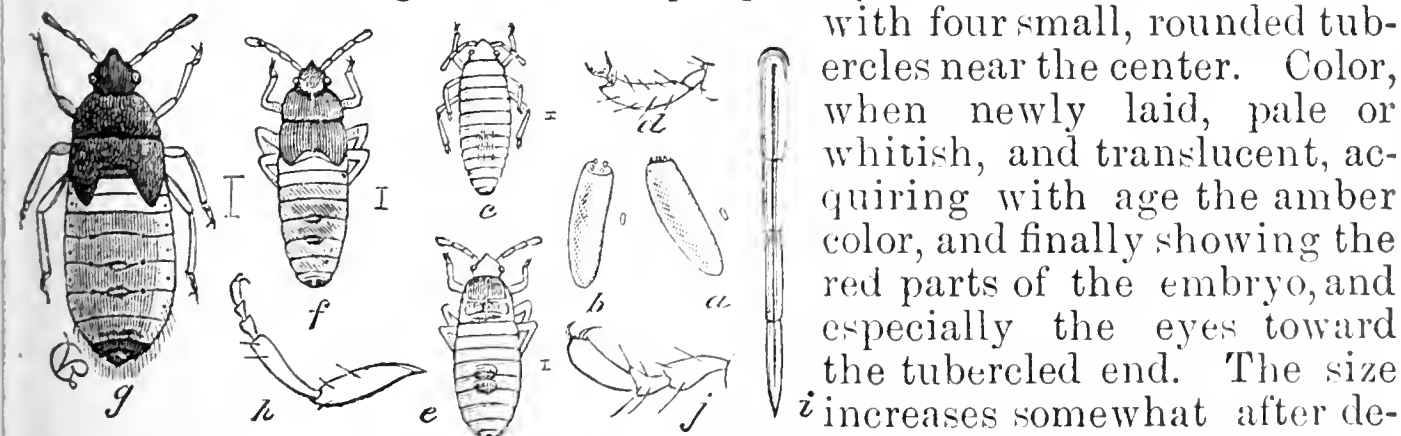


FIG 10. Chinch-bug, Larva, Pupa and Egg. *a* and *b* eggs; *c* young larva; *d* tarsus; *e* larva after first moult; *f* larva after second moult; *g* pupa; *h* leg; *i* the beak or tubular mouth. (See fig. 10, *a b*.)

with four small, rounded tubercles near the center. Color, when newly laid, pale or whitish, and translucent, acquiring with age the amber color, and finally showing the red parts of the embryo, and especially the eyes toward the tubercled end. The size increases somewhat after deposition, and will sometimes reach near .04 inch in length.



*Larval stages.*—The newly hatched larva (fig. 10, *c*) is pale yellow, with simply an orange stain on the middle of the three larger abdominal joints. The form scarcely differs from that of the mature bug, being but slightly more elongate; but the tarsi have but two joints (fig. 10, *d*) and the head is relatively broader and more rounded, while the joints of the body are sub-equal, the prothoracic joint being but slightly longer than any of the rest. The red color soon pervades the whole body, except the first two abdominal joints, which remain yellowish, and the members, which remain pale. After the first moult (fig. 10, *e*) the red is quite bright vermilion, contrasting strongly with the pale band across the middle of the body, the prothoracic joint [first behind the head] is relatively longer, and the metathoracic joint [third behind the head] shorter. The head and prothorax are dusky and coriaceous and two broad marks on the mesothorax [second joint behind the head,] two smaller ones on the metathorax, two on the fourth and fifth abdominal sutures, and one at the tip of the abdomen are generally visible, but sometimes obsolete; the third and fourth joints of the antennae are dusky, but the legs are still pale. After the second moult [fig. 10, *f*] the head and thorax are quite dusky and the abdomen duller red, but the pale transverse band is still distinct; the wing pads become apparent, the members are more dusky, there is a dark red shade on the fourth and fifth abdominal joints, and ventrally, a distinct circular dusky spot covering the last three joints.

*Pupa.*—[Fig. 10, *g*.] In the pupa all the coriaceous parts are brown-black, the wing-pads extend almost across the two pale abdominal joints, which are now more dingy, while the general color of the abdomen is dingy gray; the body above is slightly pubescent, the members are colored as in the mature bug, the three-jointed tarsus is foreshadowed, and the dark horny spots at the tip of the abdomen, both above and below, are larger.”

The characters of the perfect insect are so fully given in the descriptions by Say and Dr. LeBaron, already quoted, that it is unnecessary for me to repeat them here. I may add that the antennæ, which are not described, are a little less than half the length of the body, composed of four joints, the last being the largest. Dr. Fitch has also pointed out the following varieties:

“*a, immarginatus.* Basal margin of the thorax not edged with yellowish. Common.

“*b, dimidiatus.* Basal half of the thorax deep velvety black, anterior half grayish. Common.

“*c, fulvivenosus.* The stripes on the wing-covers yellow instead of black.

“*d, albivenosus.* Wing-covers white, without any black marks except the marginal spot. A male.

“*e, cipterus.* Under or true wings wanting, wing-covers much shorter than the abdomen.

“*f, basalis.* Basal joint of the antennæ dusky and darker than the second.

“*g, nigricornis.* First two joints of the antennæ blackish.

“*h, femoratus.* Legs pale, livid yellow, the thighs tawny red. Common.

“*i, rutipedes.* Legs dark tawny-red or reddish-brown.”



Prof. Riley adds another, *melanosus*, "in which the usual white of the wings is quite dusky and contains additional black marks at the base and toward the tips, and in which all the members and the body, except the rufous hind end of the thorax, are jet black."

It is but an act of justice to state that as early as 1845 (*Prairie Farmer* for Oct., 1845) Mr. J. Hadley gave the first brief description of the larval state, although brief and making no pretensions to scientific accuracy, yet the larval and pupal states are clearly indicated. (See his letter, page 42.)

Although the habits of these insects are somewhat fully indicated in the foregoing extracts, yet it is best that I should state them briefly here in a more connected order than given in those quotations. This is also necessary as some of the earlier statements and opinions have been found to be erroneous.

### *Number of Broods and Hibernation.*

It was known soon after the insect became troublesome that there were more broods than one, some, as Mr. Hadley, supposing there were "five or six generations." It is a quite common opinion, and is held by many to the present day, that there are three broods. This belief arises very naturally from the fact that those which hibernate appear in the spring to deposit eggs; the perfect insects from these are counted as a second brood, the fall brood being the third, according to this method of counting; but as will be seen by careful observation, those which appear in the spring are the same ones seen late in the fall.

Prof. Riley published the fact in 1866 that they are but two-brooded in the northern part of this State. Subsequent observations have shown this to be the rule in the other part of the State and throughout the Northwest. There is some evidence of an occasional third brood in the extreme southern part of the State, but not sufficient to justify me in asserting it as a fact, or to satisfy me of its correctness.

Insects may pass the winter as eggs, which is a very common method; as larvæ or young, which is rather unusual; as pupæ, which is a very common method in those orders where the pupa state is one of complete quiescence; and lastly, they may pass the winter as perfect insects.

The last method is the one adopted by the Chinch-bug. When cold weather comes on those of the fall brood leave the now dry and hardened corn stalks and seek secure places in which to remain during the winter. Occasionally they take flight at this time, but usually they seek the most secure places which can be found in and immediately around the field. Any rubbish left in the field, if of a nature to meet their wants, is eagerly sought; corn shocks, straw piles, stumps, logs, and fence rows are used as hiding places; they even hide beneath the clods when no better places can be found. But many move into the forest, grove or wood-land, if either happens to be near at hand. I have found also that the line of bushes along a little branch traversing the field is a favorite resort. Sheds, barns, rail fences, and stacks often furnish them with winter quarters.

During the winter they remain in a torpid or semi-torpid state, but are easily warmed into life and activity. As the cold weather becomes more and more severe they press deeper and deeper, if possible, into the inner recesses of their hiding places. They prefer dry quarters if readily obtained.

Whether the males survive in equal numbers with the females is a point not ascertained so far as I am aware, but I am of the opinion that the females are the more numerous.

Their time of coming forth in the spring depends upon the latitude and season. In a few instances in unusually early springs they have been seen as early as the middle or latter part of March in the southern end of the State; while on the other hand, in the northern part of the State in a late spring they have delayed their appearance until late in May, and probably even until the first of June. Usually they come out during the month of April in the southern and central part of the State. But it must be admitted that there is but little testimony on this point, as but very few of our farmers pay any attention to insects except when they become injurious or appear in immense masses. The Chinch-bug, when flying, would scarcely be distinguished by the unpracticed eye from a gnat. On this account our correspondence, and the printed and manuscript notes we have examined, make far more frequent mention of the first appearance of the young than they do of the spring appearance of the hibernating brood.

#### *The First Brood.*

Immediately after they come out of their winter quarters they pair, and soon the females commence depositing their eggs. Unfortunately for the farmer, nature appears to have made a special provision for them to adapt them to the vicissitudes of season and climate even in reference to oviposition. If compelled to deposit all their eggs at one time, an entire brood might be destroyed by a single drenching rain; but the female proceeds leisurely with her work, day by day she deposits a few, those in her ovaries developing as necessity demands; the process being carried on for two or even three weeks before it is completed. Each female, according to Dr. Shimer, deposits about 500 eggs.

As a general rule the eggs deposited at this time are placed just below the surface of the soil on the roots or lower part of the stem above the surface. The moisture of the soil at the time probably has something to do with the position, the higher being selected when it is damp and the lower when it is dry; the condition as to compactness or hardness doubtless has also something to do with the position selected.

The eggs are more liable to be affected by climatic influences than the perfect insects, and are soon destroyed by heavy rains. As an evidence of this I refer the reader to the statement of Prof. Ross, page 54. In about fifteen or sixteen days after they are deposited they commence hatching. The young insects, which have been heretofore described, without any apparent surprise at finding themselves in the land of the living, seem to be perfectly at home in their new situa-

ion, and, what is of far more importance to them, perfectly aware of the best means of supplying their natural wants. Without delay they at once insert their tiny beaks into the wheat stem on which they find themselves placed, and commence pumping out the juices on which the vigor and life of the plant depends. They are faithful workers, seldom allowing the little pumping machine to stop operation. As a necessary consequence their growth is somewhat rapid, and their jackets soon become too tight and they are compelled to strip them off or stop pumping; preferring the former, they cast off the old garment to make way for the new one nature has provided; or, in other words, undergo a moult. The Chinch-bug passes through four of these moults before reaching the perfect or winged state, varying in color and markings after each. "It is bright red with a pale band across the middle of the body after the first; somewhat darker with the merest rudiments of wing-pads after the second; and quite brown with distinct wing-pads, but with the pale transverse band still visible after the third."—Riley.

The entire process requires from five to seven weeks. It is not long after they acquire wings—a few days only—before they pair and the females deposit their eggs.

### *Migrations.*

Before the females of this brood deposit their eggs they leave their original quarters and migrate in search of a more abundant supply of food. When this movement takes place it appears to be a very general one, and not, as sometimes supposed, solely for the purpose of enjoying the season of their amours or for depositing eggs, though these may be and doubtless are often in part the cause of this movement. About this time the wheat becomes dry and hard, and no longer furnishes a supply of food; hence, they are necessarily forced to migrate or perish. Occasionally they take to flight, and this appears to be more common some years than others, depending to a great extent upon the state of the weather, and perhaps to a certain degree upon being the time of their amours, as suggested by Dr. Shimer. But the far more usual and almost universal method is by marching along the surface of the ground. As will be seen by reference to the foregoing extracts from replies to my circular, there appears to be no uniformity in the direction taken; in fact, they sometimes scatter and go in different directions from the same field, but as a general thing the masses take one direction, which is towards the nearest field of corn, oats or some other cereal or grass that is still in a succulent state. In most of the State where corn is the chief or second crop it is generally attacked. As the number of stalks to a given area is much less than in the wheat field the forces are concentrated, and each stalk of corn receives the bugs of perhaps a hundred wheat stalks. When the insects are very numerous the effect is soon visible.

In these migrations the insects are by no means all matured, often the majority have not advanced beyond the pupa state, but the want of nourishment forces them to "go west" or in some other direction in search of food. In all such movements mature and immature indi-

viduals will be observed. In some instances the numbers are so great that not only is the surface of the ground literally covered, but they are piled on each other. If disposed to fly, which is not often the case, it sometimes becomes necessary to protect the nostrils of the horses at work in the fields. Those who have never witnessed a movement of this kind have a very faint idea of the immense numbers of individuals there are, and the vast army of insects a single field of wheat has been feeding. Simply as a matter of curiosity I have made a calculation in order to ascertain the number of individuals on a given area. Suppose it to be the side of a field forty rods long from which they were issuing and that they covered the ground completely, but singly, for a width of one rod, this would give at least 175,000,000 individuals.

The brood which arises from the eggs which these deposit may be called the "fall" or "second brood," and is that which, in the perfect state, passes the winter.

#### *Natural Agencies which Assist in their Destruction.*

Many insects are subject to the attacks of other insects which are termed parasites. Unfortunately this little pest seems to be followed by no such relentless enemies as pursue the Army-worm, the Plant-lice, etc. Even the carnivorous species which wage such an incessant warfare against the rest of the insect tribes seem to have little or no taste for such an unsavory morsel as a Chinch-bug, and if we judge them by our own nasal organs we cannot blame them. Still there are a few that now and then prey upon them, but even these do not appear to follow up the work very vigorously. Among these we may mention as the most valuable, some species of Lady-bugs, as the Spotted Lady-bug (*Hippodamia maculata*. DeG.), the Trim Lady-bug (*Coccinella munda*. Say.) The former species is our most common Lady-bug, oval in form, of a brick-red color, with two black spots on the thorax and ten on the wing-covers. The latter is somewhat smaller, almost hemispherical; of a clay-yellow color without spots of any kind on the wings.

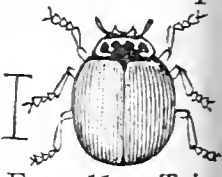


FIG. 11. Trim Lady-bug, enlarged, the line to the left is true length.

According to Dr. Shimer, the Lace-winged flies (species of *Chrysopa*) prey upon Chinch-bugs.

The Many-banded Robber (*Harpactor cinctus*. Fabr.) an insect with a curved beak and belonging to the same order as the Chinch-bugs, is occasionally found preying upon these insects. It is a little over half an inch long, of a yellowish color, having the legs marked with numerous narrow, dark bands.

The common Quail undoubtedly feeds upon these insects to a certain extent; and according to Prof. Ross and others, Frogs also consume a large number. But, after all, the aid derived from these natural enemies amounts to but little. The chief natural agency to which we may look with confidence for help against these foes, is moisture, especially in the form of heavy rains.

The testimony to the fact that rains destroy not only the young but the eggs and the perfect insects is too abundant to be any longer



a matter of doubt. So well known has this fact become that farmers throughout the State no longer have any fear of the Chinch-bugs in damp and rainy seasons. It is now well established, also, that dry weather is essential to their development in injurious numbers; and after studying their habits and history for nearly twenty years I am satisfied that for their development in excessive numbers two successive dry years are necessary.

### *Remedies.*

The following, from an article I prepared for the *Prairie Farmer* some two years ago, so clearly expresses my opinion on this point and on the subject of the preceding paragraph that I repeat it here without change:

As the bugs from which the future generations are to be developed hibernate in the perfect state, it is evident if these can be destroyed their development will be prevented. It should also be remembered that at this time their number is reduced to the minimum and that they are quiescent. I therefore, at the time I discovered their mode of wintering, suggested burning as a remedy, and am still of the opinion that, if properly carried out, it is the most effectual one that can be adopted. I am aware that Dr. Le Baron (whose opinion as an entomologist is always entitled to the highest consideration) appears to have some doubts in regard to the value of this remedy; also, that Prof. Riley (whose opinion is equally valuable), although recommending it, appears to place it second in his list of means of counteracting them. Yet a careful examination of the evidence they present, when compared with my own observations and other testimony, has failed to change my opinion. Irrigation, if it could be thoroughly carried out, would be the most effectual; but this cannot be done in Illinois; and although theoretically the most complete remedy, is practically of but very little value.

As is well known, they hide during winter in cornstalks, straw, rubbish, under the bark of stumps and logs, etc. When abundant in timbered sections, many winter in the bark of trees, under the leaves and other places in the forest, but so far as I can learn, no one in this portion of the State has ever noticed a general exodus from the fields to the forest in the fall; but, on the contrary, those who have noticed them most carefully, bear testimony to their aversion to flying. While the cases given by Dr. LeBaron, Dr. Shimer and Prof. Riley indicate that cold may kill them, on the other hand Prof. Ross mentions a case in which some were thawed from ice in which they had been frozen, and moved about as in spring, and I have found them in the coldest weather of winter semi-torpid but easily revived. We must therefore consider these cases as presenting opposite extremes.

It is quite probable that the method of harvesting corn by cutting the stalks and standing them in shocks or ricks is one means of preserving them. Leaving piles of straw and other rubbish in the fields affords them winter quarters from which to issue the following spring to trouble the farmer. And if we add to these, grassy fence corners and spots in and around the fields, we need not wonder when we see



them abundant in spring where they were hid during the winter. Before the prairies were settled and cultivated, this insect may have existed here, but if its multiplication was prevented by the annual burnings of the prairie grass.

In order that this remedy may be effectual, it must be followed out thoroughly, and all the farmers in the infested district must act in concert, otherwise the labor of one will be rendered valueless by the neglect of another. But this need not be done annually, as our knowledge of the habits of the insect is sufficient if properly used, to give us warning of the danger to be apprehended. I do not believe these insects ever appear in vast and destructive numbers without giving indications of their coming the previous season. This may be doubted by some, yet several years study of their habits has led me to this conclusion; and the facts derived from numerous farmers, with whom I have conversed on the subject, point in the same direction. How often do we hear it said, when they are destructive: "There were some last year, but not enough to do any great damage." The warning was given but not heeded.

If moisture has a tendency to destroy them it is evident that in the winter following a rainy season they will be reduced to a minimum in respect to numbers, and although the following season may be favorable to their development (that is, dry,) they cannot increase to the same extent possible when two favorable seasons come in succession. The second brood may excite some alarm, but it is apparent that four successive broods without any counteracting influences to check them will produce more than two broods. We may, therefore, safely conclude that so far as the copious rains of the present season have extended, there need be no fears of the corn being attacked, and unless the fall is quite dry, there need be no serious apprehensions in regard to next season;\* and I do not think they will appear in very injurious number for at least two or three years to come.

If the season has been dry and an examination (and farmers should be careful to make close and thorough examinations) in the fall shows them to be present in considerable numbers, although they may have done no material injury, nor even attracted attention, yet it may be set down as probable, in fact almost certain, that if the next is dry, unless killed by an unusual winter, they may be expected in destructive numbers. It is true they sometimes appear in great numbers when no complaint has been made the previous season; but if a careful examination had been made, the numbers hidden from the cursory glance would have excited surprise. This I know from personal observations made during winters preceding their visitations.

If an examination reveals their presence, the work of destruction should commence. First, some other method of harvesting corn than cutting it up should be adopted, at least it should not be allowed to stand in the field; the stalks and rubbish should be burned and every hiding place as far as possible should be subjected to the fiery ordeal. Limited areas which cannot be reached by fire where it can be done, should be thoroughly and repeatedly drenched. In timbered sections it would be wise to fire the leaves of the surrounding forests as soon as possible after they are sufficiently dry

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\* Since this was written the result has verified the prediction.

There must be concert of action on the part of all the farmers in each neighborhood; as soon as the pests are noticed by one, warning should be given to others, and a systematic attack should be made. The grangers and farmers' clubs, organized throughout the country, afford an excellent means of obtaining this concert, as well as giving timely warning of the appearance of the pest.

As a general thing, farmers wait until the enemy is upon them in full force before they ask for advice. While the entomologist may and does sympathize with them in their troubles, yet he is nothing more than a man, possessed of no superhuman power. The advantage of his scientific knowledge does not consist in inventing means of destroying devastating hordes, but in devising means, from his knowledge of the habits of the species for preventing their development.

Dr. LeBaron discusses somewhat fully the different proposed remedies, but unfortunately the report that contains the article does not appear to have been generally distributed and is now out of print. I have therefore concluded to give the following somewhat lengthy quotation from his article.

As will be seen, he does not place the same reliance upon burning that I do. Still I have not, as yet, seen any reason to change my opinion, the only matter of doubt in my mind being as to the most propitious time. It is quite probable that the fall, before they have left the fields, will be the best time. This is a matter yet undetermined.

*The Plan of Sowing Grain so early in the Spring as to get in advance of their depredations.*

"The well known fact that winter wheat generally matures before the young brood of Chinch-bugs makes its appearance, and thus escapes their ravages, naturally suggested the idea that the same end might be accomplished with respect to spring wheat, if the seed could be got into the ground very early in the spring. However plausible this supposition may appear, the experiences of the past season would seem to show that any reliance based upon it must prove, in a great measure, fallacious. Notwithstanding that the last spring was dry and favorable for the early sowing of grain, and notwithstanding that it is universally understood by farmers that the earlier wheat can be sown the better for the crop, and therefore it may be presumed that wheat was sown unusually early, yet the result could scarcely have been more disastrous. I am not prepared to say that nothing can be gained by this course, but in view of the experiences of the past season, I do not see how we can place much reliance upon this method of escaping the ravages of the Chinch-bug.

"In this connection we may advert to the plan of sowing certain stimulating substances, such as salt and lime, with the seed for the purpose of hastening the growth and the ripening of the grain. It has also been supposed that a pretty heavy dressing with such materials might render the soil obnoxious to the bugs. I have known of attempts being made to protect corn from the bugs, by the application

of salt and air slacked lime, but without any visible effect, and it is not probable that any quantity of such substances which we could reasonably apply to the soil would be effective in preserving our crops from these insects. But in the other point of view, that of hastening the ripening of the grain and thus placing it in advance of the depredations of the bugs, this plan seems to me to be well worthy of a trial. I was informed by a farmer living in Dixon, that he tried sowing salt with his spring wheat, at the rate of one barrel to two and a half acres, and that upon the field so treated, the crop was much larger than on the other portions, and ten or twelve days earlier. The effects of the salt will differ, of course, to some extent, like other applications, according to nature and condition of soil.

*“The attempt to save a part of our crops by preventing the migration of the bugs from one field to another.*

“It is well known that when the small grains become too mature and dry to afford nutriment to the chinch-bugs they migrate in vast numbers into the adjoining cornfields, and generally destroy from a half dozen to a dozen or more of the outer rows, and nothing but the great extent of the fields of the West, and the exuberance of the plants, which at this time have nearly completed their growth. preserve the corn crop from the same destruction which has overtaken the smaller grains.

“As this migration takes place before the young brood have acquired wings they necessarily travel on foot, and various attempts have been made to intercept their progress. The principal of these are a succession of furrows plowed across their path, and a barricade of fence boards besmeared with coal tar or kerosene oil. The first plan, but very partially successful, is so simple and easy of execution that it is always worthy of trial. I was informed by some farmers who practiced it the past season, that it very materially checked their progress for the first day or two, so long as the furrow was fresh and the earth friable; but that a shower of rain or heavy dews for a succession of nights so consolidated the earth that the insects could pass over.

“The other plan is much more effective, but also much more troublesome and expensive. It consists of a barricade of fence boards placed end to end and set edgewise into the ground, with the upper edge besmeared with some offensive substance, the one most commonly used being coal-tar. This method has been extensively resorted to the past season in the central part of the State, and especially in the neighborhood of the Bloomington gasworks where the coal tar is extensively manufactured. I was informed by one of the proprietors of the gas works that nearly one hundred and fifty barrels of tar had been purchased at that establishment for this purpose. I had an opportunity of seeing this method put in practice, on a large scale, on the farm of Mr. Joshua Sells, of Bloomington. At the time of my visit Mr. Sells had discarded the boards as an unnecessary trouble and expense, and had adopted the simple and more expeditious plan of running a stream of tar from the spout of an old teakettle directly upon the ground along the exposed sides of his cornfields. He found

that a gallon of tar would extend about ten rods, so that a two-gallon kettle twice filled would furnish a strip of tarred ground the whole length of a forty-rod cornfield. The tar had to be renewed every other day, and oftener in case of rain. The insects would crowd up to the line in such numbers that in many places they would pile up from half an inch to an inch deep, and could be scraped up by the double handful. But so long as the tar was kept fresh not a bug would cross it. They were not prevented from crossing by the adhesive nature of the tar but by its repulsiveness. The bugs would not touch it. They were destroyed by conducting them into perpendicular holes, or by shoveling them in and burying them. The usual price of coal tar at the gasworks is about two dollars a barrel. This is the most effective means yet resorted to for intercepting the progress of these insects when in the act of moving from one field to another; but the trouble and expense of using it, especially at a distance from the places where the tar is manufactured, will probably prevent its ever being very generally practiced. The great deficiency of all such methods as a remedy for the chinch-bug is that, at best, they only protect that crop which is usually the least damaged by them.

*“The method of destroying the insects by burning corn-stalks and other rubbish in which they are supposed to hibernate.”*

“We have just adverted to the fact that when the small grains fail the Chinch-bugs migrate into the corn, and that at this time they travel on foot and confine themselves mostly to the outer rows. But shortly after this the young bugs acquire wings and then spread themselves over the fields in large flocks. It is a question of considerable importance, and one to which but little attention has been paid, whether these insects materially damage the corn crop after this general scattering of themselves, in the latter part of summer. From the circumstances of the case, this question does not admit of a very easy solution. The fact that these insects require comparatively little nutriment after they have attained their winged and mature state, taken in connection with the vast extent and luxuriance of the western corn-fields, and with the additional consideration that the crop, being at this time considerably advanced, the loss would be only comparative and therefore not easily discriminated; all this tends to involve the subject in much uncertainty.

“Mr. Geo. W. Patten, of Delavan, Tazewell county, at whose house I visited in the height of the Chinch-bug season, actively co-operated with me in the determination of this and other matters appertaining to these destructive insects. Mr. Patten took the pains to visit many of the farmers in his own and the neighboring counties, all of which were badly infested, for the purpose of making inquiries upon this point. He found it to be the general opinion that the bugs had damaged the crop very sensibly. As the whole State has suffered severely the past season for the want of rain, there was the additional difficulty in this case of distinguishing between the effects of the drouth and that caused by the bugs. The insects themselves, however, fur-



nish a key to the solution of this difficulty, by virtue of their gregarious habits. It appears that they do not scatter themselves indiscriminately over the field, but that they move in large flocks, not unlike their fellow depredators—the blackbirds. Accordingly the cornfields are found to be damaged in patches, and it is thought to a sufficient extent to materially diminish the crop.

“This general diffusion of the Chinch-bugs over the corn fields after midsummer, taken in connection with the common observation that they remain there until late in the fall, has naturally suggested the expediency of gathering the stalks together and burning them, after the corn has been harvested, with the view of destroying the bugs. It has also been advised, in order to make the remedy more sure, to burn the dead grass and other rubbish which accumulates around the borders of fields and fences. My own observations have led me to the conclusion that this remedy also, in the way that it would be likely to be generally put in practice, can be of but little avail. Upon examining an infested corn field late in October, I found that the bugs had left the upper part of the stalks and had collected about the one or two lowermost joints, under the sheaths of which they were congregated. They had gone thither, partly perhaps to avoid exposure to the cold winds of approaching winter, but chiefly, no doubt, for the sake of the nutriment which they could still extract from the lower joints of the stalks after the upper ones had become dead and dry. Upon visiting the same field a month later, (Nov. 22), after winter had virtually set in, the mercury standing  $15^{\circ}$  above zero, the ground whitened with snow, after cattle had had the range of the field, very few bugs could be found. A few were found in deep cracks in the stalks, and a few were lying torpid upon the ground close to the roots of the corn. Upon digging up a number of hills no bugs could be found beneath the surface. Where the great majority of them had gone was not apparent. It is known that some of these insects hibernate under boards and flat stones, lying loosely upon the ground, and similar situations. Dr. Shimer found many of them under the fallen leaves of apple trees, but nearly half of these were dead. I have heard of their being seen flying in flocks towards the woods late in the fall. I cannot vouch for the truth of this, but I found them this fall in small numbers under the loose bark of prostrate logs, in the edge of the woods, half a mile from any tillage land. I also found them congregated on the under side of some flat stones lying upon stubble land. Within a few rods from them was a ravine filled with long dead grass, but I could find no bugs amongst the grass. It is proper to say, however, that this last was not a badly infested locality.

“With the view of obtaining further observations upon this part of the subject, still later in the season, and especially in the badly infested district, I wrote to my friend Mr. Patten, whose assistance I have above been happy to acknowledge, and requested him to examine some of the corn fields in his vicinity. From Mr. Patten’s reply, under date of Dec. 20, I extract the following valuable observations :

• “Since the receipt of your letter, I have at different times examined corn stalks with a view to finding Chinch-bugs, but have not succeeded in finding a live one. I have a piece of ground sown to fall wheat, from which I had carried what few stalks of corn the bugs



had left standing, and had thrown them in heaps along the edges of the field. These heaps I have been examining, and have always found large numbers of dead bugs, but no live ones. To-day it occurred to me that perhaps by bringing them into a room of proper temperature they might show signs of life; but after giving them a fair test I have been unable to bring any to life. In all shocked corn that was put in shock before the frost killed the corn, I find large numbers of dead bugs, from the ear down. In later cut corn they do not seem to be so numerous. In the stalk fields I find very few bugs, either dead or alive. To-day I chopped up stalks by the roots, examining each sheath, from the ground up; then opened the stalks, both sound and fractured ones, but found nothing that could be recognized as ever having been a Chinch-bug. That the bugs disappeared from their usual haunts upon the approach of severe cold weather, I am fully satisfied, but where they now are I have failed to ascertain. The first thought is that they have gone below the surface of the ground; but when we consider that our cold weather came so suddenly upon us that the first night the ground was frozen to the depth of three or four inches, it hardly seems possible that the Chinch-bugs could have penetrated it.

“Mr. Patten made the following curious observation bearing upon the hibernation of these insects:

“‘About the time of our first frosts, while gathering hazel nuts in the timber, I observed that in nearly every instance where a nut had been bored into by an insect or grub, from one to four Chinch-bugs had found their way into the nut. Whether they were there for winter quarters, or were feeding upon the partly consumed nut, was a question which I could not solve.’

“Mr. Patten concludes his letter with the following practical remark:

“‘As to burning the stalks with a view to destroying the Chinch-bugs, I have but little faith in it. Could the stalks be burned before excessive cold weather sets in, very probably a large portion of the bugs could be destroyed, but by the time the corn can be harvested and the stalks are dry enough to burn, the Chinch-bugs have taken to their legs or wings, and left for parts unknown.’

“What strikes us as remarkable in these statements of Mr. Patten is that all the Chinch-bugs which he discovered appear to have been dead. The question arises, did they die a natural or unnatural death? Had they arrived at the natural term of their lives, or were they killed by the sudden accession of cold weather, or by some other and unknown cause? As many of these insects were found in tolerably well protected situations, that is, under the sheaths of cornstalks which had been laid in piles, it does not seem probable that they could have been killed by the first cold snap of winter. The most plausible explanation of the case I can give, is, that these dead insects were the old bugs of former broods which had arrived at the end of their natural lives, whilst the instincts of the new brood, which are to perpetuate the race in the succeeding year, had led them to seek out more secure and permanent retreats.

“From all this we conclude that late in the fall, and when winter is about to set in, Chinch-bugs, like most other insects, seek secure and

hidden retreats where they will not be exposed to the snows of winter, nor the cold rains of the fall and spring, and therefore that the burning of corn stalks or other loose rubbish, late in the fall, will destroy but a very small proportion of them. The only way to accomplish this end to any considerable extent, would be to husk the corn as early as possible, and then cut off the stalks close to the ground and burn them. But even here it is very questionable whether the bugs would not leave the stalks before they were dry enough to burn. But in any event, the plan is scarcely available in actual practice. In the first place, most farmers depend upon their stalks for fall feed for their cattle; and if a farmer should conclude to sacrifice his stalks for this purpose it would insure him no immunity from the inroads of the insects in the spring, from surrounding localities.

“It may seem to be poor encouragement to show that the plans and preventives upon which we have been taught chiefly to rely, for checking the ravages of this formidable insect, are of little real efficacy. But it is best to know the truth, and to see the evil in its true proportions. The first step to take, in meeting a real danger, is to divest ourselves of all false securities.

*“The prevention of their breeding to any serious extent, by abstaining from the cultivation of those grains upon which they chiefly subsist.*

“If then our supposed remedies for the Chinch-bug prove in a great measure fallacious; if experience shows that we cannot get our grain into the ground so early but that the bugs will be even with us; if plowed furrows and tarred barricades can only be resorted to when most of the mischief has been done; and if these insects hide themselves so securely, in the winter, that burning cornstalks and other rubbish can destroy, at best, but a very small proportion of them; and, finally if their natural enemies are so few as to make no perceptible impression upon their countless hosts; then we are driven to inquire, with the more earnestness, whether we can take a step in advance of all these imperfect palliatives, and absolutely prevent the breeding of these noxious insects, to any serious extent, by abstaining from the cultivation of those crops which are most congenial to their nature. It may seem a hard alternative to give up the raising of some of our most valuable crops, at the behest of these nauseous *Hemiptera* but a hard remedy is better than no remedy. It is better to save your labor and your seed, than to lose seed and labor and harvest likewise.

“What then does experience teach us with regard to the breeding habits of these insects, and the plants upon which they mostly subsist?

“When the warmth of spring has become sufficiently confirmed to penetrate the hidden recesses where insects hibernate, many different species which have wintered over, in the winged state, are seen emerging from their retreats, and launching out upon the vernal air, apparently rejoicing in their new lease of active existence. Among these in the localities where they prevail, the Chinch-bugs are to be seen, flying in dense flocks, in search of the plants at the roots of which it is their instinct to deposit their eggs. Mr. Sells, of Bloomington,

informed me that whilst plowing about the first of May his clothing and his horses were thickly sprinkled over with them, and that the horses were seriously annoyed in breathing by the bugs flying into their nostrils. These insects deposit their eggs at the roots of our cultivated cereals, and some of the grasses which most nearly resemble them. As the Chinch-bug is a native insect it must have subsisted originally upon the native grasses, before the cultivated cereals were introduced. The Chinch-bug was then a rare insect, only occasionally met with by collectors. Mr. Thomas Say, who spent twenty years in collecting and describing insects, in many parts of the United States and their Territories, first described the Chinch-bug, from a single specimen, and the only one he had ever seen, and which was captured in the eastern part of Virginia. But there is no difficulty in obtaining specimens now. We have, ourselves, been the means of their excessive multiplication, by furnishing them with a superabundance of congenial food in the shape of our cultivated grains.

“But the question now before us is, upon which of these grains do they thrive best, and will they thrive sufficiently upon all of them to multiply to a serious extent, or are they restricted in their food plants to such a degree that we have it in our power to get rid of them at any time by abandoning the cultivation of some one or more of these grains.

“It seems remarkable that these insects should make a selection between plants so similar, both in nature and appearance, as are several species of what are known as the small grains. Yet abundant experience has taught us that they do make a very decided selection. It is known that they always give a strong preference to spring wheat and barley, where these are at hand. Where these two grains are not available, they will oviposit upon either of the others, and perhaps to about an equal extent. We know this from the fact that all of these grains are sometimes considerably injured where Chinch-bugs abound, and the chief reason, probably, why winter wheat does not suffer as much as spring wheat, is that this crop gets nearly matured before the new brood of bugs makes its appearance; and accordingly we sometimes see late pieces of winter wheat almost as much damaged by them as the spring wheat. But the main question is, whether if no spring wheat or barley be raised, the Chinch-bugs will continue to thrive and multiply to excess upon any other kinds of grain. The general opinion is that they will not. And yet a sufficient number of exceptional cases occur to throw some doubt upon the matter, and to induce some farmers to hold the opposite opinion. Chinch-bugs are, in some years, found in considerable numbers in the southern part of this State, where the winter grains exclusively are raised. A number of cases, also, like the following, have come to my knowledge: Mr. D. Veatch, of Livingston county, stated to me that winter wheat, oats and corn, were all seriously damaged in his neighborhood, though but little spring wheat was raised; and on his own farm, a field of thirty-six acres of oats was not worth harvesting, though no spring wheat had been raised in its vicinity for the last five years. And a somewhat similar case was related to me by a Mr. Vail of Tazewell county. More definite testimony is needed upon this subject. My opinion, from my present knowledge, is that such cases are rare and

exceptional, and perhaps could be easily explained if we knew all the circumstances.

“From the foregoing observations we draw the following practical conclusions :

1st. That it is useless to attempt to raise spring wheat or barley where Chinch-bugs have been present in any considerable numbers the preceding year, unless we have reason to believe that they have been killed off by heavy rains.

2d. That in case the season should be favorable to the propagation of the Chinch-bug we always have it in our power to get rid of these pests by the abandonment of these two kinds of grains for one or two years. But to make this course effective there must be a concert of action by farmers over a considerable section of country.

3d. That the presence of Chinch-bugs the preceding year will not prevent the raising of corn or any of the winter grains.

4th. With regard to oats, the testimony thus far is that if this grain be sown where Chinch-bugs abound, and especially if it be sown exclusively, it will be damaged to a greater or less extent the first year, but that the bugs probably will not continue to breed in it to any great extent in succeeding years.

#### *“Other Proposed Remedies.*

“It may be proper before closing to advert briefly to a few of the more plausible of the other remedies for the Chinch-bug which have been suggested. It has been proposed to burn over the infested and ruined grain fields just before the time for the bugs to leave them, with the view of destroying the bugs and thus preventing their migration into the corn. This is a good suggestion, provided the grain is dry enough to burn before the bugs leave it ; and, also, provided it will burn low enough to kill the bugs, which in this case would all drop to the ground. The plan would be most likely to succeed by the aid of dry straw and favorable condition of wind and drouth.

“Another plan which has been proposed is to sow a small proportion of winter rye (one bushel to twelve) with the spring wheat, with the expectation that the bugs would feed upon the green rye near the ground, whilst the more rapidly growing wheat would rise above it and come to maturity. This suggestion is founded upon the mistaken notion that the Chinch-bugs feed upon the green blades of the grain, whereas they imbibe their nutriment, first from the roots, and afterwards from the lower joints of the stalk.

“The well attested fact that Chinch-bugs are checked in their operations by rain, induced Dr. Fitch to advise the sprinkling of wheat fields—or at least those parts of them where the bugs first made their appearance—with water by means of a garden engine, or some other contrivance. This would be an interesting experiment where the field is very small and the supply of water abundant ; but we presume the Doctor would hardly recommend this plan as practicable on the forty thousand square miles of territory overrun this year by Chinch-bugs at the west.



"All the attempts to check the depredations of the Chinch-bugs, by throwing offensive substances upon them, such as tarred saw-dust, salt or lime, have proved to be labor lost. The recommendation of salt application had the run of the newspapers the past season. Both this and the air-slaked lime were thoroughly tried by Mr. Sells, of Bloomington, without making any perceptible impresssion upon the bugs."

I most heartily agree with Dr. LeBaron in regard to topical applications; any thing short of something that will destroy the crop will fail to destroy the bugs, except water. After they have once entered the grain field in full force there is nothing which has yet been suggested that will destroy them except submerging in water, unless it be some such agent as fire, which as a matter of course destroys the crop. When they attack the corn it is possible by great labor and expense to keep them down with hot water carefully applied. It is possible that while on the wheat they may be destroyed by fumigating with sulphur, tobacco smoke, or the fumes of some substance of this kind. But all such remedies are impracticable.

The suggestion by Dr. LeBaron to refrain from planting certain crops is one not likely to be put into practice even should it appear by experience to be a somewhat effectual remedy. But as it would certainly not cause the pest to become extinct, the remedy is too costly when the chances that the pest will not appear the very season the measure is adopted, are about equal to those that it will be abundant, the result in this respect depending on the character of the season.

Clean farming is the best under all circumstances, and if adopted as a rule will tend largely toward preventing the increase of Chinch-bugs. Preparing the ground and rolling it well after planting will also aid in the same direction. But one of the best methods to prevent their increase, is diversified farming. Massing crops in immense bodies and cultivating the same thing year after year necessarily tends to increase the insects that feed on these crops. So long as this violation of natural laws, and I might say the true theory of the farmer's profession and life is continued, so long will it be necessary to war with increasing hosts of insect foes. Enlarging farms and increasing crops will of necessity bring these evils; reverse the system—divide the farms and diversify the farming—and it will be far less difficult to cope with the insect foes. But it is perhaps more difficult to bring this state of things about than to put into operation Dr. LeBaron's suggestion.

#### PLANT-LICE—(*Aphidæ*).

So far only one species has been detected injuring corn, to wit: the corn Aphis (*Aphis maidis*. Fitch.); but as it is my intention to treat this family in my next report, in addition to the species mentioned, will give here a brief account of the different kinds of Plant-lice

and introduce some cuts to illustrate their distinctive characters. Notwithstanding these insects are so common, yet I find that there are many persons even among our farmers who appear to be unable to distinguish them by their common name of *Plant-lice*. But it would seem to me that there is scarcely an individual, old or young, who has paid any attention to plants during the summer, that has not observed upon the leaves or stems, twigs or bark, minute soft-bodied insects busily engaged in sucking the sap with tiny beaks, usually without wings and generally huddled together in little groups. On account of their somewhat strong resemblance to certain other unpleasant insects sometimes found on the human head, and their parasitic habits, they have by common consent received the very appropriate name of *Plant-lice*. There is scarcely a plant in the vegetable or flower garden, a bush or tree in the yard, orchard, nursery, vineyard, grove or forest but what, at some time, is infested by these insects.

On account of their great similarity in appearance and habits as seen by ordinary observation, it would be thought impossible to find sufficient distinction to separate them into different groups, except into the two divisions, the woolly and those not woolly, as often characterized by horticulturists. But this is so far from correct that I have concluded to introduce here a short description of the characters by which the groups may be distinguished that our farmers may be able to distinguish more closely between their minute insect enemies. And I do this now because through the liberality of our State officers I have been enabled to prepare some engravings by which I can furnish cuts to illustrate these differences.

The term *Plant-lice* in its broadest sense has been used to embrace three different families of insects, belonging to the sub-order HOMOPTERA. This has been done on account of their similarity in several respects, such as the following:

1st. In having the mouth formed for sucking, by being prolonged into a slender, horny, jointed tube, which arises far back under the breast, apparently between the front legs.

2d. In not undergoing a complete transformation as do beetles, butterflies, etc.; the larva and pupa, or in other words the young, being similar in form to the perfect insect.

3d. In having but two joints in the tarsi or feet.

4th. In having the antennæ longer than the head and composed of filiform or cylindrical joints.

5th. In the fact that the winged individuals always have four wings.

6th. In the fact that all live upon the juices of plants.

7th. In their small size, no species of our country exceeding one fourth of an inch in length of body, while many fall considerably short of one-tenth of an inch.

Although agreeing in these respects the species belonging to the three families alluded to—which are named respectively, *Psyllidæ*, *Aphidæ* and *Aleurodidæ*—may be readily distinguished from each other by the following brief characters. The *Aleurodidæ* look almost exactly like very minute moths, the wings being broad and shaped like those of a little moth and more or less powdered or mealy, which ad-

to the resemblance. Very few species of this family have been discovered, and so far they have never been known to be injurious in this country.

The insects belonging to the family *Psyllidæ* bear a strong resemblance to the true Plant-lice, having much the same form and somewhat similar, transparent wings. The differences may be understood by comparing the annexed figure of *Psylla pyri* with figures of true Plant-lice shown further on. The antennæ are split into two slender bristles at the tips; the front wings have one principal vein which divides near the base into three branches, each of which again forks, and the hind wings have several radiating veins; the head is as broad as the thorax, and the abdomen is small compared with the rest of the body. In addition to these characters they also possess the power of leaping, and hence have been named "Jumping Plant-lice."

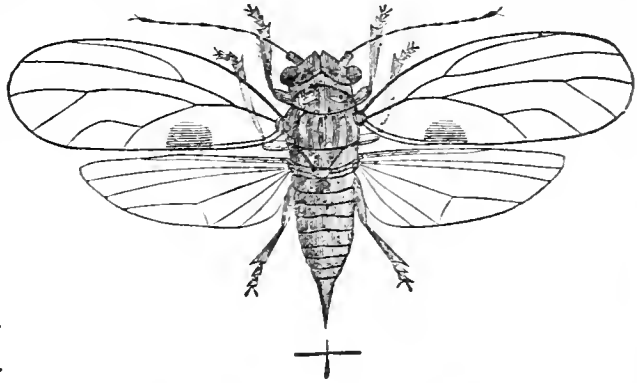


Fig. 12. *Psylla pyri*.

The *Aphidæ* or true Plant-lice do not possess the power of leaping; the antennæ are without the two bristles at the tip, but the terminal joint is often slender and bristle-shaped, and they usually contain six or seven joints, but are sometimes reduced to five or even three; sometimes they considerably exceed the body in length, but are sometimes much shorter. The wings are very delicate and membranous,

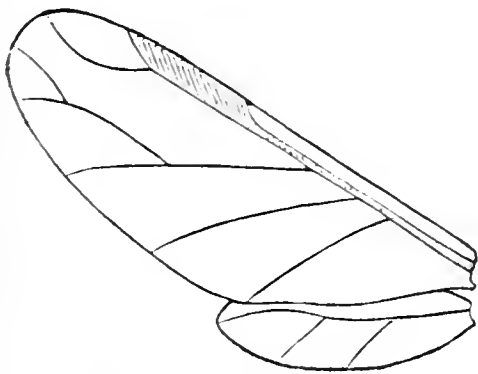


Fig. 13. *Aphis mali*.

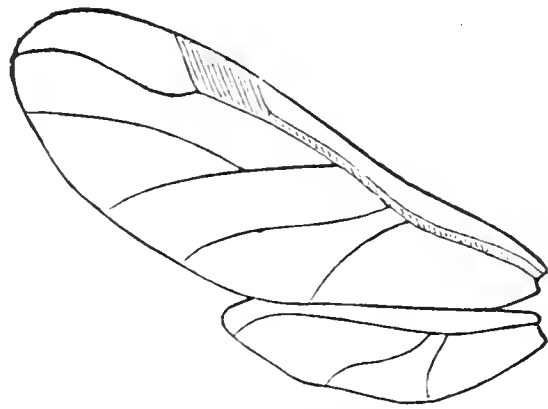


Fig. 14. *Schizoneura vagans*.

and usually transparent; a strong rib or vein courses along near the front which, in the typical species, sends off three branches running obliquely backwards toward the hind margin; the outer or third branch usually gives off near its middle a fork running toward the tip which often again forks before reaching the margin, as in Fig. 13. In some species there is but a single fork, as in Fig. 14; in others the third branch is simple and not forked, as in Figs. 15 and 16; in some species the third branch vein is wholly wanting, as in Fig. 17.

The hind wings usually send off two posterior branches from the rib-vein, as shown in Figs. 13, 14 and 15; but in some instances there is but one, Figs. 16 and 17, and in one group there is no branch vein.

As a general rule the wings when at rest are placed above the back in the form of a very steep roof, but there are some species in which they lie horizontally on the abdomen when at rest.

As these differences in the antennæ and wings correspond with certain constant differences in habits, entomologists have used them for the purpose of dividing the family, which is quite extensive, into sub-families.

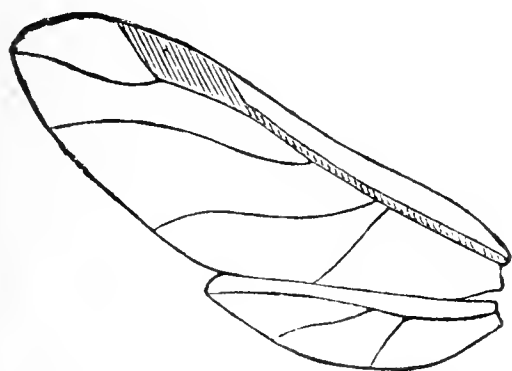


Fig. 15. Wings of *Pemphigus*.

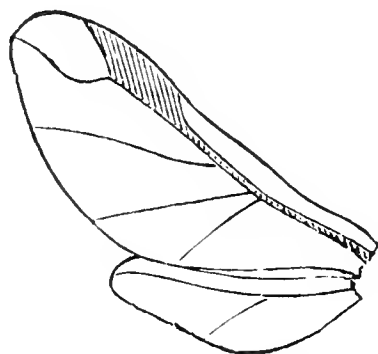


Fig. 16. *Tetraneura ulmi*.

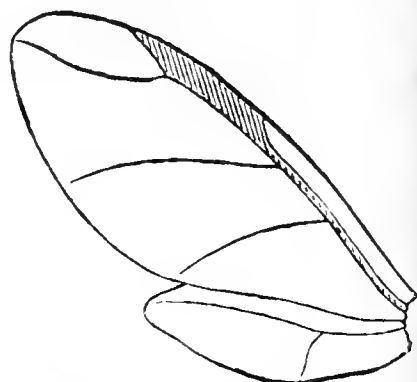


Fig. 17. *Chermes laricis*.

G. B. Buckton, of England, the latest authority on these insects, in his recent work on the "British Aphides," arranges the family in the four following divisions or sub-families:

I. Upper wings with the third discoidal vein twice forked. Lower wings with two oblique veins. APHIDINÆ.

II. Upper wings with the third discoidal vein once forked. Lower wings with two oblique veins (except in *Colopha*, where there is but one). SCHIZONEURINÆ.

III. Upper wings with the third discoidal vein simple, not forked. Lower wings with one or two oblique veins. PEMPHIGINÆ.

IV. Upper wings without the third discoidal vein. CHERMESINÆ.

Besides these differences in the various groups of the family there are others of equal importance in separating species, and also as indicating difference in habits. In a very large number the abdomen is furnished with two tubes, usually called "honey tubes" or "nectaries," which arise like little horns from the sixth segment. These appendages serve for the passage from the body of a sweet fluid, and appear to act as escape pipes for the excessive amount of sap imbibed by these incessant pumpers. If we examine a properly arranged series of species we shall find that these tubes gradually decrease in length until the orifice alone remains, and at last this disappears. This decrease appears to correspond, to a certain degree, with the degradation of the species.

There are some species which are always found more or less covered with a whitish, cottony or downy substance, while others are always naked; some have the very singular habit of bringing forth their young alive, while a few are always oviparous; some confine their operations entirely to the leaves, others to the twigs and bark and others to the roots, while others operate both on the stem and roots or leaves and roots. Some reside exposed on the surface of the leaves or bark, while others, by some peculiar power or property of their secretions not yet well understood, form galls in which they carry on their operations and pass the greater portion of their existence.

But the strangest fact connected with the history of these insects is their method of reproduction. They, as likewise all other species belonging to the sub-order *Homoptera*, undergo only a partial transfor-



ation ; that is to say, they are never worms, grubs or maggots, and never undergo those remarkable changes which transform the grub into a beetle, the caterpillar into a butterfly, or the maggot into a fly. The larvæ and pupæ are similar to the perfect insect in form and habits ; and although they frequently cast their skins, and winged specimens gradually acquire these organs, there is no true dormant pupæ or chrysalis state, as we find in many other insects.

In the autumn, as a very general rule, the last brood consists of winged specimens, both males and females. These pair, soon after which the male dies ; the female deposits her eggs, after which she also dies. Early in the spring, as soon as the sap begins to flow, these eggs hatch and the young lice at once insert their tiny beaks into the bark or leaf on which they are situated and begin to pump up the sap. They wander but little, their entire time being devoted to feeding ; hence they grow rapidly and soon come to maturity. These females, by some strange provision of nature, are capable of producing other individuals without the intervention of the males, and instead of depositing eggs, as the last fall brood, are usually viviparous, bringing forth living young. These are likewise all females, similar to those from which they sprang, and they, in turn, produce a similar brood in the same anomalous manner. This process is repeated again and again during the summer and until in the fall, through some six or seven or even more generations. The last fall brood presents a remarkable variation from this process as it usually consists chiefly of males and females which acquire wings. These, as previously stated, when pairing deposit eggs which remain over winter.

In the present report it is unnecessary for me to mention or describe any other species than the Corn Plant-louse (*Aphis maidis*) which was originally described by Dr. Asa Fitch, and subsequently more thoroughly studied by Mr. Walsh, former State Entomologist, and which I have found during the past season in considerable numbers on the corn in the southern portion of the State, feeding on parts of the plant hitherto not known to be infested by them.

#### THE MAIZE OR CORN APHIS—(*Aphis maidis*.) Fitch

This species, which appears to be different from the one infesting the Maize or Indian corn in Europe, was formerly supposed to confine its attacks to the stem or peduncle which bears the ear, the most vital part, so far as yield is concerned, of the entire plant ; but Mr. Walsh afterwards found Aphides infesting the roots, which, having reared to the perfect or winged state, he was satisfied belonged to this species. Fortunately I have had an opportunity during the past year of studying this species and of adding further evidence on this point and also of giving new facts in reference to its habits.

I will give first the characters as presented by Fitch and Walsh, and also a description from specimens obtained during the summer from a different part of the plant.

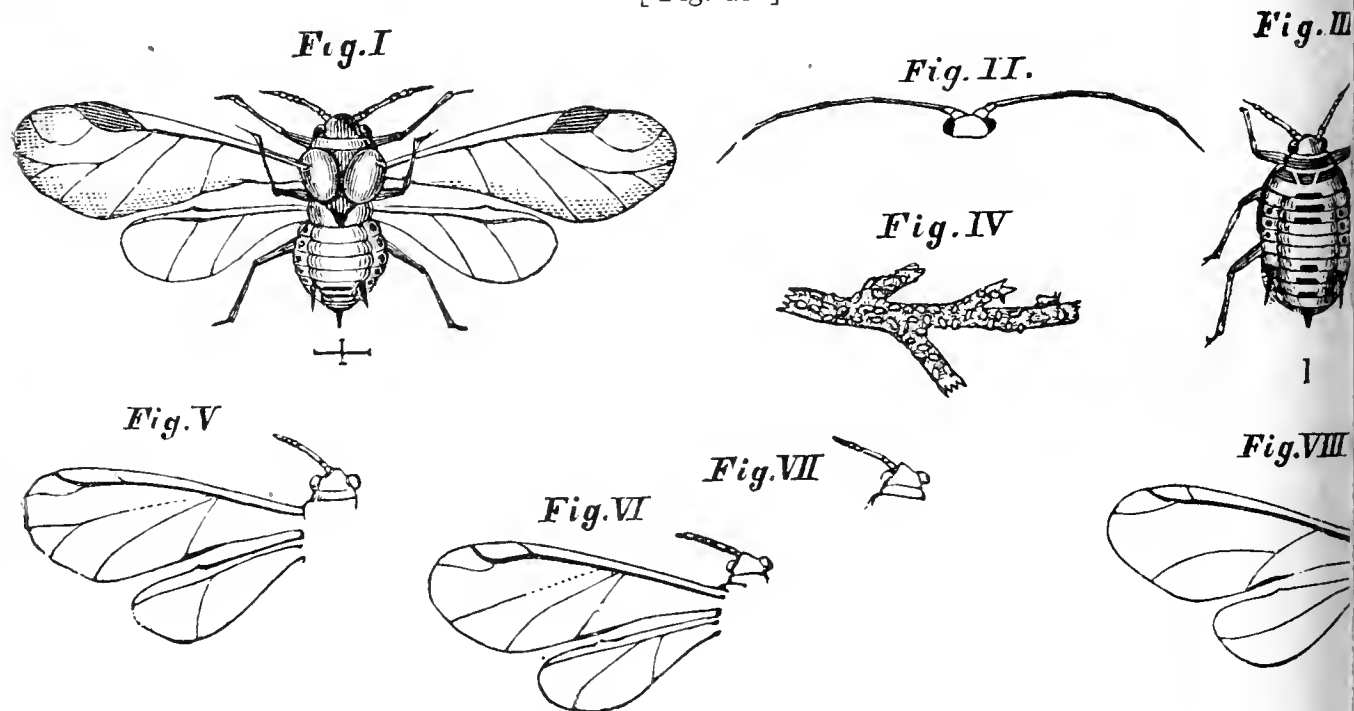
Dr. Fitch's description of those he found infesting the ear stalks in substance as follows:

The larvæ are either green or yellow; the latter being those which ultimately acquire wings; before changing into pupæ, they usually acquire a pale reddish color, and are dusted over with a white powder.

The wingless females are dull blackish, tinged with green and sprinkled with fine whitish powder; head and generally two bands on thorax, black; the abdomen is usually marked with black spots along the sides; honey-tubes rather short; antennæ black, and not more than half as long as the body. Winged females, similar; length of the body, six-hundredths of an inch; general color, black; the abdomen dark greenish, with black dots along each side, and three black bands at the tip.

Mr. Walsh describes those he found infesting the roots as having the general color, both of the pupa and perfect insect, pale green; the female pupa usually has three, short transverse dark lines on the thorax, and three similar ones on the abdomen. It is figured in the fifth volume of the transactions of the Illinois State Agricultural Society, a copy of which is reproduced here.

[ Fig. 18. ]



- I. *Aphis maidis*—winged insect.  
 II. Head and antennæ of *Aphis mali*.  
 III. *Aphis maidis*—wingless female.  
 IV. Portion of corn-root infested by *A. maidis*.  
 V. *Colopha ulmicola*—showing veins of wings and antennæ.  
 VI. *Pemphigus populicaulis*—showing veins of wings and antennæ.  
 VII. (Should be omitted.)  
 VIII. Wings of Phylloxera.

The antennæ are unusually short for this genus, scarcely reaching to the tip of the thorax, but nevertheless it appears to be a true *Aphis*; the honey-tubes are also rather short; the first discoidal vein is farther from the second than the second is from the third, and the stigma is prominent and pointed at each end. He states that the pupa is dusted over with a whitish bloom like that of a plum, and with dusky markings.

In the latter part of July I found an *Aphis* feeding on the tassels of corn, which, upon examination, I found to belong to this species. Late in the season other specimens were sent me in alcohol which I

en gathered in May in large numbers on the roots of corn; these, though in the pupa and larva state, showed so clearly the marks and other characteristics, mentioned by Mr. Walsh, that there was no missing their identity.

It is therefore quite certain that this species is not confined to any one part of the plant but infests the greater portion of it, at least its most vital parts, and when very abundant, as it is in some cases, does serious injury. The root variety appears to retain the pupa form for some time, and I think it more than probable that many of them never acquire complete wings, although the wing cases are formed.

I add here a description of specimens found on the tassels.

*Wingless individuals.* The full grown are of an apple-green color throughout, except the front of the head which is dark; honey-tubes short, cylindrical, not reaching quite half way to the tip of the abdomen, deep black with small black spots surrounding the base. Body elliptical or slightly ovate in outline and of but moderate width; the very young have the sides nearly parallel; antennæ scarcely half the length of the body, dark-brownish, seven-jointed, third joint the longest, about equal in length to the fourth and fifth united, fourth, fifth and sixth nearly equal in length, seventh a little longer than the sixth; whole antennæ having a few scattering hairs. A stripe running along the margin at each side of the abdomen of a little darker shade than the central portion; legs dusky, darker at the joints and tips.

*Winged individuals*—Head and thorax of a shining black; abdomen pale greenish yellow, dotted along the lateral margin with black; honey-tubes black, similar to those of the wingless individuals; legs dusky pale at the immediate base; antennæ about half the length of the body; beak very short, scarcely reaching beyond the base of the fore legs. Wings erect in repose, of usual form, third discoidal vein twice forked; transparent, veins slender, slightly dusky, the stigma elongate fusiform and rather slender; the sub-costal vein for some distance from the base recedes somewhat from the costal, and then at about two-thirds the distance approaches the costa; the first vein about three times as far from the second at the tip as it is at the base; the second is slightly farther from the base of the third than the base of the first. The second fork arises near the apex of the wing; the stigmatic vein curves somewhat sharply at the base, and then is nearly straight to the tip.

As a general rule we may know that Plant-lice are on a plant by seeing ants running hurriedly up and down it. It is chiefly by watching for these that I discover aphides when searching for them. Occasionally I find them before the ants appear to have noticed them, but this is seldom the case.

*Remedies*—It is not a difficult thing to destroy Plant-lice when they are on low shrubbery and not spread over too large an area. Fumigating with tobacco smoke, fumes of sulphur, etc., is an effectual remedy when it can be carried out, but this would be impracticable if we attempt to apply it to a cornfield. A small patch of sweet corn may be, perhaps, profitably preserved by this method.

Drenching with soapsuds or other obnoxious mixtures has been recommended, but it fails to reach all, and although many are destroyed, those that remain, by their exceeding fecundity, soon renege the colonies. Fortunately these insects do not materially injure the corn, and when they become numerous, as a general rule it is not long before one or more of their insect enemies appear and soon play havoc with them. I have frequently noticed *Syrphus* flies very abundant in cornfields, where they have collected not only for the sweets, but also for the purpose of feeding on the aphides. These flies are beautifully colored, usually with cross stripes of bright yellow and black, and have a singular habit of poisoning themselves in the air by the rapid motion of their wings. In some places they have received the common name of "sweat bees."

The following notes in regard to this species are extracts from correspondence received during 1877:

"ATHENS, MENARD COUNTY, July, 1877.

"Plant-lice on the roots of corn did considerable damage in 1874. Not perceptibly injurious since, and then confined to limited areas on old lands."

E. HALL.

"ELMIRA, STARK COUNTY, Nov. 27, 1877.

"On the 19th of May one of my neighbors came to get me to go and examine a field of corn that he said was being destroyed by something and he could find nothing that could account for it. I found the corn about three inches high and hundreds of hills withering and dying, and on careful examination I found the roots and base of the culm below the ground literally swarming with Aphides. I think from some hills I could have gathered a teaspoonful of the little creatures. I estimated about one-fifth of the stand of corn in that field to be then destroyed by them. There had been a crop of rye raised on the ground the season previous. I had before seen slight injury from Aphides, but nothing to compare with this."

E. R. BOARDMAN, M. D.

Mr. Boardman also states under date of Dec. 5, in answer to some inquiries: "I find on referring to my notes the specimens sent were collected on the 22d day of May. The field was planted the 10th of May."

I had intimated in reply to one of his letters that it was rather singular that they should appear there in such numbers when corn had not been raised on the field the previous season. He says:

"In regard to those Aphides, it appeared singular that they should exist in such numbers in that field while in an adjoining field, separated only by a road, there were only a very few specimens found and no injury sustained from them. This adjoining field had been cultivated in corn for several years, and the only way that I could account for it was that the field where they were found had a hazel copse along one side of it, and that they may have come out of that as they were worse on that side of the field."



## MOTHS—LEPIDOPTERA.

(By G. H. French, A. M.)

THE SALT MARSH MOTH—(*Leucarctia acrae*—Sm.)

The larva is the "Salt Marsh Caterpillar."

This insect, now widely distributed, was first described by Dr. Harris in 1823, and received its name from the fact that the salt marshes about Boston, which afforded considerable hay, had been for some time over-run and laid waste by swarms of these caterpillars. From the local character of the name, and from the fact it closely resembles one form of the caterpillar of the allied species, the *Virginia Ermine Moth*, it was for some time supposed that this insect was confined to the region of the sea-board, or at least that it was not found farther inland than the chrysalids had been transported in the salt marsh hay that was annually taken to the interior. But now it is known to be almost as common as the Yellow Bear, though perhaps it does not equal that caterpillar in numbers in most parts of the state. In habit it closely resembles the Yellow Bear, eating freely the tender leaves of most of our garden vegetables as well as the field grains, weeds, etc.

The general color of the caterpillar is darker than the Yellow Bear, but it may be easily mistaken for the darkest form of that caterpillar. When full grown it is an inch and three-quarters in length. The body is clothed with long hairs which are sometimes black and sometimes brown on the front part of the body, but are of a lighter brown on the sides. These hairs grow from yellowish colored warts that are regularly arranged on each segment. The body without the hairs is yellow, shaded at the sides with black, with a blackish line along the top of the back. The stigmata or breathing holes on the sides are white, and are very distinct even through the hairs.

The sexes of the moths differ in color, the female having the wings white, while the male has only the front wings white above, the hind wings, and the underside of the body and wings being deep ochre-yellow. In both sexes there are about twenty black dots on the front wings, and five on the hind wings; and the abdomen, or hind body, deep-ochre yellow with rows of black dots.

Dr. Harris says there is in Massachusetts only one brood of the caterpillars annually, but in the Middle and Southern States there are two broods occurring in about the same periods as the two broods of the Yellow Bear. The first brood is produced from eggs that are laid by the moths about the middle of June on the grass or other leaves the caterpillars are to eat when hatched. A single female will thus deposit it is said, eight hundred eggs. It takes these seven or eight days to hatch. After passing five or six weeks in the larva state they conceal themselves in walls, under stones, or in any place that offers

protection, where they make hairy cocoons in which they change to chrysalids. These cocoons are made of hairs from their own bodies and they are held together by the manner in which the hairs are placed together, without being interwoven with silk. At the time when they are ready to undergo this transformation they may be seen crawling in various directions, seeking places of shelter. This brood emerges from the chrysalid state about the first of August, but the second brood passes the winter in the chrysalid state to come out in May of the following season.

*Remedies.*—The same artificial remedies that are given for the destruction of the Yellow Bear in the next article will apply here. Should they become numerous in grass or corn lands the most effective means of destroying the chrysalids will be to burn the stubble late in the fall or as soon as dry enough in the spring, as there is usually enough matter even in our corn-fields to accomplish this. Should there not be, old straw can be scattered over the ground. Like the Yellow Bear the parasites to the caterpillar are of great service in keeping it in check. (For scientific description see part second of this report.)

THE VIRGINIA ERMINE MOTH. (*Spilosoma Virginica*. Fabr.)

The larva is the Yellow Bear.

The caterpillar to which Dr. Harris gave the name of Yellow Bear is widely distributed, and is found from June to October eating a great variety of plants. In the vineyard it often does serious damage to the grape vines by denuding them of their foliage; in the garden it destroys the young peas, beans, cabbages and sweet corn; in the fields it helps the other destroyers to lessen the stand of corn; and, like the worm that destroyed Jonah's gourd, it attacks the morning glories that afford shade and ornament to our homes. In fact it eats many kinds of young and tender leaves without apparent discrimination, though I found in my observations during the past season that it persistently refused to eat the rough leaved varieties of grape.

This larva is a rough hairy caterpillar about an inch and a half long, varying in color from pale creamy white to dark brown, many of them when about half grown being a foxy red with darker extremities. The hairs rise in clusters from warts that are of the same color as the skin, and are on all parts of the body except beneath. Though varying so much in color they all have the underside of the body black with a transverse line of the same color, more or less prominent between the segments. This difference of color is not confined to different broods as though it marked varieties but the different individuals of the same brood will exhibit all the differences in color. I have seen some that were all white up to the last moult, after which some were white and others almost black. There are two broods of the worms in a season, the two somewhat intermixing by the different individuals remaining different periods in the larva state. The eggs are laid in clusters on the leaf where the food of the worms is to be obtained, and they hatch in about six days. The larva period last

four or five weeks, at the close of which they transform to chrysalids in cocoons made of hairs from their own bodies, held together by the manner in which the worm weaves them. The first brood of the moths emerge from the chrysalids in about ten days, but the last brood passes the winter in the chrysalis state.

The moth has white wings and is usually called "The Miller," it enters houses at night and flits about the lamps, as, like many other moths, it is attracted by light. It has a black dot in the middle of each of the front wings, and two black dots on each of the hind wings. There is orange yellow on the back of the abdomen each side of a row of black dots, and a little of the same color on the front thighs.

*Remedies*—Hand picking is usually the best means of destroying them, as their depredations to cultivated plants are usually local or confined to small areas, and their size renders them easily seen and removed. Were it not for the fact that nature has provided a large number of insect foes that prey upon this caterpillar, its voracious appetite and rapid increase in numbers would make it a formidable enemy to the farmer. Prof. Riley says of this:

"It is fortunate for us that this caterpillar is attacked by a large number of insect parasites, for, were this not the case, it would soon multiply to such a degree as to be beyond our control. We know of no less than five distinct parasites which attack it—some living singly in the body of the caterpillar, and issuing from the chrysalis without spinning any cocoon of their own; others living singly in the body, but forming a cocoon of their own inside the chrysalis of their victims, and still others infesting the caterpillar in great numbers, and completely filling the chrysalis with their pupæ.

## CUT-WORMS.

In Europe these caterpillars are called Surface Grubs, a term that is appropriate to only a part of the species, for though most of them feed upon plants close to the surface of the ground, there are some species that climb low bushes, such as the currant and gooseberry, and even apple and other fruit trees, the buds of which they eat or cut off; while there are others still that work wholly beneath the surface. For this reason the term "Cut-worm" seems more appropriate for these caterpillars than Surface-Grubs. The name is sometimes used to designate the occasional habits of other caterpillars that do not belong to this group of the Owlet Moths, as, for instance, the early brood of the Army-worm (*Leucania unipuncta*.) For the same reason the caterpillars of the Violet Nephelodes may be included in the list, for it was found during my observations last summer to have the habits of the Cut-worms, though according to structure it is more nearly related to the borers, of which the Stalk-borer (*Gortyna nitela*) is a good type.

These caterpillars differ in the place they cut off the plants upon which they feed. This is sometimes done at the surface of the ground, a little below the surface, or about an inch above, while some species

will climb the stems of the larger herbaceous plants to cut off the leaves, that they may eat them more at their leisure. Others still, as said before, will climb shrubs and trees to feed upon the leaf and flower buds, each species generally adopting one of these modes of operation, though it is evident from observation that this is not wholly the case. Some Cut-worms eat all they desire of a plant during the night time and lie motionless during the day; while others, after severing a plant or a leaf from its stalk, drag it to a place of concealment, usually the end of the stalk into the mouth of a hole, when they will lie and eat the next day, hid from birds and other foes. Such habits are common to those that pass through their changes in a shorter period than some other species, and whose rapid growth seems to require this extra food.

These larvæ or caterpillars are thick greasy looking worms, with a distinct horny shield or plate on the top of the segment or ring back of the head, called the *cervical shield*. They are usually marked with shining piliferous or wart-like spots on each segment, from which arise short hairs. These piliferous spots are generally black, though sometimes brown, and at others the same color as the rest of the body. They have sixteen legs, six of which, the true legs, are near the head and have a hard or chitinous exterior. The eight legs under the middle part of the body, called the prop or prolegs, and the two at the posterior extremity of the body, called the anal legs, are fleshy appendages covered with skin like the surface of the body. When full grown these caterpillars, as a rule, descend a few inches beneath the surface of the ground where they transform to chrysalids in an oval, earthen cocoon. The length of time they remain in this state varies from ten days to several weeks with those that come out as moths the same season, while it is probable that the second brood of some species pass the winter in the chrysalis state.

The moths that are produced from these caterpillars generally fly at night and remain quiet during the day time. They are attracted by a light and hence frequently fly into dwellings at night and flit about the lighted lamps, often perishing in the flame. Their bodies are rather thick, less than an inch long, with tufts of hairs at the shoulders, and in some species on the back of the abdomen, while some have a fan-like tuft at the end of the abdomen of the males. The rather narrow front wings are generally dull, dingy gray or brown, and when at rest lay like a flat roof over the back, completely concealing the hind wings that are folded so as to be covered by them.

#### *Items of their History.*

For the purpose of comparing the habits of Cut-worms, so far as their work has been noticed in our state, and also of forming some idea of the amount of damage done by them, a few quotations from old files of the *Prairie Farmer* and from letters received during the past season are given below. By this comparison we shall be better able to know what to do to prevent their ravages. It is true that where little is known in regard to the habits of insects the means employed for their destruction, because of a want of that knowledge, may be of



little service, or cost the farmers more than the value of the crop saved, and in that case the result is a loss instead of a gain. When a farmer or community has had this kind of experience any new measure is looked upon with distrust. This is not what we want, a leap in the dark as it were, but to know as fully as possible the character and condition of our foe before we attack him, and then make the attack where it will be the most effective with the least expense.

Cut-worms are, according to the more common acceptation of the term in this country, the larvæ or caterpillars of moths belonging to the genus *Agrotis* and a few other closely related genera, that usually feed at night and lie concealed during the day time. Their place of concealment is just beneath the surface of the ground, beneath dead leaves and grass that are moist, or sometimes among the compactly folded leaves of growing plants where considerable moisture is retained, and where they will lie and feed during the day.

L. D., of Woodburn, Macoupin County, writes to the *Prairie Farmer* May 9, 1845: "Last year the Cut-worms were hard on some corn fields here. Some of the farmers had to plant the third time before they could go to plowing, meanwhile the weeds were growing and choking what the worms had left. I think if fall-plowing for corn were adopted, this evil would be lessened very much, if not entirely removed. In coming to this conclusion I have the experience of last year in my favor. In ten acres of corn which my father raised, the ravages of this worm were plain enough all over the field, except on a few lands that had been plowed in the fall with the intention of sowing winter wheat. Last fall, and during the "lovely winter weather," our plowing was all done for spring crops. We commenced planting corn the 4th of April. It all came up very well and the ground was as free from weeds almost as you could wish, and now we are tending it, while some others have not done planting."

The following are gleaned from my correspondence:

S. B. Mead, M. D., of Augusta, Hancock County, says: "Have injured some, but not bad this year. Bite the corn close under the top of the ground."

G. G. French, M. D., Shobonier, Fayette County, says: "Cut-worms troubled some, about equal to craw-fish in my fields which are low. Two years ago were quite bad."

H. M. Russell, Urbana, Champaign County, writes: "Very slight damage done. Have been troublesome former years to gardens but not very to corn."

Wm. A. Griffin, New Windsor, Mercer County, writes: "All the damage ever done by Cut-worms in this locality has been on timothy and clover stubble newly broken."

Joseph Teft, Elgin, Kane County, says: "Very little, if any, injury has been done to corn by Cut-worms in this or former years."

Lorenzo Rank, Oswego, Kendall County, says: "There are some cut-worms, but not extensive, and have done little injury. They are limited to the sod corn. Have been in former years quite troublesome. Fall plowing and late planting—June 1st—have been resorted to as remedies."

E. M. Bowers, McLeansboro, Hamilton County, says: "Have done no damage to corn this year. Sometimes do considerable damage to

young corn; worst on stubble lands. Fall plowing for spring planting a good remedy."

E. Hall, Athens, Menard County, says: "A few cabbage Cut-worms in gardens. Injurious to some extent on weedy and grassy lands about every year except this. Not considered a bad pest, however."

A. S. Van Winkle, Trenton, Clinton County, says: "We have a few species of *Agrotis* in this locality that do considerable damage to corn crops, etc., during some years, while at others it is hardly noticeable." Mr. Van Winkle then mentions some of the species, the most prominent of which are the Black Cut-worm, the Western Striped Cut-worm, and the Variegated Cut-worm.

C. E. Worthington, of Chicago, gives me a list of those found destructive there, which will be found mentioned in their appropriate places. He also says: "I am inclined to think that the larvæ of many species included in *Mamestra* and *Arzama* and intervening genera have similar habits." This is including in the list more than is usual, but I have reason to think he is correct.

Prof. T. J. Burrill, Urbana, Champaign County, says: "Several species of *Agrotis* are found abundantly upon lawns, etc. In gardens they do much damage."

E. R. Boardman, M. D., Elmira, Stark County, says: "In reference to the Cut-worms mentioned, I make them out to be the larvæ of *Agrotis telifera* (the Black Cut-worm). They are dark, greasy-looking worms, with flesh-colored backs. They were very abundant on some pieces of meadow lands that were broken up in the fall and planted with corn last spring. I found them mostly on dry, rolling ground, where they did considerable damage to crops. They disappeared about the 15th of June; at least, I could find but very few after that date." As I used Dr. Boardman's notes elsewhere, they might be omitted here did we not need them to compare with points made by other writers.

David Gore, President of Macoupon County Agricultural Society, (given me through Prof. J. D. Conley, Carlinville,) says, "It has been observed that they damage crops more especially on wet land. The past season they damaged the corn crop about five per cent. From their nature it is expedient to drain the land well for they do very little damage on dry land."

V. R. Faught, Elvaston, Hancock County, says, "The Cut-worms do more injury here than any other insect. They feast not only on corn, but all kinds of vegetables. As I am a tiller of the soil I have a chance to know how much mischief insects can do. If I only had what they have destroyed for me I should be a wealthy man."

#### *Remedies.*

Under this head I shall take up here only such as will be applicable to the treatment of Cut-worms in the corn field, leaving the rest of the subject to be treated in part second. The remedies may be conveniently classed under two heads, Artificial and Natural.

*Artificial Remedies.*

In the garden or a small area there is probably no better method of preventing the Cut-worms than to hunt and kill them wherever their work is noticed, but in fields, the way fields are cultivated in Illinois, this is impracticable. Where this will not do fall plowing will probably be found the most effective of any artificial means, for the following reasons:

It is thought that nearly all the species pass the winter in the ground in a torpid state, rolled up in a little cell that it has formed in the soil, though probably the Variegated Cut-worm is at this time a chrysalis. By plowing late enough so that these are turned up after the weather is so cold that they cannot secure a place of protection again before winter sets in, they will be exposed to the inclemencies of the weather which will prove their destruction, and this will be the same whether in the worm or chrysalis state, for it is not really the freezing that hurts them, but the freezing in connection with the loose wet soil, and this will kill the chrysalis as quickly as it will the worm or caterpillar. Besides breaking up their cells and thus mingling the worms and chrysalids with the dirt, many of them would be brought to the surface and would be eaten by birds.

In all the cases in the extracts where remedies have been given fall plowing has been the principal one resorted to, and there seems to be only one exception to this. Dr. Boardman states that they were most destructive on pieces of meadow land that had been broken up in the fall and planted in the spring. There are two probable reasons for this: first, the plowing may have been so early that the worms would have a chance to form a new retreat if disturbed, but, what is quite probable, many of them were not disturbed on account of the tough sod not being broken up.

If the remedy is to be in the fall the question may naturally arise, where may we expect to find them the following year. Has soil anything to do with it? Nearly all the writers quoted seemed to have a theory on that point which is probably more or less substantiated by experience, but a comparison of the notes will make it evident that soil has but little, if anything, to do with the question, even when we consider it as wet or dry, high or low. Still, we must not go too far here for the wetness or dryness of the *season* has much to do with their work, but of that hereafter.

What was on the land the fall before has more to do with the prospect of injury from Cut-worms in the spring than anything else. By a comparison of the notes they have been found to be injurious on "timothy and clover stubble newly broken," "limited to sod corn," "worst on stubble land," and by stubble land any farmer in this section of the country knows is meant a growth of weeds in the fall after the grain is taken off, that would equal a meadow for luxuriance. "On weedy and grassy lands," "meadow lands that were broken up," etc., but here is far enough for our purpose.

From this it may be inferred that land that is kept clean during the summer and fall will not be troubled with Cut-worms the following season, and a treatment to fall plowing will not be necessary for the

purpose of ridding the land of them, but where the land that is intended for spring planting has been covered during the summer and fall with a growth of such vegetation as they relish, the season being favorable, there they may be expected in the spring. The reason is, that most of the species deposit the eggs from which the worms are produced in the latter part of summer or fall, and they feed upon this rank vegetation till the cold fall and winter weather alike kills the vegetation and numbs the worms when they are from a half to two-thirds grown. Instinct impels the parent moth to deposit the eggs where the necessary food will be at hand for the young when hatched, and for this reason lands that are comparatively free from vegetation during that season will be usually free from Cut-worms the following spring. It might be added here that nearly all writers concur in the opinion that fall plowing is one of the most effective means of destroying Cut-worms. Dr. Harris recommends it, though with some doubt. Dr. Fitch repeats it in his valuable report. The newspapers have, with few exceptions, told the same story; but in the latter we sometimes come across an exception, as the following from the January number, 1852, of the *Prairie Farmer*. The writer says: "There is an idea abroad that late fall plowing destroys several species of insects by freezing. Among these are the varieties of the Cut-worm. So far as this worm is concerned, we believe the idea to be a mistaken one, since he does descend below the frost for his winter quarters, but may be found, while the ground is yet frozen in the spring, within an inch or two of the surface. Were he to be turned absolutely out of the soil and subjected to the cold of winter it might be fatal to him; but fall plowing will do this to very few indeed, however plenty they may be in the ground. Indeed, we rather suppose that the majority of them would be buried much deeper in the earth than would otherwise be the case. Does, then, fall plowing do no good in destroying them? it may be asked. It certainly does if it destroys their food, for as soon as the ground becomes warm in the spring they begin to wake up and eat. But if there is nothing for them to live upon they must die. For this cause plowing may destroy them."

Another writer in the February number, 1853, of the same journal says, after speaking of some other points: "Others plow them up in the fall with a view to freeze them out, not thinking that they will bear cold like Esquimaux."

There is some truth in both of these statements. It is not claimed here that by plowing them out the Cut-worms are subjected to any more cold, for it is not claimed that cold alone will kill them. By cutting into the frozen soil under a clump of grass, various kinds of insects will be found where the ground is frozen several inches below them. This will be noticed, however, the grubs, caterpillars and chrysalids will each be enclosed in a cell of the dirt, so that there is a space around the worm and the worm itself is clean and free from dirt. While the soil is frozen these retain their shape so distinctly that there is no mistaking it, even if there might be at other times. In this condition it is evident that freezing does not injure them for nature has prepared them for it the same as it has many other animals. But my experience is that if these same caterpillars, or chrysalids, be taken and mixed up with loose dirt, moist enough to stick to them, and then subjected to freezing, it proves fatal to them.



This is done by late plowing and the cold fall and winter rains. But where there is considerable sod that does not break up, many of these it is presumed, will not be disturbed by plowing. In this case the lack of vegetation on the surface in the spring, as spoken of by the first writer, may cause many of them to perish from starvation, if the roots of the old sod does not supply them with food. There is one exception to this rule.

Prof. Riley has shown that the eggs from which the spring brood of the Variegated Cut-worms are produced, are laid in the spring on the twigs of various trees and bushes, upon the leaves of which they feed till they undergo the first moult or casting of the skin, after which they display the true Cut-worm propensity. This will not alter my proposition so far as the application of even that species to the cultivation of corn is concerned, for the eggs for this brood are generally deposited before corn is planted, and they would not be likely to be placed where there was no prospect of food for the young when hatched.

W. Holt, of Ceresco, Wis., gives an incident in the May number, 1850, of the *Prairie Farmer*, that may be of interest under the head of "Artificial Remedies;" but let him tell his own story:

"Last spring I had a piece of stubble ground of about four acres (oat stubble) that I planted to corn. Some two weeks before I ploughed it, I burned off the stubble from nearly three acres, but did not burn off the residue until the day before ploughing it. The entire piece was ploughed at an average depth of eight inches, and the whole treatment was exactly the same, with the exception of the time of burning the stubble off the two parts. The difference in the time of planting the two parts was two days; the soil of the two portions is alike, being a vegetable loam with a subsoil of clay. Now for the result. In that part which was burned over about two weeks before ploughing, the ravages of the Cut-worm were severe—so much so that more than one-half of it had to be replanted, and some parts of it the *third time*; while on the other part, hardly a single blade of corn was molested, or a worm seen.

"What caused the difference? If the fire destroyed them on the part *last* burned, why not on the part first burned?—for the first burn was more thorough than the second, the stubble being dryer, etc."

The above is suggestive of a remedy that may prove beneficial in many instances, viz: burning stubble or a mass of weeds that may be on the ground before plowing. To be efficacious it should be done just before plowing for corn, or after the weather is quite warm, for if done too early the fire will fail to reach the worms, as in Mr. Holt's first burning.

The reason is obvious. The first burning was done before the worms were out of the ground, and they were not injured. The second took place after they had been warmed into life and commenced operations, hiding during the day, as is usual with them, under the dead grass and weeds in preference to going into the ground. Cut-worms and several other kinds of caterpillars may be found any year during the month of May and the fore part of June under such rubbish in meadow and unplowed stubble lands. If such lands that were intended for planting were burned over just before plowing in-

stead of early, as is sometimes done, it is evident that many insects would be destroyed.

It is scarcely necessary to speak at length here of the various preparations that have been from time to time recommended to keep off Cut-worms, but which have been proven to have little or no value. Among these, soaking the corn, before planting, in copperas-water, kerosene, etc., are favorites. As the worm does not molest the kernel but the green plant, these can be of little or no service. They will burrow in dry salt, lime or ashes as readily as in dirt; hence, to resort to their use is a waste of time and material. Prof. Riley suggests in corn fields that have been subject to the attacks of Cut-worms: "it is well to plant so much seed as will enable them to glut their appetites without taking all the stalks in the hill." It seems to me that if this suggestion were taken and a few kernels more were planted than just what was expected to stand, less bare places in the corn field would be the result. The following familiar lines are to the point:

"One for the blackbird and one for the crow,  
Two for the cut-worm and three to grow."

#### *Natural Remedies.*

It is fortunate that nature comes to the aid of man in fighting the host of foes that conspire against him in his efforts to secure from the soil by the labor of his hands that maintenance which was entailed upon him when Adam was commanded to go forth and earn his bread by the sweat of his brow. Among the higher forms, the carnivorous serve to keep in check the too rapid multiplication of plant-eating animals, so that the vegetable products of the earth are not too scanty for the use of man and the animals useful to him. What the lions and tigers, cats and dogs are to man among the larger animals, the insect-eating birds and the great number of carnivorous insects are to him in keeping in check his insect foes; nay, more, for their rate of increase is more rapid than that of the larger animals. Prof. Riley counted a single cluster of the Variegated Cut-worm eggs and found it to contain 542, which, as he says, were probably laid by a single moth. Each one of these eggs is capable of producing a caterpillar that will consume twenty-five times its weight of vegetation to bring it to maturity; or, if the worm weighs a quarter of an ounce when full grown, it has consumed about six ounces of vegetable matter. From this it is easy to see that were there no check placed upon their multiplication there would soon be a sufficient number of them to denude the earth of all kinds of leaves they would eat.

Birds take part in this destruction. When the ground is plowed, either in the fall or spring, they hunt out and destroy a great many of them. As the Cut-worms usually hide during the day time the destruction of them by birds at other times is not very great. Many species of insects prey upon them, and in fact form the chief means of keeping them in check. These will be described in detail in the second part of this report, as they relate to the subject in general, and not particularly to Cut-worms as applied to corn insects.

Besides these, the condition of the weather has much to do with insect life. Inclement weather at the time of hatching may destroy great numbers of them. It is evident, too, that more damage is done by them in the spring, if the weather is only moderately warm and moist, than if it be dry and warmer. I observed last spring that during a week of such dry weather the Variegated Cut-worms ceased to work in the garden, where they had been very numerous before, though they did not go into the pupa state until some days after this in my rearing boxes.

For the convenience of farmers who may want to identify Cut-worms or their moths, there will be given here a general description of such species as are commonly found in corn fields. The balance of the group, so far as known to occur in the State, and the scientific description will be found in part second.

### THE BLACK—C-RUSTIC—(*Agrotis c-nigrum*—Linn.)

The larva is the Spotted Cut-worm. This worm when found is usually about an inch long, of ash gray color irregularly spotted on the sides with brown, while along the subdorsal region is a row of somewhat triangular brown spots, broader behind than before. In the southern part of the State they may be found in fields and gardens about the last of April or the first of May, soon after which they enter into the chrysalis state, appearing as moths from the middle to the last of May. The moth has the fore wings of a purplish ash color with the light orbicular spot or the spot near the middle of the wing that is circular in most Cut-worm moths, so opened that the black surrounding it bears some resemblance to the letter C.

Little seems to be known of the actual habits of this Cut-worm, though the moth has been known for sometime, and it seems to be widely distributed. While in confinement it ate the same kind of food and seemed to have the same habits as our most common Cut-worms.

C. E. Worthington, of Chicago, says that it, in connection with several others, "is very abundant here as an injurious insect, very destructive to cabbages and almost every young vegetable."

As my observations confirm the above I will insert this brief account of it here. The position in which I have found them rather suggests that they have the climbing habit also. Last April I found a chrysalis of this species at the roots of a soft maple (*Acer dasycarpum*) above the ground in the dead grass. A few days afterwards I found a worm at the roots of a peach tree. This of course is not proof positive but is what the courts would term circumstantial evidence. For other characters and observations see part second.

### THE GOTHIC DART—(*Agrotis subgothica*—Haw.)

The larva is the Dingy Cut-worm. This caterpillar, named by Prof. Riley in his first report the Dingy Cut-worm, closely resembles the

one named by him in the same report the Western Striped Cut-worm, but as he there tells us, may be distinguished from the other by three permanent differences: "1st. It never attains quite so large a size; 2d. It is generally darker and more dingy, and the longitudinal lines are consequently less distinct; 3d. It is generally of a more decided dull pale buff color on the back."

This Cut-worm is when full grown about an inch long and marked similarly to the Western Striped Cut-worm. They remain in the larva state longer than some other species as they do not change to chrysalids till about the first of July. The chrysalis is of the usual shape but differs in color from most of the other species, being honey-yellow shaded with brown. The eyes are dark brown and there are two spots of the same color on the wing sheaths just above the antennæ.

The moths that come out about the first of September are smaller than the Master Dart moths, and may also be identified by the following points: 1st. The hind wings of the Gothic Dart are pearly white with a narrow dark outer border, while the hind wings of the Master Dart are quite dark; 2d. The ground color of the front wings of the Master Dart has a lilac tinge which the front wings of the Gothic Dart lack, its place being supplied with a blackish shade; 3d. The outer third of the front wings of the Master Dart are uniform dark ash-gray, the same space in the Gothic Dart contains a lighter line running from the tip to the hind angle, while the border outside of this is black.

#### THE MASTER DART—(*Agrotis herilis*—Grote.)

The larva is the Western Striped Cut-worm. This worm is found in the same places as other Cut-worms and at the same time, but it remains in the ground as a chrysalis longer than the most of them before reaching the moth state, coming out in August and September. It was reared and described by Prof. Riley, and as it bears a close resemblance to the Striped Cut-worm, he named it the Western Striped Cut-worm, not because of its being found only in the West, but to designate it from the one named by Dr. Fitch the Striped Cut-worm, for in fact it is widely distributed over most of the United States.

The worm is about an inch and a quarter long, the ground color of a dirty white or ash-gray, inclining to buff on the back, having three broad, dark lines and two narrow light ones along the sides, and a light one, edged on each side with dark, along the middle of the back. The moth has dark lilac gray fore wings marked chiefly with buff and black. The reniform or kidney-shaped spot is buff, as well as a line that extends from the shoulder through the middle of the wing to below the reniform, where it turns towards the hind angle. A short spear of the buff runs to near the top of the orbicular spot. Each side of the reniform spot are black patches.

A. S. Van Winkle, of Trenton, Clinton County, writes me that this is one of the corn Cut-worms of that place. I have observed that the moths were quite numerous here in Carbondale the last of August



and the fore part of September, hence it must have been numerous here in its season. At Irvington, Washington County, where I was the fore part of the season, there were some, but it was not so numerous as some other species.

### THE CHECKERED RUSTIC—(*Agrotis tassellata*—Harr.)

The larva is the Striped or Corn Cut-worm. In his second report made to the Agricultural Society of New York, Dr. Fitch briefly describes this caterpillar under the name of the Striped Cut-worm. In his ninth annual report he gave the insect a more extended description in both the moth and the larva state, and headed the article with the title of the Corn Cut-worm, as his studies of the habits of the caterpillar had convinced him that while it was a general destroyer, being found in the garden as well as the field, it was one that was very destructive to corn, though he speaks of it through the article as the Striped Cut-worm. The perfect insect he names *maizi*, designating it as a variety of one named by Linnaeus *nigricans*. For some reason a doubt has existed for some time past as to the identification of Dr. Fitch's *maizi*.

Recently it has been satisfactorily determined that the moth described by Fitch was none other than the one named by Harris in his work "Insects Injurious to Vegetation," *Agrotis tessellata*. For further explanation of this point see part second.

In reference to the habits of this Cut-worm Dr. Fitch says, that in June it severs the young corn and other plants half an inch above the ground by night, hiding itself by day slightly beneath the surface. It is a thick cylindrical gray worm an inch and a quarter long with rather faint paler and darker stripes; the top of the neck shining black, with three whitish stripes. They continue to work till about the middle of June, drawing the spears of corn and other plants they cut off to the mouth of their subterranean holes where they may feed during the day hid from their enemies. This is a habit that is common to many other Cut-worms whose rapid growth during the latter part of their larva state seems to require that their food be taken oftener than it would be if they ate only during the night. The Variegated Cut-worm, when confined in the rearing cage away from the hot sun and the birds will eat nearly as much through the day as during the night in the last week or ten days of its larval state.

The moth, according to Dr. Harris' description, has "the fore wings dark ash-colored and exhibits only a faint trace of the transverse double wavy bands; the two ordinary spots are large and pale and alternate with a triangular and a square deep black spot; there is a smaller black spot near the base of the wing. The hind wings are brownish gray in the middle, and blackish behind. It expands one inch and a quarter."

The moths appear about the first of July, and after pairing lay their eggs singly on the ground at the roots of grass, weeds or other vegetation, upon which the young worms are to feed during the rest of the season; either upon the tender succulent roots below the surface, or

upon the herbage above the ground during the night. By the time the frosts and cold nights of fall warn them of the approach of winter they are about half grown. They now descend several inches into the ground where they remain torpid during the winter, to come forth when the warm days of spring that have started vegetation have also warmed them into life.

THE REAPING RUSTIC.—(*Agrotis messoria*—Harris.)

The larva is the Dark-sided Cut-worm.

This worm, similar in habit to the Climbing Cut-worm, was first described by Prof. Riley in the *Prairie Farmer* of June 2, 1866, where he designated it as the Dark-sided Cut-worm. A year after this, on June 22, 1867, he published in the same paper some further observations on this and other Cut-worms, and there named the moth that is produced from this one, *Agrotis Cochranii*, in honor of Mr. J. W. Cochran, of Calumet, Ill., who had materially assisted him in his study of the Cut-worms. Although this is the first that had been written about

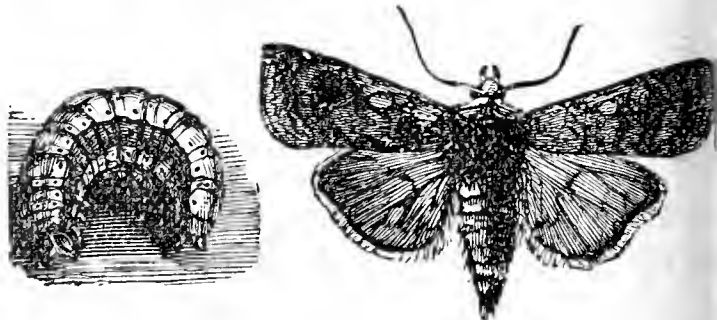


Fig. 19. The Reaping Rustic.

the Caterpillar, the moth had been found and named at two different times before this, by Grote and Robinson, in the first volume of the transactions of the American Entomological Society, where it was called *Agrotis repentis*; but the first name given to the moth, and the one by which it is now generally known was *Agrotis messoria*, by Dr. Harris in his work "Insects Injurious to Vegetation."

Although the descriptions we have of this Cut-worm relate wholly to its climbing habit, I am satisfied that with some others it does not confine its depredations to eating off buds from trees and shrubs in our orchards and gardens, but that it takes part in the destruction of field crops as well. This is one of the five species that were reared by Dr. Harris that, as he says, "some of them were dug up among cabbagees, some from potato hills, and others from the corn field and the flower garden." At the time, he made no description of the caterpillars, as he evidently supposed they all belonged to one species, for he says of them, "much to my surprise, however, these Cut-worms produced five different species of moths; and, when it was too late, I regretted that they had not been more carefully examined and compared together before their transformations."

The caterpillar is in general color dingy ash-gray with the sides darker than the rest of the body. In the young worms the sides are much darker, and the white below the dark sides "is then cream colored and very distinct." The top of the body has a little inclination to a shade of flesh color, while on each segment there are eight small black shining spots, from each of which arises a short bristle-like

air. When full grown it is a little over an inch in length. When about to transform it goes into the ground for that purpose and changes to a chrysalis about three-fourths of an inch long.

The moths come out in July and August and deposit eggs for another brood of the caterpillars that pass the winter in the ground in a torpid state.

The moth is not quite an inch and a half across the wings. The front wings are of a dark gray color which has a very slight purplish tinge, the end of the wings being some darker than the general color. The usual transverse bands are present and are very distinct, and of a dark brown color, almost black. The round or orbicular spots and the reniform or kidney-shaped spots are gray surrounded by the same dark color, and are very distinct. If we compare this with the Climbing Rustic the markings will be seen to be about the same but the color much darker.

### THE LANCE RUSTIC—(*Agrotis ypsilon*—Rott.)

The larva is the Greasy or Black Cut-worm.

Although some species of our Cut-worms may be locally more numerous in individuals this one has about as wide a range as any, at least in the United States. In reference to its distribution in Illinois I have had it reported to me during the past season from various parts of the State as one of the species especially destructive in corn-fields and gardens, a few of which I will mention.

A. S. VanWinkle, of Trenton, Clinton County, writes that it "does considerable damage to corn crops, etc."

C. E. Worthington reports it from the vicinity of Chicago.

E. R. Boardman, of Elmira, Stark County, writes in regard to this species: "They were very abundant on some pieces of meadow land that were broken up in the fall and planted with corn last spring. I found them mostly on dry rolling ground, where they did considerable damage to the crops. They disappeared about the 15th of June, at least I could find very few after that date."

The above was a part of a letter bearing date of November 24th, 1877, and what is worthy of notice here is that this seemed to be the prevailing species in that locality the past season according to his observations, as the Variegated Cut-worm was the most abundant in Washington County, though the other was present. Thus we find that it is not always the same species that does the damage in the same locality different seasons. I find from the collections made in the vicinity of Carbondale that the southern part of the State was also represented.

Prof. Riley, in speaking of the habits of this Cut-worm, says: "Though it has not, so far as I am aware, the climbing habit, it has a most emphatic and pernicious *cutting* habit."

The worms vary considerably from an almost uniform dark greasy gray color with a faint stripe of dull dirty yellow along the back, to a dull leaden brown inclining to black. It is to the latter form that the appellation of Black Cut-worm will apply. The worm reaches its

maturity in our State from the last of May to the middle of June, and is then about an inch and a half long. The most prominent characters of the moth, which appear a month later, are the front wings light brown shaded with dark brown, and a dark brown lance shaped spot running from the reniform or kidney-shaped spot, outward part way to the outer edge of the wing, and contrasting strongly with the light brown around it. This lance shaped point is almost or quite met by another one that begins in a zigzag line near the outer margin of the wing. There are usually several other smaller points from the same light line that are below the first one mentioned. The hind wings are almost a pearly white with very little of the dark outer border that is usually found in these Cut-worm moths. The expanse of the wings is a little over an inch and three-quarters.

#### THE UNARMED RUSTIC—(*Agrotis saucia*—Hub.)

The larva is the Variegated Cut-worm.

These worms when they first make their appearance in the spring are usually not more than three-fourths of an inch long and are then quite dark colored. The general color is flesh gray with elongate black patches on the sides, a creamy stripe along the stigmata or breathing pores, and a triangular black patch just before the anal extremity of the body. On the top of each segment is a bright yellow point which is especially distinct in the anterior part of the body. Besides these marks the upper surface of the body is irregularly mottled with fine dark spots. As the worm increases in size it grows lighter and the light stripe along the sides is frequently a series of blotches instead of a line.

The moths from these worms vary considerably in different individuals. The general color of the fore wings is a dark brownish gray with the front edge of the wings in some specimens almost black while in others this space is dull golden buff color, with dark brown or black points along the front edge of the wing. In the dark specimens the two spots that are found on the wings of all of these moths are darker than the ground color, with hardly a trace of the double wavy bands, but in the lighter specimens these two spots are lighter than the ground color, and the double wavy bands show a little plainer.

It is probable that there are two broods of worms of this species in a season, for the moths from the first brood come out of the chrysalids from the 15th to the 25th of June, after remaining in that state about twenty days. I have not seen the eggs, but Prof. Riley states that one batch was sent him by J. M. Shaffer, then Secretary of the Iowa State Agricultural Society, found on a cherry twig; also, a short time after, Mr. L. M. Lyon, of Bethalto, Ill., presented some to the Altoona Horticultural Society that were found on an apple twig, while Prof. Riley found some the same season on a White Mulberry leaf. This taken with the fact that they do not exhibit the Cut-worm propensity of concealing themselves in the ground up to the first moult, as shown by Prof. Riley, but feed upon vegetation wholly above ground, would lead us to conclude that they are usually laid upon some stem or twig



where the young feed till they cast their skins the first time, when they descend to the ground and are thereafter true Cut-worms. Those that Prof. Riley reared from the eggs passed through all their changes in thirty-five days, shedding their skins four times from May 24th, the time they hatched, to June 15th, when they went into the ground to transform to chrysalids.

During the time that I had quite a number of these Cut-worms in a rearing cage, I fed them upon several different kinds of plants, for the purpose of observing what they ate the most readily. The usual food I gave these as well as other Cut-worms was Knot-grass (*Polygonum aviculare*), a weed that is abundant about every dwelling, and which they ate readily. With this I from time to time gave them corn, grass, peach leaves, the tender ends of grape vines, and also planted corn in their cage. The grass and corn placed in the box were eaten sparingly, neither being very tender. The peach leaves and grape shoots were entirely consumed, while the ends of the young shoots of the corn planted in the box were eaten off at the surface as soon as up, which of course did not kill the stalks as it only took off the ends of the leaves. As there was plenty of food in the box all the time they allowed the corn to grow, and as the stalks became harder they only ate from the sides of the leaves. From the above it is evident that as a corn insect this is not so injurious as some other species, especially where there are weeds in the corn to furnish them food when the spears of corn have become a little tough. It is also evident that where the corn is eaten by them it will not be liable to kill the corn, for the reason that it is cut off above the ground and will generally grow up again.

#### THE CLANDESTINE OWLET MOTH—(*Agrotis Clandestina*—Harr.)

The larva is the W-Marked Cut-worm.

The first account we have of the habits of this worm is a communication from Dr. F. E. Melsheimer, of Dover, Penna., to Dr. Harris, in which the worm "is said to attack young corn, and to feed indiscriminately on all succulent plants, such as early sown buckwheat, young pumpkin plants, young beans, cabbage plants, and many other field and garden vegetables." Other writers have since corroborated these facts, besides adding some new points.

Prof. Riley first gave a detailed description of this Cut-worm with a name characteristic of its appearance, though the moth was one of the four or five described by Dr. Harris in his "Insects Injurious to Vegetation." It was given the name of W-Marked Cut-worm on account of the characteristic markings resembling this letter, which it has on its back. The general color of the caterpillar is ash-gray inclining to dirty yellow on the back and upper sides, with the black and brown spots on the back so arranged as to bear a general resemblance, when seen from behind, to the letter W, though this is not apparent in the thoracic segments. In the young worms the color is a

more decided gray and the W-marks are less distinct. In feeding it frequently drags its food to a place of concealment to feed upon it during the day.

The moth, which comes out the latter part of June, has the front wings generally of a dark ash color, with only a faint trace of the double transverse lines that are found in most species. The two ordinary spots are small and narrow, the one nearest the shoulder, the orbicular, being oblong-oval and connected with the oblique kidney-shaped spot, or reniform, by a longitudinal black line. The hind wings are rather dark, and the head and legs darker than usual. The wings, when expanded, measure an inch and three-quarters.

#### THE DEVASTATING DART—(*Hadena devastatrix*—Brace.)

The larva is the Glassy Cut-worm.

It is probable that this species will be more destructive to the general produce of the garden than to corn, but as it is of rather general distribution it may be included here. The caterpillar when full grown is about an inch and a quarter long, the body a translucent glassy green, with the head a bright venetian red, and the cervical shield, or the upper part of the neck, dark brown. It may be readily recognized by these characters.

The moth is of rather a dark drab or yellowish gray color on the fore wings with the usual lines and marks, the lines of a dark brown color. At the extremity of each fore wing is a transverse light line from which are several dark brown points extending towards the base of the wing. The reniform or kidney-shaped spot is partly surrounded by white, while there is sometimes a little of the same round the orbicular.

#### THE AMPUTATING BROCADE MOTH—(*Hadena arctica*—Boisd.)

The larva is the Yellow-Headed Cut-worm.

The characteristic habits of this caterpillar were studied by Dr. Fitch and given in his report for 1863 to the State Board of Agriculture of the State of New York. In speaking of this and the Striped Cut-worm, he says: "Just as the Striped Cut-worm was about to vanish, another one, larger and more voracious, came out to occupy its place and continue the work of destruction in the fields, none of them being met with in the gardens. It was on the 20th of June that in examining a corn field, I first noticed this second worm, lying under the sods, it being of a white or pale smoky color with a bright tawny yellow head, and the same kind which I have heretofore named the Yellow-headed Cut-worm. This corn field had been broken up just before planting, and the roots of the grass were still juicy, succulent and unwithered, at least in the larger masses of turf, and this worm evi-

dently preferred these grass roots to the young corn; for on examining a multitude of the hills of corn in which one or more of the young plants had been cut off, it was invariably the striped worm first mentioned which was discovered there, not one of these Yellow-headed worms had as yet molested the corn. Five days afterwards, this same corn field was again visited. The weather in the interval had been warm and dry, whereby the grass roots in the clumps of turf had become dry and withered, unadapted for feeding the worms any longer, and now on examining where the blades of young corn had been newly cut off, the mischief was discovered to have been done in nearly half the instances by this Yellow-headed worm, which was found lying in the earth contiguous to the severed plant."

The date of this visit was June 25. He afterwards states that a few years before he found the same Cut-worm making severe havoc in a corn field the first of June. In speaking of the habits of the two worms still further, he said it could be told which of the two had cut off a spear of corn before unearthing it, for the striped worm cut off the spear about an inch above the surface of the ground, while the yellow-headed worm cut off the spear about an inch below the surface. Those cut off by the first would, the most of them, grow again, as only the leaves would be severed; but where the spears were cut below the surface of the ground the culms in most cases would be severed and those plants would be destroyed. For this reason the yellow-headed worm would be the more destructive of the two to cornfields. These worms continue their work of destruction till about the first week in July, when they descend into the ground to undergo their transformations, appearing in the moth state about a month later.

The moth is larger than the one from the Striped Cut-worm, being nearly two inches across the wings; and differs from those belonging to the genus *Agrotis* in having little tufts of hairs on the back of both the thorax and abdomen, while in the male there are broad, fan-like tufts at the end of the body. The outer ends and base of the fore wings are dark ash-gray, the middle part rich reddish-brown, while the ordinary spots and a band across the outer part of the wings are of a lighter gray than the base. There is also some of the reddish-brown sprinkled over all parts the wing where brown is not the ground color.

#### THE FALL ARMY-WORM—(*Laphygma frugiperda*)—Guenee.

The first notice we have of the destructive habits of this caterpillar is in the American Entomologist, Vol. 2, page 43, where the editors state that they had received numbers of these larvæ from Mr. E. Daggy, of Tuscola, Illinois, in July, 1868, and that they eat into the heart of young corn plants in Central Illinois, besides feeding externally on the leaves. In a subsequent article the insect was again referred to and called *Prodenia Daggyi*, or Daggy's Corn-worm, in honor of Mr. Daggy who first called attention to it. By this time it was found that it not only ate corn, but was also very destructive some seasons to fall-sown wheat and rye, as well as grass and some

other substances; and it was rechristened by Prof. Riley the Fall Army-worm, or *Prodenia autumnalis*.

Wishing to know how extensive Mr. Daggy's observations had been with the worm, and whether it had been injurious several seasons in succession, and also whether specimens could be obtained, either of the worms or moths, for comparison, I wrote Mr. Daggy and received from him the following reply:

BLOOMINGTON, ILL., August 2, 1877.

DEAR SIR—Yours of the 30th of July asking in reference to Corn-worm moths is at hand. In reply will say, that I was at Tuscola until June '76, and never saw that worm after the season I sent it to Mr. Walsh, and of course have none of them now, and have no sort of idea what became of them. Their ravages were confined to a small area, so far as I was able to learn, ending with that crop of corn. Regretting that I cannot serve you,

I am yours truly,  
E. DAGGY.

Besides the brief mention given above from articles already cited, this caterpillar has been an object of sufficient destructive importance to call forth lengthy articles in the third and eighth Missouri Entomological Reports, where the description and habits of the insect in its different stages are given, as well as a comparison of this with the true Army-worm (*Leucania unipuncta*). A few years since, about 1873, this worm made sad havoc in winter wheat in Washington county, in September, or after the winter wheat was up two or three inches high, but only a limited amount of damage was done to corn.

The eggs, according to Prof. Riley, are deposited in clusters, sometimes two or three deep, on the under side of various kinds of leaves, and very much resemble the eggs of the Unarmed Rustic, only they are less compressed and the ribs less distinct. There are from two to four broods of the worms in a season, and were it not for the numerous enemies that prey upon them, the ratio of increase would be so great as to devastate crops of their food plants every season, but fortunately their visits in great numbers are separated by intervals of several years, and then their depredations are frequently local.

The ground color of the caterpillar is variable, generally black when young, but when full grown, from pale brown to dirty green, with more or less of pink or yellow admixed, mottled with crimson and yellow and the markings in brown. Back brownish, with a narrow line in the middle bordered each side by a darker shade. On each side is a dark line that is bordered above with yellow. Below the stigmata or breathing pores is a line, either buff or flesh colored, bordered above with a wavy yellow line. Under side pale.

The moth is variable. The fore wings are narrow, with the general color mouse gray, variegated with smoky brown, reddish yellow and white, a patch of the latter color usually found near the apex. The hind wings are a pearly white with a narrow dark outer border.

*Remedies.*—Where this worm appears in great numbers it exhibits more of the Army-worm traits than any other, and the artificial means that are recommended for that caterpillar may be used for this.



THE VIOLET NEPHELODES—(*Nephelodes violans*—Guenee.)

As corn forms one of the food plants of the caterpillar of this moth, it may be placed here among the corn insects, though the extent it may injure corn is unknown, for I fail to find any record of the insect except in the moth state.

I found while watching it in the rearing box that it possessed the same habits as the larvæ of the genus *Agrotis* and those more closely related to that genus, for which reason it might be called the Smooth Cut-worm and placed in that group of injurious insects; though the structure of both the caterpillar and moth are more like the Stalk-borers, of which *Gortyna nitela* is a good example.

My notes indicate that the first time I found this worm was April 28th, and that it lay partly concealed in the grass under the edge of a piece of old stove pipe. At this time it was about an inch long and so dark that it was almost black, with the light stripes appearing to go only a short distance from either end towards the middle. During the month of May I found more of them with several other larvæ under patches of dead grass where there was moisture and grass and weeds at hand for food. At this time the worms were larger and lighter than those first found. In length it was at this time 1.75 inches. In form robust, with the head about four-sevenths the width of the body. Above the lower edge of the stigmata are four broad, dark brown longitudinal stripes alternating with three narrow grayish yellow ones, the latter being in the dorsal and subdorsal regions, and lighter at the extremities of the body than in the middle. In their motions they seemed to be sluggish unless disturbed when they could move rapidly.

While in confinement I fed them on young corn, grass and knot-grass, a weed that grows about every dwelling. They ate without seeming preference all of them, eating both the culms and leaves of the corn. Like the larvæ of the different species of *Agrotis*, they fed mostly at night and lay concealed during the day. As there was usually plenty of material in the box for them to hide under they commonly hid under that above the dirt, but they sometimes would hide beneath the dirt. When they had attained their full size they went into the dirt and changed to robust, dark brown chrysalids, larger proportionally in the middle than the species of *Agrotis*, and tapering more abruptly from the middle to the tip.

The moth is about the size and about as dark as the dark specimens of the Unarmed Rustic. It is of a rich brown color, tinged all over with a rosy hue, except a space in the centre of the fore wings, which is brown, and the outer portion of the hind wings, which is a blackish slate color. The fringe on the hind wings is a rich rose color. but on the fore wings a little darker.

They went into the chrysalis state in June and came out as moths about the middle of September. From this, and the fact that the caterpillars were nearly grown when found in April, there must be only one brood in a season, and the partly grown larvæ must pass the winter in a torpid state. Under my treatment they exhibited only a

Cut-worm trait. Should they multiply so as to be destructive to corn and grass, burning our meadows and fields late in the Spring will doubtless destroy them.

#### THE STALK-BORER—(*Gortyna nitela*—Guenee.)

For the characters of this species, as well as *Gortyna nebris*, see Miss Smith's article.

#### THE SPINDLE WORM MOTH--(*Achatodes zea*—Harris.)

Though little has been said in regard to this insect since Dr. Harris described its habits, I am satisfied, since it is found throughout the northern part of the State, that it has not abandoned its old habits, but that it still eats into the young and tender stalks of growing corn.

From Dr. Harris' description we learn that "its ravages generally begin while the corn stalk is young, and before the spindle rises much above the tuft of leaves in which it is embosomed. The mischief is discovered by the withering of the leaves, and, when these are taken hold of, they may be drawn out with the including spindle. On examining the corn, a small hole may be seen in the side of the leaf-stalk near the ground, penetrating into the soft center of the stalk, which, when cut open, will be found to be perforated, both upwards and downwards, by a slender worm-like caterpillar, whose excrementitious castings surround the orifice of the hole. This caterpillar grows to the length of an inch, or more, and to the thickness of a goosequill. It is smooth, and apparently naked, yellowish, with the head, the top of the first and of the last wings black, with a double row, across each of the other wings, of small, smooth, slightly elevated, shining black dots."

The chrysalis is formed in the hollowed out stalk, and the moth issues from it early in August. The wings expand a little less than an inch and a half. The fore wings are gray, streaked with rust red along all the veins, with about three somewhat irregular transverse lines of the same, and a large patch at the apex. Hind wings smoky brown. The body a purplish gray, with a row of rust red tufts down the back from the head to near the end of the abdomen.

*Remedies*—I will quote those recommended by Dr. Harris: "In order to check the ravages of these insects they must be destroyed while in the caterpillar state. As soon as our corn fields begin to show by the withering of the leaves, the usual signs that the enemy is at work in the stalks, the spindle worms should be sought for and killed; for if allowed to remain undisturbed until they turn to moths, they will make their escape, and we shall not be able to prevent them from laying their eggs for another brood." About as good a method as any, if the above suggestion is acted upon, will be to cut such infested stalks and at once feed them to cattle before the caterpillars have a chance to escape.

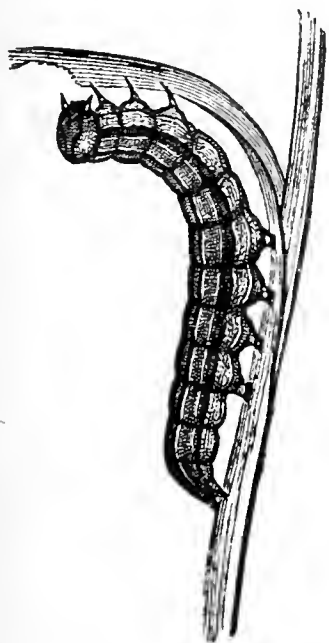
THE ARMY-WORM—*Leucania (Heliophila) unipuncta*, Haworth.

Fig. 21. Larva of Army-worm

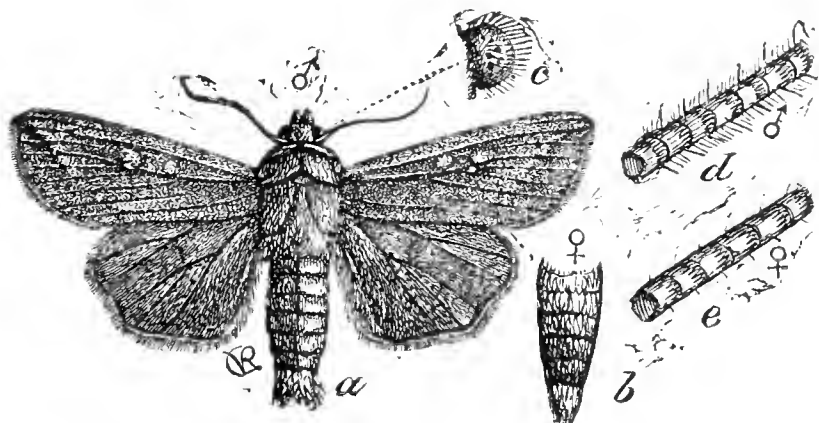


Fig. 22. Army-worm Moth.



Fig. 23. Army-worm Chrysalis.

So much has already been written about this insect that a lengthy dissertation here would seem out of place. In common with the grasses and small grains, corn is subject to the attacks of these worms in the spring, either by the migratory broods that travel in large numbers, making a general destruction of whatever vegetation is in their path, or it may be in the role of a Cut-worm where the single individuals feed at night on the blades, or cut off the young stalks and remain hid during the day. It is only at intervals of several years that the Army-worms appear in vast numbers, but almost every season a few may be found, fat and greasy looking fellows, apparently less adapted to traveling than their more restless brethren. It was in the latter role only that I observed them the past season. At such times the number is usually limited, and if the usual preventives that are used for Cut-worms be applied, especially the precaution of burning rubbish on the ground before plowing, but little damage will be experienced from them in the Cut-worm capacity, at least so far as corn is concerned.

I am aware that plowing under grass and other substances enriches the land more than if the same material be burned, and to burn such material every season without some compensation, is an exhaustive process to the soil, as the substances, if burned, not only add nothing to the decomposed vegetable matter that the soil requires for plant production, but the alkali thus produced serves to dissolve and more rapidly use up the humus the soil already contains. The result of such treatment, as every farmer of observation is aware, is large crops for a year or two and then a falling off, unless it be in exceptional cases where the land has a large surplus of vegetable mould, when alkali is beneficial. In view of this it is better to examine for Cut-worms or other similar insects under bunches of dead grass just before plowing in the spring, and not resort to burning unless there is reason to believe it is necessary.

When a field is attacked by the migratory broods of Army-worms about the best remedy is *ditching*, or making a ditch around the field to be protected, with the side next the field smooth and perpendicular, as they cannot readily climb such a wall of dirt and they will tumble into the ditch in attempting to cross it, where they may be destroyed. Sometimes they migrate in such numbers that the ditch, if shallow, may be filled so full of the worms that a portion may pass over. To avoid this the ditch should be made deep enough to prevent such an occurrence. The ditch may be made with a plow at first, cleaning out with a shovel.

"The general color of the full grown Army-worm is dingy black, striped longitudinally as follows: On the back a broad dusky stripe; then a narrow black line; then a narrow white line; then a yellowish stripe; then a narrow subobsolete white line; then a yellowish stripe; then a subobsolete white line; belly, obscure green."

The general color of the fore wings of the moth is light reddish-brown or fawn color, with the ordinary spots a little lighter than the ground color, but chiefly known by a small white spot in the centre of the wing, and an oblique dusky line from the tips towards the hind margin. The hind wings are blackish, darker in the outer part.

#### CORN-WORM OR BOLL-WORM—(*Heliothis armigera*—Hub.)

The Armed *Heliothis* is largely cosmopolitan in its character, being found not only throughout various parts of the United States, but also in Europe, Asia and Australia. In the Southern States the larva is known as the Boll-worm, and forms one of the chief obstacles in the insect line to the successful raising of cotton. In the more Northern States, especially in the latitude of Southern Illinois, it is known as the Corn-worm because it annually does a considerable amount of damage to the ears of growing corn; and in those parts of this section where cotton is raised, that plant will also be injured by it as well as corn. It does not stop here, however, but goes into the gardens and eats the ears of sweet corn, green tomatoes, green peas and peppers; and if I mistake not I have found the same worm in the growing seed pod of a species of Hibiscus (*Hibiscus grandiflora*) that grows along our streams. In the more northern portion of the State it seems to do but little damage. It is reported as occasionally found in the corn though it is not considered injurious. Some years, however, they occur there in considerable numbers and injure corn to some extent though less than farther south. The following letter received by Prof. Thomas from Mr. W. B. Brown, of Belvidere, containing specimens of the worm for identification will give an idea of their work there the past season.

"I found them eating the corn from the cob, or rather they had been eating for they were all dead when I discovered them, not having made the discovery until after a hard freeze. They commenced at the small end of the ear and took it all as they went, apparently continuing to work around the ear. I found some ears from which the corn had been eaten off two or three inches. The worm is of a dark



brown in its original state but has turned very much darker since I found it."

As a Corn-worm, the amount of injury it does varies with the season, and somewhat with the locality. It attacks corn in the ear, eating first the silk, and as it increases in size the kernels on the end of the ear while in the milk state. Prof. Riley says of its destructiveness, "We have seen whole fields of corn ruined in this way in the state of Kentucky, but no where have we known it to be so very destructive as in Southern Illinois." In the second volume of the *American Entomologist* he says of its work in the state of Kansas that, "in 1860—the year of the great drought in Kansas—the corn crop in that state was almost entirely ruined by the Corn-worm. According to the *Prairie Farmer* of January 31, 1861, one county there, which raised 436,000 bushels of corn in 1859, only produced 5,000 bushels of poor wormy stuff in 1860; and this, we are told, was a fair sample of most of the counties in Kansas. The damage done was not by any means confined to the grain actually eaten by the worm; but we are informed in the same excellent article just now referred to, the ends of the ears of corn, when partially devoured and left by this worm, afforded a secure retreat for hundreds of small insects, which, under cover of the husk, finished the work of destruction commenced by the worm, eating holes in the grain or loosening them from the cob. A species of greenish brown mould or fungus grew likewise in such situations, it appearing that the dampness from the exuded sap favored such a growth. Thus decay and destruction rapidly progressed, hidden from the eye of the unsuspecting farmer."

I quote the above because it aptly represents what I have seen here during the past season. As a general thing I think it has not been so destructive during the past season as it is sometimes, but in one field of late corn I found nearly every ear eaten by them, there being from one to half a dozen worms to each ear. In many of them, when my observations were made, while the corn was yet soft, the process of moulding and decay had progressed to such an extent that it was difficult to conceive that such corn could ever become anything fit for man or beast to eat. In some fields I visited the injury was much less, while in others only a few eaten ears could be found.

The Corn-worm is about an inch and a half long when full grown, and varies in color from pale green to dark brown, striped longitudinally with darker stripes of the same color, being somewhat lighter when young. Though this variation in color is so great as to make them look like different insects, still the markings are the same, the green worms marked with stripes of darker green, and the brown ones with darker brown, all having eight round, shining black spots on each segment of the body, from which arise short brown hairs. The head and neck are brown. When full-grown they leave the ears and descend into the ground where they change to chrysalids that are light chestnut brown with the marking darker.

With us the worms are said by Prof. Riley to be two brooded, while according to Glover they are three brooded in Georgia, and are probably single brooded still farther north where the seasons are shorter. The first brood remain in the chrysalis state from three to four weeks when they come forth as moths, the second brood remaining in the

ground through the winter. Mrs. Mary Treat, of Vineland, N. J., says the first brood of the worms live upon the staminate flowers or tassels of the corn before the ears make their appearance, or before the tassel has come out above the leaves, eating through the leaves while they are yet folded around the tassel. As I have taken the moths, as well as have reared specimens, hatched in May, I should think her observations correct. In this case the moth must lay the eggs either in the axils of the upper leaves, or in the very top of the opening bunch of leaves, where the young worms as they hatch can find ready access to their food. The brood that works on the ears is produced from eggs laid on the silk; and when hatched, which requires only a few days; they feed upon the silk, if the ends of the husks are well up above the ends of the ears, till they are about a third grown before they reach the ends of the ears. As soon as they come to the kernels they work their way round the ear inside the husks, sometimes eating only the outside portion of the kernels, or boring through the under side next to the cob so that when the husks are stripped back the worm may be nearly half hidden in the corn. As the corn gets hard their work generally stops, though they will occasionally eat into corn that is quite hard. Those that are full grown before the corn becomes hard leave the ears to go into the ground to undergo their transformations, while others that have not reached that stage die and rot in their burrows, these adding to the general mouldiness and decomposition that helps to make the corn unfit for use. This however, is not always the case.

The moth is variable in depth of color and shading, but is usually of a pale clay yellow with a more or less distinct tinge of olive green, the forewings marked with olive and rufous, with a blackish spot near the middle of the wing, and a dusky shade near the outer margin. The general color of the hind wings is paler than the fore wings, the outer border a dark brown or blackish band interrupted in the middle by a pale spot.

*Remedies.*—I do not know that any insect parasite has been found that preys especially upon these worms. The fact that they remain hid from sight enclosed within the corn husks would of itself be a good reason why they are not destroyed by some of the numerous ichneumon and tachina flies that usually serve to keep down the otherwise rapid increase of many caterpillars; hence the remedies that will serve to keep these worms in check, aside from the natural influence the seasons may have on them, must come directly from the farmer. My observations point to the following means as in a great measure accomplishing the desired end:

*Early Planting*—Near the town of Carbondale were two fields of corn that were separated only by a rail fence, the one planted early, the other late. I passed through both fields September 24th, and found no worms in the early piece and no signs of their work, while in the other field fully nine-tenths of the ears were wormy. There might have been a few ears in the first piece that had had worms, but all I would say is that I did not succeed in finding any by examining quite a number of ears as I passed through. Of other fields examined I found the early planted but little molested, while that which was planted late was considerably so. It has been said by others that the

earliest and the latest planted fields are eaten the most. This may be so some seasons, but did not seem to be the case the past season.

*Topping the Corn.*—During the latter part of September I had a chance to examine two fields of corn in Union county that had been topped for the fodder. The work had been done about ten days before. I should say that ninety per cent. of the ears at this time were quite hard and husks dry. From an examination of a large number of ears I found only two worms, and they were in ears that were still green. Nearly one-half the ears showed the work of the worms at the ends, but to a more limited extent than usual. My conclusions were that topping the corn had hastened the ripening, thus rendering it difficult for the worm to eat it; and at the same time, as the ears now stood out in the sun unshaded by the stalks and leaves, the extra heat rendered it uncomfortable for the worm and hastened his departure. There was but little injury sustained by the corn in this case, for the ends of the ears were but little eaten and were dry. When we remember that a considerable portion of the early part of their lives is spent in the silk before reaching the ears it is plain that hastening the ripening of the corn must considerably lessen the amount of damage done by them.

*Fall Plowing.*—To make it plain how this is to reach them I shall have to explain some observations made on the fall brood of chrysalids that were found during the month of November in a field where the worms had been very abundant in the corn before it was harvested. In digging for the chrysalids round the corn hills I found that instead of their occupying an oval earthen cocoon, as has usually been written of them, and as they apparently do in the rearing box, they were down in the ground from five to six inches below the surface in a hole about a third of an inch in diameter reaching from the chrysalis to the top of the ground, where it was covered over with a thin film of dirt from an eighth to a quarter of an inch thick. This hole was larger at the bottom than at the top, apparently so as to give free motion to the chrysalis, and usually bent in its course, so that the lower part would have an inclination of perhaps forty-five degrees. At the bottom would be found the chrysalis, the small end downward and the head upward. In one case I found the hole so bent that the chrysalis occupied a horizontal position. The hole was smooth inside, and was perhaps made so by cementing the dirt together, but of that I could not tell, for the whole ground was moist, though dry enough to be firm. I took several of the chrysalids and put them in a box with some loose dirt and then moistened it, after which I allowed them to freeze. The dirt, when they were allowed to freeze, was dry enough so that if it had been in the garden and turned over with a spade it would crumble. When examined after the freezing all were dead. Some others taken up in the bottom of their subterranean habitations, without sifting the loose dirt round them in their holes, and allowed to freeze, were not killed by freezing.

My conclusions were, that so long as they were in the smooth compartments they had made for themselves, free from any loose dirt that would become wet and stick to them, they could pass the winter in safety, even though they might be frozen; but, when the dirt was packed loosely round them and became wet and stuck to them, then

freezing killed them. Their holes, running cell-like as they do from the surface down into the ground five or six inches, must be broken up by plowing, and when once broken up with the loose dirt round them the rains and the freezing winter weather would have the same effect on the chrysalids that moisture and freezing had on those in the box of loose dirt. Fall plowing, then, for these reasons, will probably be the most efficient means of destroying these insects; besides, if done late enough, it will rid the ground of Cut-worms, etc.



## REPORT OF MISS EMMA A. SMITH.

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To Cyrus Thomas, State Entomologist of Illinois:

I hereby submit to you my report of the noxious insects of Northern Illinois, which have come under my observation during the summer of 1877.

Directly after my appointment by yourself as your assistant, I sent out cards to all the principal places in Illinois north of Springfield, urging correspondence on the subject of injurious insects, the result of which I will give in the notes following. Many of the letters I followed in person, making investigations I could not have otherwise obtained. Many kinds which have proved injurious to vegetation in Northern Illinois have been treated of at length in other reports, and I will simply mention them, together with the locality most infested. Of the original work I have been enabled to do I will treat of at length. There are a few insects whose life history I have commenced to unravel, but the time given has been too short to complete the knowledge sufficiently to treat of here.

The Colorado Potato Beetle, *Doryphora*, *10-lineata*, Say, during early summer, had every indication of becoming common throughout Northern Illinois. The people in the infested vicinity, when showing the greatest apprehension from their ravages, were relieved by heavy rains, which killed many of them, and but little damage ensued.

The Canker-worm, *Anisopteryx vernata*, Peck, made its appearance during the past two years in both Tazewell and Peoria counties, although not so numerous as in the year 1876, yet enough so to cause much damage.

The Tent Caterpillars have been very numerous both in orchards and forest trees, the Fall Web-worm, *Hyphantria textor*, Harris, being, perhaps the most numerous.

Comparatively little has been written me of the Chinch-bug, *Micropus leucopterus*, Say, and for the reason, undoubtedly, that the summer has been an unusually wet one.

The oak forests have been seriously injured by the caterpillar of a small moth, which has appeared in great numbers, and although it has been observed in years previous, yet not to any great extent. I have succeeded in working up the natural history of the insect, and

record the same, together with the parasites and insect enemies, illustrated with original drawings by Mr. Emerton.

The Strawberry-worm, *Emphyrtus maculatus*, Norton, has caused considerable damage to the strawberry vines by eating both leaves and blossoms, and in some instances, as I found in the garden of Mr. O. B. Galusha, Morris, Ill., when infested by both Strawberry-worm and Strawberry-leaf-roller, *Anchylopera fragariæ*, Walsh and Riley. The only means of destroying the insect for succeeding years is that of plowing up the vines and being cautious of the choice of young plants.

The Raspberry-worm *Selandria rubi*, Harris, was numerous in the same garden. The larva is a small green worm which feeds upon the leaves, eating out small holes between the ribs. They are inactive during the heat of the day, feeding only in early morning and evening.

The cornstalks have been injured by a borer which has eaten the pith of the stalk. It is the larva of a moth, *Gortyna nitela*, Guenee, the same that occurs in garden vegetables and that Dr. Le Baron mentions in his second report as infesting the stalks of wheat. I shall treat of this more particularly farther on.

Of the Bark-lice infesting both orchard and forest trees, I fear more serious harm is committed by them than is generally understood.

The apple trees are showing the effect of the numerous scales of the *Aspidiotus Harrisii*, Walsh, upon the bark, and unless proper attention is given them the probabilities are the increase will prove a source of trouble to the orchardist.

I have given considerable attention to the Bark-louse, *Lecanium acericola*, Walsh and Riley, found upon the soft maple trees. From the fact that the tree is used so extensively for shade, and the habits unrecorded heretofore, I have prepared as full and complete a life history of the insect, together with the parasites infesting the same, as was possible to make in the time given.

I am pleased to state that the general desire on the part of farmers and teachers with whom I have met has been for knowledge on the subject of Entomology. They feel the necessity of becoming acquainted with their insect enemies and friends, as well as the artificial means of fighting them; but I am sorry to observe how few of the same people possess the several Entomological reports sent out by the State.

With the desire of increasing the interest already awakened, and also to add knowledge, I consented, to deliver lectures before the Teachers' Institutes and Normal Schools where I have been so requested, and from letters received since, find the seed sown has come up and bids fair to produce fruit in good season.

The taste for the study is developing, and I sincerely hope the day is not far distant when economic entomologists shall be found in every city and village. Then much that remains a mystery now will be such no longer, and the agriculturist shall wage war with the insect foes intelligently.

I gladly send you the collection of insects of the different orders which I have brought together during the year, for the purpose of adding to the number already in your possession, to be placed in the State House at Springfield, and congratulate you upon your success in

bringing together so successfully the noxious and beneficial insects of the State in such a way that those not conversant with the technical terms of the science may be enabled to recognize them in the relative positions which they occupy. The wood cuts illustrating the insects treated of, unless otherwise stated, are original, made expressly for my report, drawn by Mr. J. H. Emerton, of Salem, Mass., from nature, the specimens sent him by myself.

To Mr. J. Duncan Putnam, Davenport, Iowa, I wish to express my earnest thanks for the valuable assistance gained by notes on the maple tree bark-louse, *Lecanium acericola*, and other insects, as also the generous disposition of his most excellent library.

To E. T. Cresson, P. R. Uhler, C. V. Riley, E. R. Boardman, F. M. Webster and others I am indebted for assistance, and to all agricultural editors who have sent me papers, notes, specimens and all other favors I am truly grateful.

It gives me great pleasure to acknowledge my indebtedness to Col. R. G. Ingersoll, of Peoria, for the influence he has so generously exerted in my behalf. Through his kindness I have been enabled to obtain free passes on all the important railroads of the State, thus affording me the opportunity of making more extensive field examinations than I could otherwise have done. And to the Superintendents of the roads, who so readily complied with his request, I express my sincere thanks.

Among the number are the Chicago, Burlington & Quincy; Chicago, Rock Island & Pacific; Illinois Central; Peoria, Pekin & Jacksonville; Toledo, Peoria & Warsaw; Chicago & Alton; Indianapolis, Bloomington & Western; Peoria & Rock Island; Pekin, Lincoln & Decatur; Western Union, and the Illinois Midland.

And most of all I would express my gratitude to you for the trust implied in my work, and the encouragement you have ever given me in the pursuit of this my favorite study.

Most respectfully yours,

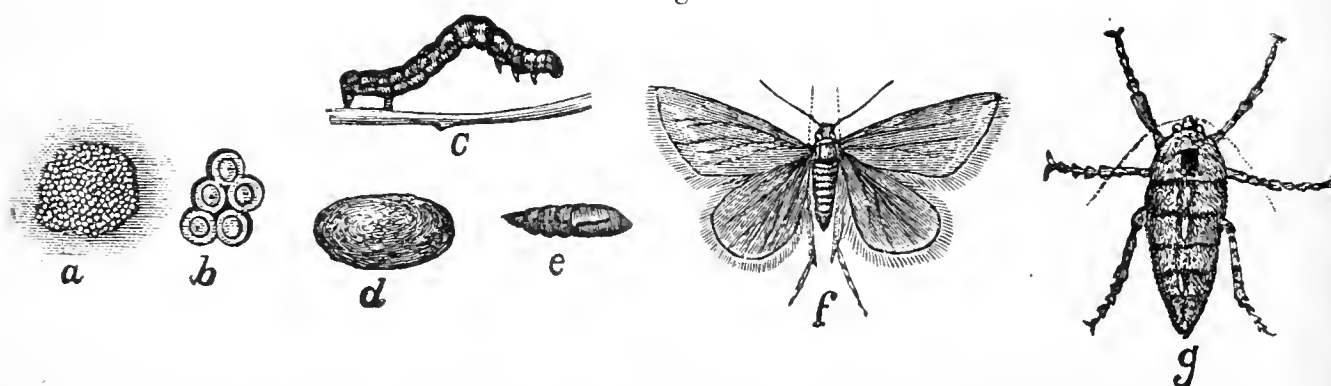
EMMA A. SMITH.

PEORIA, ILL., December 20, 1877.

## NOTES OF THE YEAR.

THE CANKER-WORM—*Anisopteryx vernata*—Peck.

Fig. 24



The Canker-worm in its various stages : *a* Egg-mass ; *b* eggs magnified ; *c* the caterpillar or larva ; *d* cocoon ; *e* chrysalis or pupa removed from the cocoon ; *f* male moth ; *g* female moth.

The Canker-worm has appeared in Northern Illinois during the past season, and has been the means of doing considerable damage to the various orchards. In Peoria county I have observed them to a limited extent for the past two years, but all the precautions urged were neglected, and the increase has been rapid until the orchardists realized the extent of damage these insects were capable of committing. The plan of plowing the ground after the worm had entered, and turning in hogs to destroy the chrysalids, was resorted to in an orchard of over three thousand trees, but partially failed because of the limited number of animals. In this particular orchard many hundred trees have died from the effects of the worms ; and the remedy of applying the rope and tie bands to the trunk of the tree, thus entrapping the wingless females when ascending the tree, as recommended by Dr. Le Baron in his second Illinois report, was urged and complied with, and, it is hoped, with favorable results.

## THE TENT CATERPILLARS.

The Tent Caterpillars have been unusually plentiful, those infesting the apple orchards and forest trees. The apple tree Tent Caterpillar *Clisiocampa Americana*, Harris, has been treated of so fully in both agricultural papers and State reports, together with the remedies for destruction, that their presence in an orchard speaks only of careless neglect.



The Fall Web-worms, *Hyphantria textor*, Harris, are perhaps harder to combat because of the extreme height of the trees which they infest. In the Springdale cemetery, a place of over two hundred acres, situated just out of Peoria city, the webs were unusually numerous and upon nearly all varieties of forest trees, as the hickory, ash, oak, black walnut, black cherry, as also upon the fruit trees, apple and pear. This insect is generally considered single-brooded, although it is possible in some latitudes they are double. Perhaps the cheapest and most effectual manner of destroying these insects is by means of the lighted torch or burning a whisp of straw directly under the web containing the insects. They can be destroyed any time during the day, since the habit of the insect is to enlarge the web and thus enclose its food and not leave the same in a body during intervals in search of food, as do the *Clisiocampa Americana*.

#### THE STRAWBERRY-WORM—*Empyrtus maculatus*—Norton.

During the latter part of April and first of May I received letters with specimens from Mr. O. B. Galusha, of Morris, Ill., in reference to a small green worm destroying the strawberry vines. May 22d I visited his place and found the vines to be of the Wilson variety, the leaves and blossoms so badly eaten as to destroy all prospects of a crop of berries. He had plowed up one part of the patch, and in another some half mile distant had allowed poultry the freedom of the vines, which readily devoured the worms.

The insect proved to be the larva of *Empyrtus maculatus*, first described by Mr. Riley in the *Prairie Farmer* under date of May 25, 1867; the same has since been rewritten in various reports. The species appears to have a wide range, since it is reported from various sections in the East and from Ontario, as also from the States of Illinois, Missouri and Iowa. I have met it through Northern Illinois during the past two seasons, and scarcely a patch of vines are entirely free from a limited number, even though no serious effects have been produced and their presence hitherto unsuspected.

In Mr. Riley's 9th Missouri report, page 27, is found a short history of the insect from which I will draw that others may be enabled to recognize the enemy who may not chance to possess this valuable work. "Early in spring numerous flies may be seen hanging to and flying about the vines in fields which have been previously infested. They are dull and inactive in the cool of the morning and evening, and at these hours are seldom noticed. They are of a pitchy black color, with two rows of large, transverse, dull, whitish spots upon the abdomen. The female, with the saw-like instrument peculiar to the insects of this family, deposits her eggs by a most curious and interesting process, in the stems of the plants, clinging the while to the hairy substance by which these stems are covered.

The eggs are white, opaque, 0.03 of an inch long, and may be readily perceived upon splitting the stalks, though the outside orifice at which they were introduced is scarcely visible. They soon increase somewhat in bulk, causing a swelling of the stalk, and hatch in two weeks, more or less, according to the temperature, and during the

early part of May the worms attract attention by the innumerable small holes they make in the leaves. Their colors are dirty yellow and gray-green, and when not feeding they rest on the under side of the leaf, curled up in a spiral manner, the tail occupying the center, and fall to the ground at the slightest disturbance. After changing their skin four times they become fully grown, when they measure three-fourths of an inch.

At this season they descend into the ground and form a very weak cocoon of earth, the inside being made smooth by a sort of gum. In this they soon change to pupæ, from which are produced a second brood of flies by the end of June and beginning of July. Under the influence of July weather the whole process of egg depositing, etc., are rapidly repeated, and the second brood of worms descend into the earth during the forepart of August, and from their cocoons, in which they remain in the caterpillar state through the fall, winter and early spring months, till the middle of April following, when they become pupæ and flies again appear, as related.

*Remedies.*—The worms are destroyed by sprinkling the vines with a solution of one pound of Hellebore to twenty gallons of water, and since they first make their appearance while the vines are in blossom, poultry can be allowed the freedom of the vines to an advantage, if thought preferable to the solution.

#### THE STALK-BORER—*Gortyna nitela*—Guenee.

Various complaints have reached me during the past summer from the Northern part of the State that the stalks of corn have withered and died in the field, when, upon examining the stalk, a small worm was found enclosed, and which proved to be the originator of the mischief. The worm is known to entomologists as the larva of a moth called the *Gortyna nitela*, Guenee. The habits of the insect in its various stages were first described in the *Prairie Farmer* under date of February 23d, 1867, by Mr. Riley. Since that time various notes have been added in the *American Entomologists* and State reports, but even at this date the entire life history is not complete. The eggs have not been discovered by observers, but it is evident they are deposited singly on the stalk of the food plant, the young larva, as soon as hatched, boring into the stalk and feeding on the inner pith; the entree is made through a round cylindrical hole near the ground, the worm working up.

It has been supposed that the insect matured in one stalk, but during the past summer I have found half-grown worms entering non-infested stalks, and opened withered ones from which they had made their escape; and Mr. Riley states in the *Prairie Farmer*, August 11th, 1877, that "it bores into the stems of all sorts of plants, and is, some years, very common in wheat stalks, which, while yet young, it leaves through cylindrical holes in order to eat its way into some thicker stemmed plant, in which it more readily attains full growth." Their disposition is to live singly, since only one worm is in a stalk, unless in the larger corn stalks, when as many as three have

been found with division line of joint between. The change takes place in early morning or evening, although I have seen them out of their retreat during cloudy days. The larva changes perceptibly during its growth; at first it is of a livid hue, with light stripes along the body, which become broader as it increases in size, the color becoming lighter, also. The full-grown larva is so unlike the young, that, unless aware of the change undergone, it would not be recognized as the same.

The larva becomes fully grown about the last of August with us, and then changes to the chrysalis. It has been understood, that the larva leaves the stalk and bores into the ground a short distance, in three days changing to the chrysalis. I showed in the *Rural New Yorker*, September 22nd, 1877, that this was not always the case, since I have taken them from the lower part of their holes in the corn stalks, and I find Mr. Riley also had notes, made since his first articles were printed, that they do not always change in the ground. The chrysalids are "of the normal form with two fine bristles at the extremity of the body, usually closed so as to form a point, but readily opened V shaped at the will of the insect, as with hundreds of others of the same class."

The moths appear during the latter part of August, and in the month of September, hibernating during the winter, and in early spring depositing their eggs.

Complaints of their ravages have come from Dr. E. R. Boardman, of Elmira, and F. M. Webster, Waterman, Illinois, the former of whom had fifteen acres of corn destroyed by the depredations of this insect, while Mr. Webster says, they have been a serious cause of complaint on account of the injury done by them to many fields of corn.

The only notes outside of the State with reference to the injury to corn, I find in the *American Entomologist* Vol. I., page 252, wherein Mr. F. M. Norton, of Farmington, Conn., states it did great damage to the corn in that state in 1869; and from an extract of a letter to Mr. Riley, bearing the date of 1871, that it was found occurring in great numbers in corn in Centreville, Mo.

They are general feeders, infesting both our marketable produce as well as flowers and noxious weeds.

In a small home garden owned by Mr. John W. Dyson, of Galva, Illinois, I found the larva of this moth in the stalks of his corn, potato, tomato, spinach, and dahlia; this was the more noticeable when I observed the almost entire freedom from the same in the neighboring gardens. The cause of the superabundant supply may have been due to the absence of fowls which were generally kept by those surrounding.

Dr. Wm. Le Baron, the late State Entomologist of Illinois, in his 2nd report, page 141, quotes from a letter received from Wisconsin, that the wheat stalk had suffered from this insect in the summer of 1872. It is not confined to a few kinds of plants for nourishment, but is found in the stalks of tomato, potato, spinach, wheat, corn, the dahlia, aster, lily, spirea, salvia, in the milk-weed, castor-bean, rhubarb, *Chenopodium eupatorium*, in the twigs of peach and currant. It also occurs in the stalks of the common cocklebur, *Xanthium strumar-*

*ium*, the rag weed *Ambrosia artemisiæfolia*, and a variety of Hearts-ease (*Polygonum*.)

They are preyed upon by a parasite in the larva state, but I was unsuccessful—after repeated efforts—to rear it to the imago state and thus ascertain the species. From the hidden place in which it works, it is not as liable to be attacked by other insect enemies. Perhaps the best preventive is that of burning, or otherwise destroying the stems, while the worms are yet within, and thus lessen the supply the ensuing year.

When occurring in a small field, as in flower gardens, they can be cut out of the stalk without injury to the plant; their presence is easily detected by the round hole near the ground, and the wilted appearance of the stalk. This is only advisable when they occur in limited numbers, because of the length of time required to go over the field.

*Spec. Char.* Size and color of the *nebris*, from which it differs only by the complete absence of white spots, and in having the feelers a little longer and more ascending. Upper wings of a light ash-brown sprinkled with fine yellowish dots, the single angular line distinct, behind it the background becomes lighter, then towards the terminal margin it resumes its general tone. No spots. There are seen, especially when the insect is examined, when held to the light, two groups of scales, darker and more closely crowded together instead of the two usual spots.

Lower wings of a uniform livid gray with a cellular, crescent shaped spot on both sides.

Var. *a*. Smallest, traces of a subterminal line composed of yellowish points, deeply shaded in front.

*Gortyna nebris*, Guenee.—Length of the two sexes 38 millimetres. Upper wings entire of a light wooden brown, with a single distinct angular line of a yellowish white color more or less indistinct. The first three spots white as the preceding species, the intermediate often yellow.

Kidney-shaped mark, composed of a larger central spot, generally yellow, and with five or six other very small point-like spots surrounding it. Lower wings uniform light brown in both sexes. Thorax and abdomen ash-gray. Abdomen long. Base of antennæ white. Male smaller; the whole terminal and subterminal space lighter. Lower wings paler.

Mr. Riley informs me that he has bred the *Gortyna nebris*, Gu., from the weed *Ambrosia trifida*, and he feels confident that the two species *nitila* and *nebris* are identical. He comes to this conclusion after studying the two species, and possessing all the varieties between the typical forms.

#### THE OAK LEAF TORTRIX—*Argyrolepia guercifoliana*—Fitch.

It is not an uncommon sight to see the leaves of various kinds of trees and shrubs curled at the edges into little cylindrical rolls and fastened together by threads of silk; or the opening buds stayed in their development by the edges drawn together; even two and three

[NOTE—Prof. Fernald has identified this as Zeller's *Tortrix trifurculana*. C. Thomas.]



leaves are joined, a silken net covering the top. The designer of this arrangement is a small caterpillar. The roll, bud or space in the leaves serving the double purpose of place of concealment from enemies and also that of furnishing food. The choice of thus forming the house depends both upon the texture of the leaf and the insect's future requirement—whether to be inhabited singly or in numbers. Linnaeus, an eminent Swedish naturalist, gave the name *Tortricidæ* to those insects possessing this habit, the word *Tortricidæ* itself being derived from a Latin word signifying to curl or twist.

All the caterpillars placed in this family by the present naturalists are not, strictly speaking, leaf-rollers, since some are found under the bark of trees or on roots of young plants, while still others are found living exposed on plants.

The insects embraced in this family are not considered very injurious, since, as a rule, they do not occur in any considerable numbers, but like all others are subject to variations, and some seasons numbers appear in different localities, and cause much damage.

The moths belonging to the *Tortricidæ* are of a small size, rarely expanding over an inch. The fore wings broad and variegated with bands and spots, often brilliant metallic hues, while the hind wings are dull colored like the body, the inner edge being folded fan-like against the body. The palpi are short, and the antennæ filiform. They fly mostly at night, and are found during the day upon the plant on which the larva feeds.

The larvæ are cylindrical, usually transversely wrinkled, and nearly naked; when disturbed they drop suddenly, suspended by a fine silken thread.

To this family the moth under consideration, *Argyrolepis guercifoliana*, Fitch, belongs. It was first observed by Dr. Asa Fitch, and described by him in his 4th New York report in 1858, since which time nothing has been written in reference to it until an article by myself, printed in the *Prairie Farmer*, August, 1877. During the past four years it has been observed in Northern Illinois, but not until the summer of '77, did it occur in any alarming numbers.

Through the kindness of E. R. Boardman, Elmira, Stark Co., F. M. Webster, Waterman, De Kalb Co., and C. H. Davis, Le Roy, McLean Co., I have been enabled to trace the habits of the insect through its various stages.

The kinds of oak in the forest mostly injured are the Black Oak, *Quercus tinctoria*, red Oak, *Q. rubra*, burr oak, *Q. macrocarpa*, and white oak, *Q. alba*; Mr. Riley informs me he has met the insect quite common around St. Louis in Spring on the pin oak, *Q. palustris*, and I also understand through Mr. Graves, that it has occurred in Kendall county during the past summer.

*Natural History.*—The insect appears with us the middle of May, and at first eats only the parenchyma of the leaf, leaving the veins, and turns over one end of the leaf, leaving the ends open; in this home the caterpillar finds its food and place of retreat.

When full grown, which with us is about the first of June, the worm changes into the chrysalis, first spinning a silken bed upon the leaf and then remaining inside the leaf during the chrysalis state.

The moth appears as early as June 9th, and can be seen flying in the forest as late as the 25th. During the daytime they can be found on the leaves of the oak. Dr. Boardman writes me under date of June 5th: "The oak-pests commenced their work about the 20th of May. I have observed them for the past four years from the 20th to 25th of May, but not in any great quantities. This season they force themselves upon our attention, since we cannot pass through the forest without being loaded with them, while the trees are as bare as in winter; hundreds of acres are nearly stripped of their leaves, the larger trees suffering more than the smaller," and F. M. Webster, July 2nd, says; "I send specimens of a small green caterpillar destructive to the foliage of the red oaks, *Q. rubra*. They were collected when passing along the public road; on both sides the red oaks were almost denuded of their foliage. Standing under the trees the fall of the larvæ upon the ground, as they let themselves down by means of a silken thread, sounded like rain pattering on the grass, while the threads were so thick as to be noticed several rods away, the space between the lower limbs and the ground being literally white."

Owing to the number occurring the past summer the natural habit of concealment was abandoned and the whole leaf eaten. When disturbed suddenly they immediately dropped, suspended in the air by a fine silken thread, which after a time they again climbed up, resuming their work. These silken threads can be seen a long distance off. The usual custom of changing to the chrysalis inside the leaf was prevented by the utter defoliation of the trees, and they were forced to artificial means.

Scattered throughout the forest were many small cottonwood trees and hazel brush which grew in small patches; to the leaves of these many caterpillars resorted for a place of concealment wherein to change to the chrysalis. The greater number crawled under the bark of the oak trees upon the south and southwest sides, covering the entire bark from the lower limbs to the ground with a silken veil thick and continuous enough to be taken off in strips. This was of a yellowish white color, and could be seen some distance off, producing a very pleasant effect to the eye when the rays of the sun fell upon it making it glisten and sparkle; this mass was intended, undoubtedly, as a means of defence from insect enemies, and that of farther concealment than was afforded by the bark.

The chrysalis, which is of a brown color measuring from one-quarter to nearly one-half an inch long, was suspended from the posterior end secured by a few threads of silk; as many as a dozen chrysalids were suspended from one common centre, and, like many of the same family, would wriggle about violently when disturbed. Since Dr. Asa Fitch has written all that has hitherto been known of the insect and its habits, and his valuable reports are not easily obtained at the present time, I append what he says in full:

"The fore part of June, the sides of particular leaves curved upward and drawn slightly together by numerous cobweb-like threads, beneath which lies a slender grass-green, sixteen-footed worm about three-fourths of an inch long and thickness of a rye straw, which eats the ends of the leaf, and passes its pupa state in the same situation; about the first of July giving out a small moth of a pale straw color

with its body and hind wings glossy white, its fore wings prettily speckled with numerous small rusty yellow spots which run together in many transverse bands, leaving a space at their tips more vacant; its width, 0.70.

"The moth here noticed may frequently be captured in our forests the fore part of July. Its larva resides under a thin cobweb covering which it constructs over the upper surface of the leaf towards its end, thereby drawing the sides somewhat together in a concave shape. As it merely eats off the end of the leaf, transversely, moving its quarters further back as it thus consumes successive portions of it, it is obviously liable to do no sensible amount of injury unless, like some of its kindred, it has the habit at times of becoming excessively multiplied.

"But as the history of so very few of these small moths is at present known, I avail myself of this opportunity to place this species on record, and I add such a description of it as will henceforth serve for its clear identification.

"The larva is grass-green throughout, or towards each end, and beneath of a slightly paler apple green color, and along its back is a narrow stripe of deeper green produced by the internal viscera.

"It tapers slightly posteriorly and less so anteriorly. On each of its rings small pimples are symmetrically placed, from each of which grows a short white hair; the head is round and slightly flattened and as thick as the neck into which it is sunk. If expelled from its retreat, it wriggles violently about, and drops itself very suddenly towards the ground and hangs suspended by means of a fine thread, till the disturbance ceases, whereupon it climbs up again to its former quarters.

"The moth has fore wings which are twice as long as wide, their opposite sides parallel, their outer side very nearly straight with an inward curve at the base; their hind ends cut off somewhat obliquely and rounded like a slightly bent bow. Their surface is feebly glossy, and about equally occupied by straw yellow and tawny, or light brownish yellow, this latter color forming numerous small spots which are confluent into broken and irregular bands, the bands also running into each other. Two of these bands are more distinct and continuous, and when viewed vertically, are of the same tawny yellow color with the other marks, but when viewed obliquely they appear of a darker leaden or silvery brown hue, and are imperfectly edged with lines of a deeper brown color. One of these bands extends from the middle of the inner to the fore-part of the outer margin. The other is almost parallel with this, running from the hind margin near the inner angle to the outer margin, where it is usually thickened or forked. The space back of this band is slightly paler and less densely spotted, its only marks frequently being a broad oblique stripe from near the middle of the band to the tip, crossed by a curved band running nearly parallel with the hind margin, both these marks having the same leaden brown reflection with the two bands. Back of this on the hind edge and base of the fringe is a smooth tawny yellow band. The head is rough from loose scales; the feelers projecting in front like a short conical beak, their apical joint being small but distinct; and the spiral trunk is quite short, when uncoiled reaching but little beyond the tips of the feelers."

Dr. Asa Fitch, 4th New York Entomological report, 1858.

The moths of the family *Tortricidæ* vary in their primary wing markings, and although the insect under consideration is evidently Fitch's *Argyrolepis guercifoliana*, there is another moth bred by Mr. Riley on the oak, *Tortrix paludana*, Robinson, which has much the same coloring, but differs in distribution and habits, since the latter lives singly, but more often gregariously in a common web; this moth is found quite common throughout the Mississippi valley.

The effect of the depredation upon the oak forests by the larva of this moth has been to destroy many miles of trees. After the worms left, the trees made an effort to recuperate and send forth new leaves, but in many cases the strength was insufficient and they failed and died, while those that succeeded in partly resuscitating their foliage are not in the proper condition to pass the winter months, and the probable result will be the destruction of many now supposed to have partially recovered.

Dr. Boardman says in a letter of September 24th: "In regard to the number of oak trees killed in the infested forest, I might say one-tenth of the mature growth and one-thirtieth of the younger growth: the black oak, *Q. tinctoria*, suffering most, probably one-fourth of that variety destroyed, while the white oak, *Q. alba*, and burr oak, *Q. macrocarpa*, have in a measure partially recovered, but have made but little growth, and the dry weather now prevailing has caused many partly resuscitated to die."

From a communication from De Kalb county, I find the red oak, *Q. rubra*, has suffered most, probably about one-twentieth having died, the forest presenting in October a diseased and sickly appearance.

*Natural Enemies.*—In much the same proportion that the different insects increase do we find their natural enemies rise up to seek and destroy them. During the ravages of the moth in question various kinds of insects were seen feeding upon them. It is generally known that the habits of insects vary much, and even the same insect in its various stages of larva, pupa and imago differs greatly. While there are different kinds of insects which subsist upon vegetable matter and are considered injurious to vegetation, there are others which through their various stages subsist upon these insects and serve to keep them in check, thus rendering a valuable assistance to mankind. It is thus necessary to have some knowledge of entomology if we would learn to distinguish between our insect friends and foes. The larger insects are not always the destructive ones, and every effort should be exerted when seeking a remedy against injurious insects to protect those which are beneficial.

Said a florist to me, when giving a remedy for the destruction of plant lice upon his winter flowers: "I'm not afraid of those small lice, but these larger ones," and he seized a Lady-bird from its very act of eating the lice and destroyed it.

Upon the trees of the various kinds of infected oaks could be seen our large and beautiful Rumaging Beetle, *Calosoma scrutator*, Fabr. (Figure 26 represents a closely allied species—*C. Calidum*.) This beetle preys upon various kinds of insects and is especially useful since the larva is as rapacious as the full-grown beetle, and being of a large size they are capable of consuming many caterpillars.



Not only did I find them feeding upon the worms, but also inside the silken web destroying the chrysalids. Seizing one by the mandibles it would extract the contents, leaving the hard outer covering. This beetle has proved a great assistance in destroying the army-worm, *Leucania unipuncta*, Haw, the great caterpillar, *Clisiocampa Americana*, Harris, and the Canker-worm, *Anisopteryx vernata*, Peck.

To the trim Lady-bird *Coccinella munda*, Say, we are indebted for assistance in checking the ravages of this oak-pest. They were found in considerable numbers upon the infested trees.

Two species of Hemipterous bugs, kindly determined for me by Mr. P. R. Uhler, Baltimore, Md., were conspicuous because of the number upon the attacked trees. These are the *Diplodus luridus*, Stal, and a *Podisus*, probably *Podisus spinosus*, Dallas.

Fig. 25.



C. Calidum.

PARASITE ON OAK LEAF-ROLLER—*Pimpla* (Cryptus) *conquisitor*--Say.

Perhaps the most efficient assistance comes through the medium of this parasite, since when attacked it is impossible to recover, and the insect must become a victim to the enemy. The female ichneumon deposits a single egg upon the worm, and the young larva enters the body as soon as hatched and commences feeding upon the fatty substance of her victims, avoiding, however, the vital organs, since, should this occur, the caterpillar from which she derives her subsistence would perish and her own life would thus be lost. When the worm is full grown it changes to chrysalis, and the parasitic guest does the same inside the chrysalis of the Oak Tortrix, destroying the life of her victim in so doing. Thus, instead of the moth issuing from the chrysalis made by the caterpillar, a full grown *conquisitor* (Fig. 27,) comes forth having gained its life at the expense of another.

Fig. 26.



P. conquisitor.

The presence of the parasite was easily determined by a darkened spot on the dorsal side of the caterpillar, and this was also observable in the chrysalis, and so far as I was able to ascertain the various insects which prey upon them made exception of those in which the parasite had entered.

To Mr. E. T. Cresson, I am indebted for the determination of this species.

For the benefit of those not acquainted with the insect, I append the following description :

"Black, tergum with the posterior margins of the segments white; feet horny yellow, posterior tibiae and tarsi with black joints."

Body black, punctured; palpi, white; thorax, punctures minute; metathorax not distinctly punctured on the disk; wings very slightly

tinged with dusky; nervures blackish; stigma rather large, with its base and tip whitish; second cubital cellule oblique; tergum densely punctured on every part; segments on their posterior narrow margins white; oviduct about half the length of the abdomen; feet horny yellow; intermediate and posterior tarsi white, the joints black at their tips; posterior tibiæ black, white in the middle. Length one-fourth of an inch. Resembles *inquisitor*, but the posterior margin of the segments of the tergum are white." Says's Entomology, Le Conte's Ed., Vol. II., p. 687.

#### THE MAPLE-TREE BARK-LOUSE—*Lecanium acericola*—Walsh & Riley.

The soft maple-tree, *Acer dasycarpum*, Linn, is grown quite extensively in Illinois for shade, owing undoubtedly to the short time required for growth.

They have been infested for the past ten years by a Bark-louse, which is easily recognized in the spring months by a white waxy substance attached to the underside of the limbs, and from the fact that the tree is grown in all parts of the state. As but little has hitherto been known respecting the life habits of the insect, I have given considerable attention to the study, and here record the result of my investigations.

All Bark-lice belong to the order Hemiptera, sub-order *Homoptera* and family *Coccidæ*.

The insect under consideration belongs to the genus *Lecanium*, which according to Mons. V. Signoret, of Paris, includes "species either naked or inclosed, or simply covered with waxy, calcareous or filamentous secretions; and in which the females after fecundation, generally acquires an entirely different form to that which she previously possessed, and becomes fixed. Before pregnancy, they have the power to move, if necessary."

The *Lecanium acericola* was first recorded by Walsh and Riley, in the *American Entomologist*, vol. 1, page 14, together with illustration.

They say: "At figure —, we have represented a new species of bark louse, *Lecanium machuræ*, which has recently appeared in considerable numbers on the twigs and leaves of the osage orange, at Willmington, Will connty, Illinois, and also in the vicinity of Alton, in South Illinois.

"The dark part is the scale covering the insect, and this scale, as usual in the genus to which the insect belongs, is of a blood brown color. The pale part is snowy white, and is composed of a fine cottony down enveloping the eggs and young larvæ, which are remarkable for having a longitudinal dark line along the back, had strayed away from the parent scale, covering not only the bark of the twigs, but also the very leaves. Fitch describes two closely allied bark-lice infesting respectively the grape vine and the pear, (*Lec. vitis* and *Lec. pyri*), as having white cottony matter protruding from the tip of the scale, as in the species here figured. But in all the specimens of these last two species which we have seen, there was nothing of the

kind externally visible, though the eggs under the scale were partially enveloped in a delicate white floss. At figure — we also give a view of another new species of this same genus with similar cottony matter at its tail (*Lecanium acericola*) which infests the bark and the leaves of the common maple. It was received by us June 26, 1867, from Mr. B. N. McLain, of Indiana, and in a few weeks afterwards the young bark-lice commenced hatching out from the cottony matter. We have also received the same bark-louse from Mr. Tiffany, of Davenport, Iowa, who found them on his soft maples.

“None of the species belonging to this particular genus of bark-lice, *Lecanium*, have ever been known to swarm for any length of time in such numbers as to become permanently injurious to the plant upon which they feed.”

The bark-lice have been so little studied that formerly a new name was given for each kind found on different species of plants, and in this way there have undoubtedly been many species described as new which more careful study and investigation will prove to be varieties of the same. In the two species *Lecanium acericola* and *L. macluræ* every effort has been made to obtain specimens of the *macluræ*, but without success, and it is very probable the *macluræ* as found on the Osage orange by Walsh and Riley, is the same as found on the soft maple. Nothing more has been recorded in reference to it, and the above is not sufficient to give specific difference.

In an article on Homoptera by Townsend Glover recently printed in the Smithsonian report, 1876, page 44, he speaks of the *Lecanium acericulticis*, Fitch, 1859, page 776, as occurring on the silver maple in the Smithsonian grounds in Washington and other maples in the neighborhood, and says the *Lecanium acericola* and *Lecanium macluræ* are probably varieties of these. This can only be ascertained, however, by breeding the *L. acericulticis* in its various stages, together with the male, and comparing with the others. Since 1867 the maple trees have continued to harbor these small insects until the past two years. I have found them in various parts of the State, the trees in Peoria being at the present time more seriously affected than at any previous period, although the insects have been on a steady increase for several years.

The presence of myriads of these bark-lice upon the maple trees, each one sustained by the sap of the tree, can have no other effect upon them than that of serious injury. Their presence is recognized a distance off by the unhealthy and wilted appearance of the tree.

Mr. J. Duncan Putnam, Davenport, Iowa, has given careful attention to the development of this insect, and from his notes which he has generously placed at my disposal, I am enabled to substantiate my own observations with more certainty. I am also indebted to him for the loan of mounted slides of the male from which Mr. Emerton has drawn the illustration.

The season is advanced a few days in Peoria over that of Davenport, and therefore the different stages of insects are developed a few days in advance in Peoria when I made my notes.

I am not aware of anything further having been recorded respecting the life habits of the *Lecanium acericola* since the above quoted article by Walsh and Riley in 1867. A few newspaper accounts, with

the names of the authors withheld, have been written, but these have in the main been mere conjectures and erroneous in description. Some few articles have appeared in reference to artificial remedies to be applied, but up to this date nothing giving the entire natural history of the insect.

The following notes were made in Peoria, Illinois, together with specimens taken at the time, in the year 1877 :

May 15th. The female becoming distended laterally, the deposition of eggs not commenced.

May 21st. The wavy mass protruding from end of abdomen, raising that portion of the body entirely off the limb, the mass filled with eggs.

May 30th. Egg-mass growing rapidly, from warmer part of the city the mass is much more enlarged than where the former notes were taken.

June 2nd. Deposition of eggs continuing, mass enlarging, the female distended and enlarged.

June 6th. Waxy mass issuing from sides and end of abdomen.

June 8th. Found *L. acericola* on box elder tree not in any considerable number; advanced about the same in size-mass as those on soft-maple.

June 15th. To-day the young lice have for the first time been discovered.

June 16th. The young lice are hatching, but owing to a cold spell of weather prevailing at this date not as rapidly as they would otherwise have done; the deposition of eggs continuing, the female in good condition.

June 17. The young lice appearing, as soon as hatched they commence crawling quite actively over the limbs and settle down on the under side of the leaves near the mid-rib, although a few are on the upper side. When detached from the tree they will crawl up objects and show great power of endurance.

June 17th to 30th. Young lice settled down on the leaves mostly under side, although many are found on the upper side. They always settle down along the veins, and unless the eye is practiced in the search for them, they are liable to escape notice.

July 3d. The females are mostly dead, but a few in cooler places are still alive, and the egg-mass incomplete, unlike the Oyster shell Bark-lice of the apple, *Mytilaspis pomicorticis*, Riley, the body of the female does not shrink to any great extent, and after the eggs have hatched and the Mother-lice dead, the general appearance is the same as before.

July 10th. The male pupæ easily distinguished.

August 13th. Male *Lecanium acericola* coming out in considerable numbers, and come from the anterior portion of the scale. Have two wings, rose-colored, two anal stylets, whitish in color and longer than the body. Hymenopterous parasite coming out from the scales of the bark-lice, which have been observed as turning black.

August 20th. Males continue appearing, are very active flying over the leaves, coition taking place.

August 29th. Parasites numerous, one only in each body.



September 5th. Males disappeared. Young females still on the leaves.

September 30th. The *L. acericola* have commenced moving from the leaves to the limbs, and are settling down upon the lower side of the limbs, the heads not always in the same direction but always found extended lengthwise with the limb.

October 15th. The leaves are falling from the trees, and the lice returning to the limbs.

November 1st. The leaves have fallen, and the lice have settled down on under side of limbs.

The increase over last year is very great.

*Natural History.*—With the preceding notes, we have the life history nearly complete, and are prepared to enter into the minutia, somewhat.

In the autumn, when the lice have returned to the limbs from the leaves where they have passed the summer months, they have become stronger in every way. The beak, at first so fragile, is now strong enough to pierce the bark, and my impression is, made by as close an examination as is possible to make, that the beak is inserted in the limb when the removal first takes place in the autumn, remaining in this position during the winter months. I find by carefully raising the lice from off the limb, the beak is always broken off close to the head, while if this was not the case, we should find it entire on the under side of the body. They are awakened in early spring by the warm weather and the sap of the tree commencing to flow.

The greatest irregularity exists in reference to the position which they assume on the limb, the bodies oftentimes over-lapping each other, when greatly crowded, lying in opposite directions, with the exception that they are always found lying lengthwise with the limb.

Early in the month of May the attention is attracted to the ground or sidewalks, underneath the infected trees, which is covered with spots similar to honey-dew, the lower limbs and opening leaves presenting a sticky sensation to the touch, which continues to be noticeable for something over one week before the deposition of eggs commences. This is caused either by the many punctures made in the bark of the tree, the sap coming out at these points, or as is more natural, issuing from the insects themselves.

I find the appearance of this honey-dew occurring under the infested trees, recorded in the notes by Mr. Putnam, as early as May 13, 1871. The cause as given above is more rational, perhaps, when we find this ceases, as soon as the waxy secretion is observed issuing from the posterior portion of the insect.

This secretion issues from the general under surface, but particularly from the thorax and abdomen.

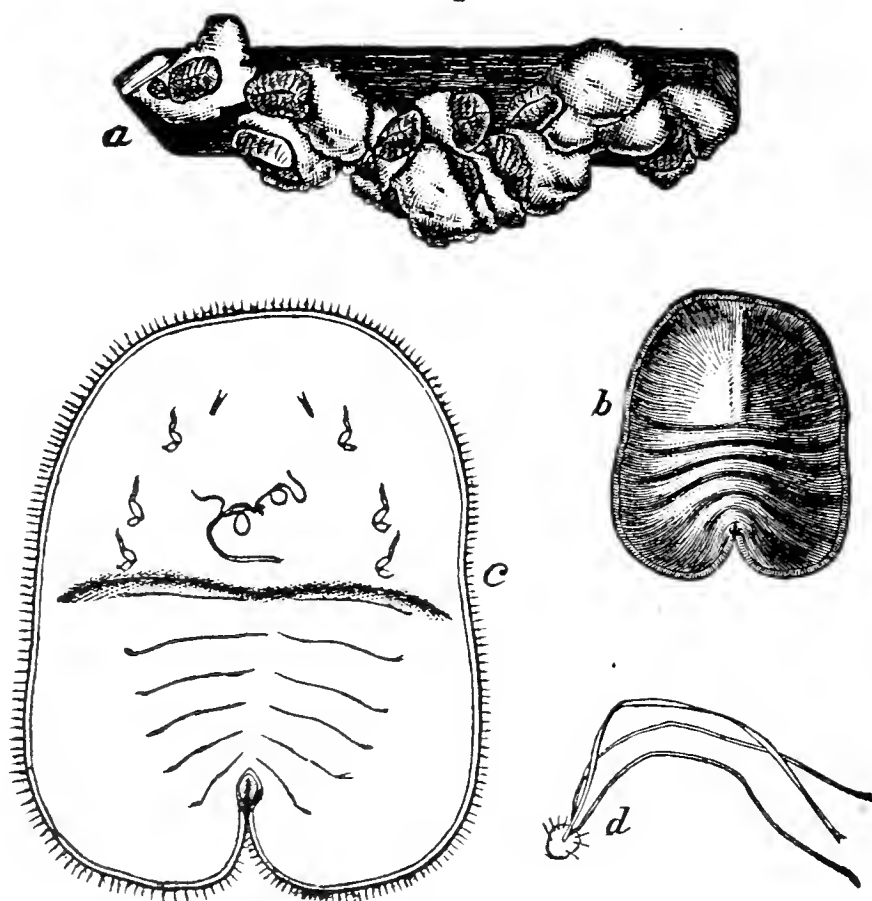
From the sides of the body under a common lens, can be seen short thick hairs, from these points and between the abdominal joints a portion of the waxy mass is secreted, but from around the anus comes the greater quantities.

In this mass the eggs are concealed, the work goes on regularly, since we find the first eggs in the mass shortly after it is perceived, and the insect continues partaking of the sap during the enlargement of the egg-mass.

The secretion at first, is soft and easily drawn out in threads but hardens somewhat by contact with the air, and remains almost perfect in form on the limbs after the eggs have all hatched.

*Lecanium acericola*, grown female shown at figure 27 *b*, representing dorsal view.

Fig. 27.



Dorsal view, oval with dorsal, convex carina and an anal fissure at extremity. Three thoracic and seven abdominal segments; margin furnished with short bristly hairs. Eyes not visible. Oviduct situated at the end of posterior fissure. Color somewhat lurid with numerous dark blotches, the lines separating segments darker, length 0.21 of an inch.

Ventral view, (figure 27, *c*.) Antennæ and legs visible but small. The beak arises from a tubercle situated at the extreme end of the head if not from a projection of the head extending slightly over the thorax.

The beak itself is a long thread-like organ. (Fig. 27, *d*.) The first pair of legs are nearly opposite the beak; the head and thorax occupying over one-half the entire insect.

The eggs issue from the oviduct, which has the opening at the posterior portion of the fissure, and are concealed within the waxy mass, the particles dividing them from the other.

When the eggs first appear, they are soft and pliable, one end more rounded than the other, and measure about .012 inches in length. As the embryo develops, the color, which at first appears yellowish white, grows darker in time.

The eggs first deposited and lying farthest from the body are the first to hatch, and this takes place before the ovisac is emptied. The oviposition of eggs continues for about five weeks, and number something over five hundred. The body of the female does not shrink in

size as is observed in other species of bark-lice, but appears much the same as when just commencing her labors. When the ovisac is emptied, she withdraws her beak from the limb and dies; the dead body remaining attached to the limb by means of the cottony secretion. The antennæ and six legs are retained, although in a rudimentary condition; no trace of the eyes can be found. When the female is removed from the limb in the spring, before the waxy mass has commenced appearing, the insect will move slowly, showing that although the legs have ceased to grow with the body, yet they are not entirely useless.

The first young lice were observed June 15, and are light sordid yellow, translucent, elongated oval, tapering slightly toward the posterior end, seven abdominal segments, division lines darker, plainest in middle, short hairs project from around the margin at regular intervals. Antennæ situated in front of the eyes, and from mounted specimens I make twelve joints. Eyes compound, prominent, dark, convex, and situated at extreme sides of the body. The beak is long, thread-like, and arises from a projection at the extreme end of head, and between first pair of legs.

At the end of abdomen projects two anal appendages longer than the entire body, which disappears in a short time. The six legs are equi-distant from each other. Length .014 inch.

In the natural condition, the young insects settle down upon the leaves of the maple almost immediately after hatching, the preference given the under side and near the mid-rib—although found upon the upper side to some extent—probably because the epidermis is more tender on the underside and they are there protected from the sun's rays.

When in a state of rest the young lice draw the antennæ under and parallel with the last joint of the fore-pair of legs, the two remaining pair extending backward.

During the summer the young insects increase in size and continually grow darker. I have not observed them in the act of moulting, and conclude if they would at all, it is by shreds of the skin peeling off, and not cast off entire, as in the usual way. Although they seldom leave the first assumed position, during the summer, they have full use of their legs since when the leaf is detached from the tree, the young lice will withdraw their beaks and move quite actively about in search of fresh food.

When young, the males and females cannot be distinguished one from the other, but in a few weeks the males cease growing and change to the pupæ state. This scale is much lighter than the growing females and was at first mistaken by myself for dead lice, as the transformation progressed, two anal stylets were seen projecting from one end, and when about to emerge the membrane at the head is slightly raised, and the true male *Lecanium* comes forth, leaving behind on the leaf the whitish larval scale. These are found scattered about among the females on both upper and under sides of the leaf.

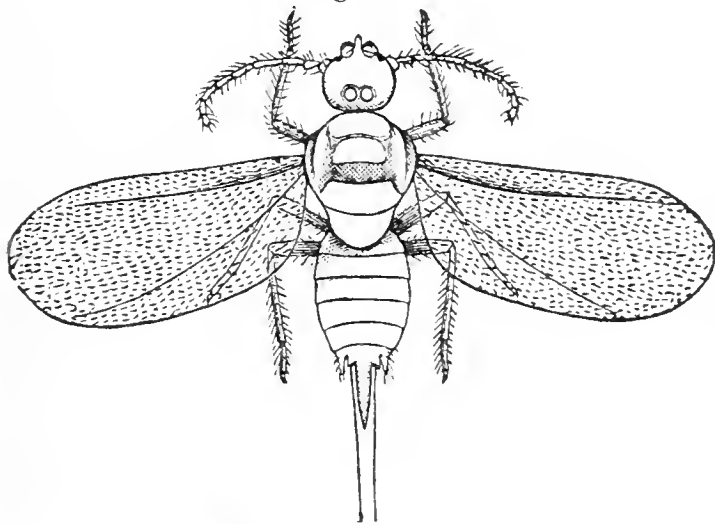
The male louse is very different from the female. During the pupa state he acquired wings for the new sphere into which he is about to enter, and although he still retains the legs and antennæ, the beak is left behind, since he will have no use for food the short time left him

to live. The first males were observed August 13th and continued appearing over two weeks. They are very active, flying about the leaves with great rapidity. At this time coition takes place, and the ovaries become developed in the impregnated females, who remain on the leaves drawing sap continually during the entire summer.

*The Male Louse.*—Comparatively few of the male lice have, as yet, been discovered, and it was with pleasure I recognized the male *Lecanium acericola* for the first time during the past summer. Their existence is for a short time, since not longer than three weeks in the year are they found—the probable life of each individual not over a few days. While the female is destined to remain upon the tree during her entire existence, the males acquire wings and fly about.

That the males are necessary for the perpetuation of the species is doubted by some authors. I made a careful estimate of the number of larval scales on several leaves of the trees recently infested and on those which had suffered a longer time, and found the average number was greater upon a much diseased tree than upon a healthy and vigorous one which had not felt the effects of the insects. It often happens that a maple tree will suddenly revive and outgrow the injury done them by the bark-lice, to an extent, even when no attempt has been made to exterminate them. Whether this is due to the greater number of the young lice proving to be males or the effects of parasites, I know not. That there were abortive females was easily seen last spring, since full grown and healthy females were found on the limbs alive after the oviposition was nearly completed by others and not commenced by these.

Fig. 28.

Male—*Lec. acericola*.

At figure 28, a, we have the male louse very greatly enlarged. Color fuliginous, with thoracic segments darker than the remainder of the body. Head small, angular in front and at the sides. Antennæ 10-jointed, filiform, pubescent—4th, 5th and 6th longest. Color light brown, proboscis absent, left off when shedding larval skin; near the place it would appear are what might be considered two eyes above and two below, and are

perhaps of use in conveying sight.

Thorax large, the mesothoracic band distinct, shining; the metathorax forming an arched shield extending a short distance over the abdomen.

Legs stout, sparsely covered with hairs, tarsi furnished with two claws at the end.

Abdomen ends in a tubercle which protects the penis, the entire about half as long as the abdomen. Two filamentous squamæ or setæ projects from either side of the penis, and are longer than the whole body of the insect.

Elytra present, membranous, hyaline, dotted with short points extending outward, and sending out at the base a forked line, one



toward upper and one toward lower margin. Mons. V. Segnoret, says in his essay on *Lecanides*, that in the place of the lower pair of wings, there are two bent halters or ballancers, which I have been unable to discover in the mounted specimens of *acericola* before me, although it is highly possible they may be found in fresh specimens.

To recapitulate, we find the *Lecanium acericola* is single brooded, the females living a few weeks over one year, the eggs deposited the latter part of May and the young lice appearing three weeks and a half after. They settle down, at once, upon the leaves of the tree, and remain until autumn, when they return to the under side of the limbs, remaining in this assumed position the rest of their lives. The males appear in eight weeks after the young have hatched and the females are then fully developed; in two or three weeks the males disappear entirely. The females remain dormant on the limbs six months and a half of the entire year.

It is well known that the varied temperature has great effect upon the length of time the insects remain in their several stages of growth.

The notes here recorded were taken during the years 1876 and 1877, and it is possible a warm spring may hasten the development of the egg and cause the young insects to appear earlier than here recorded.

Comparative statements ought be made after many years observation, and such I hope to make in time. The insect is wide spread throughout Northern Illinois, and extends to the Atlantic from where I have received specimens and information from reliable sources, and my observations have led me to different conclusions than those given by Walsh and Riley, since in *all instances* thus far have I found the females with the egg-mass and eggs upon the limbs of the tree, as represented in Fig. 28, *a*, and not upon the expanded leaf, although it is possible if the season were long enough the eggs might be found upon the leaf. I have either visited personally or received specimens from the following places wherein the eggs were deposited on the limb during the months of May and early June:

Bloomington, Le Roy, Geneseo, Rock Island, Havana, Kewanee, Peoria, Illinois, and Davenport, Iowa. In one instance I have found the *acericola* upon a box-elder tree in Peoria, but only in a limited number.

*Modes of Spreading.*—The way in which this insect is conveyed from place to place is undoubtedly through the transportation of the trees, the scales of the female adhering to the limbs when transplanted. The insects spread from tree to tree by the aid of the wind when in the egg state, the waxy mass becoming detached from the tree in very stormy weather, and being light is easily blown about. Many flies, wasps and bees are attracted to the trees by the sweet substance in the waxy mass, and the young lice, when crawling about before settling down upon the leaves, will become attached to the legs of these insects and thus conveyed to other trees.

One occurrence was noticeable, during the past summer, and worthy of mention, the cause of which I was wholly unable to account for. Four miles north of Kewanee, Illinois, in the midst of a walnut grove, close by a farm house, were a few soft maple trees, grown from seed. On one of the trees not over six feet high I found the female

and egg mass of *acericola* nearly complete, and a careful search revealed neither soft maple trees or bark-lice in the vicinity. By what means they found their way to these few trees, isolated as they were from others of their kind, was a mystery to me.

*Natural Enemies and Parasites.*—Nature has made violent efforts to destroy the *Lecanium acericola*, and one of the most effectual ways of combatting with this destructive insect is by cultivating and protecting the natural enemies. To the Lady-birds we are most indebted for services in this direction, since unlike many kinds of insects they continue their work of destruction throughout their entire active life, the larva and imago subsisting upon the same kind of food.

Three kinds of Lady-birds are found more or less numerous upon the infested trees during the summer months. The first we shall mention, *Hyperaspis signata*, Olivier, is, perhaps, the most abundant and valuable of the whole. The larva is small, light colored, and covered with a peculiar white downy substance. They are found inside the waxy mass devouring the eggs before they are hatched. In this way many eggs are prevented from hatching, and since they occur in considerable numbers we owe much to them for the valuable assistance rendered. The outside of the mass appears entire, but by carefully separating it the larva can be observed, by the aid of a common lens, in the act of devouring the contents of the eggs. Only one larva is found in each mass. The larva change to the pupa state upon the tree, from which appears a small black beetle, with one bright red spot on each elytron.

The next in importance is the *Chilocorus bivalnerus*, Muls, as shown in figure 29; although not occurring in as great numbers as the *signata*, yet they are exceedingly beneficial, since they attack the young larvæ. The larvæ, as shown in Fig. 30 are readily recognized from the *Hyperaspis signata* by the larger size and being covered with a large number of black spines, and are not found inside the egg mass. They are ravenous creatures, and since it takes a great many lice to appease their appetite they work much good in the course of their existence.



Fig. 29—*Chilocorus bivalnerus*, Muls, after Riley.

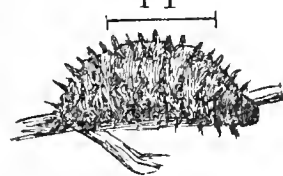


Fig. 30—Larva; after Riley.

The imago subsists upon the young lice, and is similar to the *signata* although much larger. It has, however, the same black appearance, and red spots on the elytra. The larvæ cluster together when entering the pupa state from which the perfect beetle emerges. This is effected through a split which opens upon the back.

The fifteen-spotted Lady-bird, *Anastis 15-punctata*, Olivier, is also destructive to the Bark-lice, and is even larger than the preceding ones, but does not occur in the same numbers. The larvæ are furnished with six rows of stout spinulated spines along the body, the upper surface of which is black while beneath it is pale, and is about half an inch in length. The beetle is black on the head and prothorax, having seven black spots on each brownish-red elytron, and a black spot on the scutellum; it is seven-twentieths of an inch long.

Every effort should be made to protect these Lady-birds in all their stages, and when applying artificial remedies care should be taken that it does not destroy the friends as well as the foes. I succeeded in

breeding a species of *Chrysopa* the past summer from the infested maple trees. The eggs were found in great numbers attached to the limbs and leaves, upon the long pedicel which is their customary way of depositing. The larvæ are voracious by nature, and it takes only a short time to dispose of many such small creatures as the lice; their white, spherical, silken cocoons can be found upon the leaves in July, from which the imago emerges; they are commonly called lace-winged flies. They are beautiful little creatures, with green bodies, lace-like wings and golden eyes. When handled they emit a disagreeable odor.

Unlike the three species of lady-birds mentioned above, the matured insect takes no part in the destruction of the bark-lice other than that of depositing eggs for the continuation of the species, but to the larvæ we look for the immediate benefit derived.

Beside these were found two species of *Reduviidæ*, and a species of mite, the names of which I am unfamiliar with.

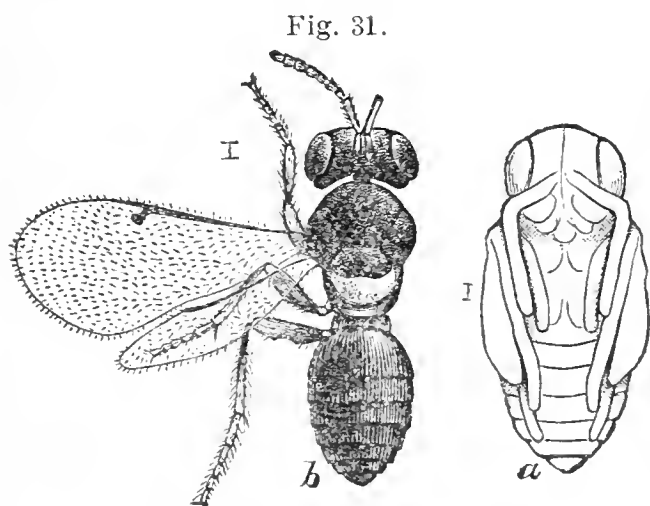
*Parasite.*—Early in the spring months small circular holes were seen in many scales of the *acericola*, the insect of course dead. It was apparent that a small parasite had been at work, and by carefully watching the young lice during the summer, I observed many scales turning black during August, and on the 13th was rewarded for my patience by finding in my breeding jars small Hymenopterous parasites of the well known Chalcid family. The larva of the Chalcid had been living in the small lice and only destroyed life when changing to the chrysalis from which it emerges as the true insect, through the dorsal side. Only one parasite is found in each insect and they are exceedingly minute.

Dr. Asa Fitch describes a parasite very similar on the *Lecanium quercitronis*, Fitch, in his 5th New York Entomologist report, page 805, as follows:

“Often a round hole will be noticed in these smaller scales, perforating them near one end. This hole is gnawed by a minute parasite, which has fed internally on the insect, and completed its transformation beneath the scale. Of five of these pupæ scales which were gathered on the first day of June, one was found to be already perforated. From another, the parasite came out five days afterwards, and a second specimen made its exit from another of the scales five days later. This same parasite also destroys the male pupæ of some of the other species of this genus. It pertains to the family *Proctotrupidæ*, and appears to belong to the genus *Platygaster*. It may be named *P. Lecanii*, or the scale insect parasite. It is quite small, measuring 0.035, and to the tip of the wings 0.05. It is shining black with its scutell pale yellow, and appearing like a large crescent shaped spot of this color placed cross-wise upon the hind part of the thorax. Its legs are white with the thighs black, except their opposite ends. Its abdomen is slightly smaller than the thorax and shaped like the bowl of a spoon, being deeply hollowed on the back and convex beneath. Its antennæ are thread-like, with the joints cylindrical and three times as long as thick, the last one not enlarged. Its wings are clear and glassy, strongly reflecting the colors of the rainbow. They are wholly destitute of veins, except a rib-vein running parallel with the

outer margin the first half of its length, and then uniting with the margin to beyond the middle, where it is slightly incurved and ends in an irregular triangular knob."

This description answers as far as it goes for the parasite bred on the *acericola*, but instead of it belonging to the *Proctotrupidæ* family, it belongs to the *Chalcididæ*. I therefore record it as a new species.



Chalcis Parasite—The short line to the left shows the natural size.

Body elliptical oval, color cinereous. Head as broad as thorax, smoky brown in color, pubescent. Thorax nearly black with a crescent shaped spot of pale yellow placed crosswise upon the hind part. Abdomen elliptical, a little longer than the thorax. Legs light brown with the femur darker, hairy, furnished at the apex of tibia with a spur, tarsi, five jointed, first joint longest. Wings membranous, hyaline. ciliated. Fore wings, with rib-vein running parallel with the margin nearly one-half its length where it unites, and ends in a stigma, something beyond the middle. Lower wings smaller without veins, the hairs forming a fringe on lower side.

I am unable to state at present whether this parasite which appears in August, is the same that emerges in early spring from the circular holes before mentioned, but judge not since the holes made by them are larger.

*Artificial Remedies*—One of the greatest benefits to be derived from the knowledge of the life history of the injurious insects, are the artificial remedies which suggests themselves and the proper time for said applications.

It will be seen by turning to my notes that the young lice appear in the month of June. It is then at this time that they are the most easily destroyed.

When first hatched they are very tender and any weak solution will destroy them. By experiment I have found that White Hellebore when used in solution to about one pound to twenty gallons of water will soon kill them, a solution of tobacco, soap and water is also good, and when applied with the aid of an extinguisher, the work is easily performed with but little time and expense. There is no use in trying to destroy them either when in their lethargic condition in the winter, or in the egg-state, but a few well directed applications at the proper time will both rid the trees from the pest and add much to their appearance. The young lice seem to assist in their choice of settling down on the underside of the leaf, since they are then the more readily reached. Great care should be taken to protect all insects which subsist upon them. The applications which I have recommended are sufficiently strong to destroy the bark-lice but will scarcely harm the larger beneficial ones. When transplanting the Soft Maples they should be carefully examined and all scales removed from the young trees, and examined from time to time to see that none escaped the eye. Remedies are often given in various newspapers



for the destruction of insects and signed by initials or a *nom de plume* ; these articles often work more harm than good, since the knowledge of the habits there given are based more upon conjectures and conclusions than actual knowledge.

Therefore, before remedies are applied, the owner of the infested trees ought to be sure they are founded upon reason and knowledge of the various stages of the insect's life. Such it is the desire of each economic Entomologist to ascertain, and although they can provide remedies for the destruction of insect pests, it lies wholly with the person suffering from the ravages whether the insect shall be exterminated or not. \*

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\* I suggested some time ago the use of Babcock's fire extinguisher as a means of destroying this pest. I understand since the above was written that Miss Smith has tested it and finds it quite successful.—[C. THOMAS.



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ECONOMIC ENTOMOLOGY OF ILLINOIS.

PART II.

LEPIDOPTERA.

OR

BUTTERFLIES AND MOTHS,

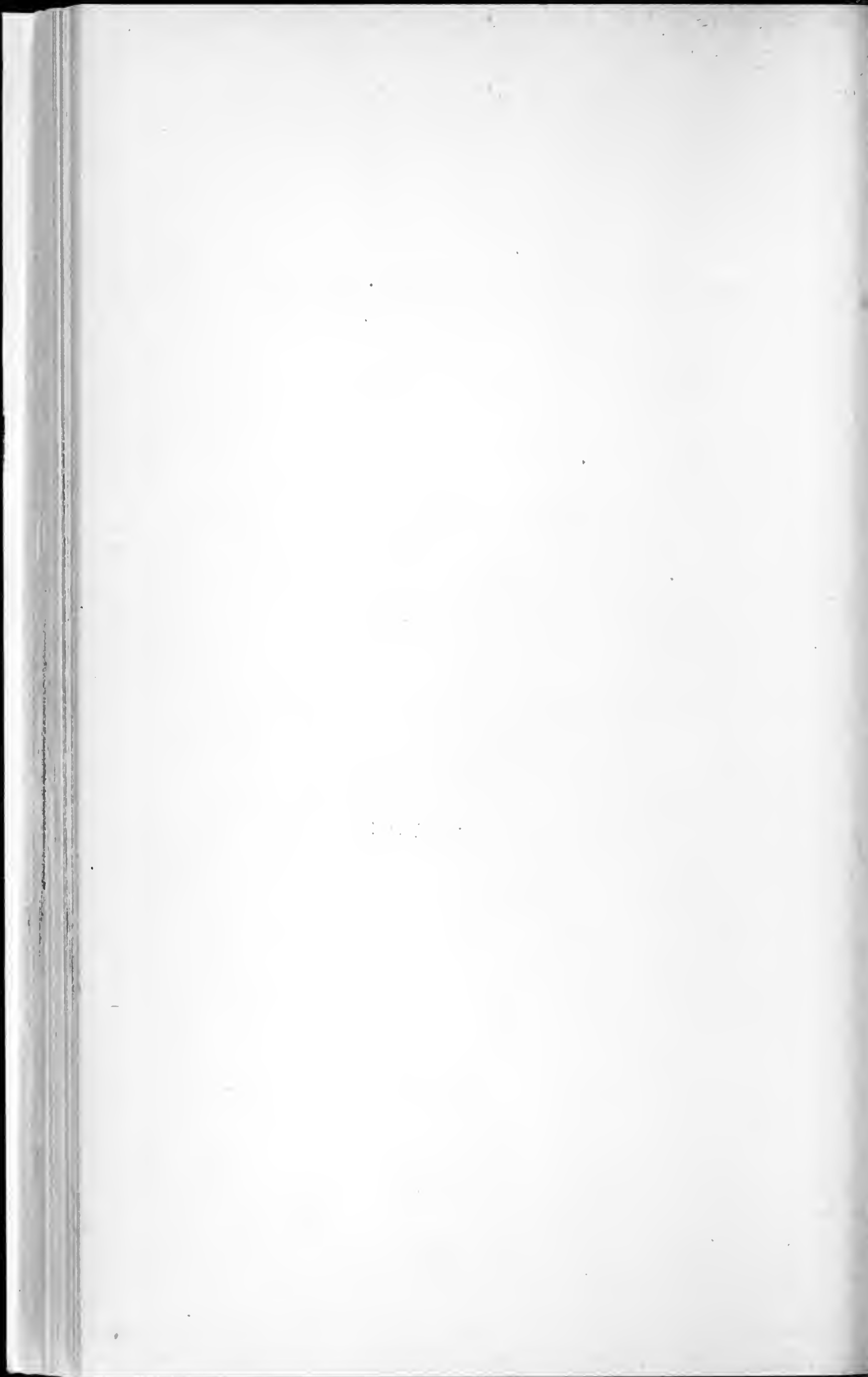
AND

THEIR LARVA, OR CATERPILLARS.

BY PROF. G. H. FRENCH.

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## ECONOMIC ENTOMOLOGY.

RHOPALOCERA—*Butterflies*—The antennæ knobbed.

### PAPILIONIDÆ.

Owing to the confusion that has existed in the arrangement of the Butterflies, or the "Day-flyers," as they are sometimes called, they have been grouped for convenience under this one family, but as the recent catalogue of W. H. Edwards, of Coalburgh, W. Va., gives a more satisfactory arrangement, and one that is likely to come into general use, we will use the family names as there given. In their more restricted sense the butterflies embraced in the *Papilionidæ* may be known by their broad wings, erect in repose; the antennæ slender and knobbed at the end, the knob either straight or slightly curved upward. They have six feet, all adapted for walking, and the front legs are not atrophied as in some of the other families.

Of this family the genus *Papilio*, or the "Swallow-tails," have the margin of the hind wings next to the body concave, and a tail-like appendage near the anal angle, sometimes nearly as long as the rest of the wing. The larvæ of these are provided with two retractile tentacles or scent organs protruding from the first segment, from which a strong odor is emitted when the insect is alarmed. The rest of the family are without tails to the hind wings in the perfect insects, and that inner margin of the hind wings is convex and bent downward, so that the sides of the two wings form a gutter along the abdomen. The larvæ are without the scent organs of the true *Papilios*.

#### PAPILIO AJAX, Linn.—The Ajax Butterfly.

This insect has but little interest to the economic entomologist, for its food plant, the paw-paw, is used only to a limited extent by man; but as it is found in various parts of the State, and will be of interest to many, it may be well to mention it here. Its wings are black, marked with greenish yellow bands, with a bright crimson spot at the anal angle of the hind wings, with the tail an inch long.

*Spec. Char. Butterfly*—expands from 3 to 3.50 inches. Wings black, crossed by seven, more or less distinct light greenish-yellow bands. The first near the body narrow, the second and fourth, broad; the third, fifth and sixth narrow, and only reaching a short distance from the costa, or front edge of fore wings. The seventh marginal and interrupted on the hind wings. The fourth band is notched at the costal end. Near the anal angle of the hind wings is a crimson space varying in form from two spots to a bar or a single spot. The tail to the hind wings is about an inch long, black, or the lower half margined with white. The outer margin of the hind wings dentate, the teeth edged with white.

PAPILIO PHILENOR, Dru.—The Philenor Swallow-Tail.

The larva or caterpillar of this species feeds wholly, it is said, upon a genus of climbing plants known to the botanist as *Aristolchia*. There are three species of this that occur with us, the Dutchman's Pipe, (*A. siphii*), the Virginian Snake Root, (*A. serpentaria*), and the Woolly *Aristolchia*, (*A. tomentosa*), all of which are sometimes cultivated for ornament, not so much for the flowers, for they are insignificant, but because the large rich foliage makes pretty covering for walls or arbors, etc. Whenever these are cultivated they are liable to the attacks of this insect.

The caterpillar is, when full grown, about two inches in length, of a velvety black color, with a slight purplish or chestnut brown tint. "It is covered with long fleshy tubercles of the same color as the body, and shorter orange colored tubercles, as follows: two which are brown, long, tapering and feeler like, springing anteriorly one from each side of joint 1, the two being movable, and alternately applied to the surface upon which the worm moves. Joint 2, with two brown tubercles, one springing from each side with a downward curve, and each about one-third those on joint 1; also, with two small dorsal wart-like orange tubercles. Joints 3 and 5 exactly like joint 2, but on joint 4, the lateral brown tubercle is replaced by a wart-like orange one. Joints 6, 7, 8 and 9, each with two small dorsal orange tubercles, and each with a lateral, elongated, pointed, brown, downwardly curved one, arising from the base of the prolegs. Joints 10 and 11 also with these lateral tubercles, but the orange dorsal ones replaced by longer, pointed, curved brown ones, which however often have an orange base. Joint 12, with two somewhat stouter dorsal, brown tubercles, but none at sides. Joints 7, 8, 9 and 10, each with a lateral orange spot just before and above the spiracles, which are sunk into the flesh and scarcely perceptible. Head, legs, venter and cervical shield the same color as the body; the venter with two tubercles on joint 5, which much resemble prolegs; the cervical shield, with an orange transverse spot on anterior edge from which is thrust osmaterium."—Riley.

These caterpillars occur on the vines through July and August, living while young in company. When full grown they fasten themselves to a twig and change to chrysalids of the usual form of the

genus, fastened by the tip end and suspended by a thread passed over the back. The butterfly issues from the chrysalis in about three weeks. The front wings are black with a greenish tinge along the veins and a more or less distinct row of white spots near the outer margin. Sinuses of the slight dentations that mark the outer margin are also edged with creamy white. The hind wings are a beautiful steel blue with a greenish cast, more prominent in the males, with a curved row of white lunate spots near the hind border, the sinuses the same as the front wings. The tail in this species is only about a quarter of an inch long. On the under side of the hind wings there is a broad steel blue border in which is a curved row of large orange spots, a segment in the front edge of each one of which is white. Expanse of wings from three to three and a half inches.

A little watchfulness on the part of those who cultivate the plants that form the food of these insects will be all that is necessary. As they feed together when young, they may be easily destroyed at that time by hand picking.

#### PAPILIO ASTERIAS, Fab.—The Asterias Butterfly.

Every season, greenish yellow worms, with black transverse bands containing yellow dots, are found on the leaves and flowers of parsley, carrots, parsnips and various other umbellate plants. When irritated, this caterpillar pushes out from a slit just behind the head a v-shaped scent organ, from which a disagreeable odor is given off. This caterpillar is the larva of the Asterias Butterfly and is known familiarly as the Carrot-worm, Parsnip-worm, etc., according as it is found on one or the other of these plants; and the odor which is given off is the means of defense against its enemies with which nature has provided it.

The butterfly appears in June and lays its eggs on the leaves of the plant upon which it feeds. From this brood a new set of butterflies appear in August, the second brood passing the winter in the chrysalis state to come out as butterflies in May or June of the following year.

The chrysalis is free, or not enclosed in silk, attached by the tip of the abdomen and supported by a loose silken thread passed over the back. It has two ear-like projections on each side of the head, and a prominence on the back of the thorax or chest. The first brood remain in the chrysalis state from nine to fifteen days.

The butterfly is about the size of the Philenor, both fore and hind wings black, and two rows of yellow spots extending across the wings parallel with the outer margin, so as to form, when the wings are spread, continuous rows across both wings. The row next the margin is composed of small spots, lunate in the hind wings, the others about three times as large and somewhat triangular. Besides these there is an extra spot on the fore wings near the costa, and a yellow lunule at the end of each discal cell. Sinuses in the edges of both wings, yellow. Between the yellow rows in the hind wings is a

row of blue spots, and at the anal angle a black spot circled with deep orange. Under side of the wings, similar to the upper only darker.

*Remedies.*—It is not usual that these butterflies become so numerous that their caterpillars are very injurious, but they may be so, locally, when hand picking or gathering the worms by hand will prove the best means of destroying them.

#### PAPILIO TROILUS, Linn—The Troilus Butterfly.

This butterfly very closely resembles the *Asterias*, but there is this difference, by which it may be easily distinguished. The blue spots of the hind wings are much larger than in the *Asterias*, covering nearly one-third the surface of the wing, and this blue has often a slight tinge of green. The yellow spots near the edge of the wings are larger, but on the hind wings are tinged with blue. The minor, or second row of yellow spots, as well as the yellow lunules at the end of the discal cells are wanting on the upper surface, but are present on the under. The eye-like spot at the anal angle of the hind wing does not surround a black spot, as in the *Asterias*, while there is a large orange-colored spot near the middle of the front margin of the same wing.

The caterpillar differs considerably from that of the *Asterias*, as also does the plant upon which it feeds. Harris' description of it is as follows: "It lives on the leaves of the sassafras tree, upon the upper surface of which it spins a little web, and folds over the sides of the leaf so as to form a furrow or case in which it resides. The fore part of its body is large and swollen, and it tapers thence to the tail. When first hatched it is slate-colored above, with a black spot, like an eye, on each side of the third segment, below and behind which is a large and long white spot, and the top of the eleventh segment is white. After changing its skin it becomes of a pale brownish olive color, the white spots disappear, and on the top of the back we find two rows of minute blue dots. When fourteen or fifteen days old it changes its skin and its color again; the back becoming pea-green, with blue dots, the sides yellowish, and the head, belly and legs pink; there is a transverse black line on the top of the first segment, and there are two large orange colored spots on the fourth segment, and two of the same color, with a black center, on the third segment. The caterpillar retains these colors from ten to sixteen days, increasing greatly in size during this period, and finally attains the length of two inches or more. It comes to its full growth when about four weeks old, and then eats no longer, but deserting its leafy habitation, it seeks a suitable place in which to undergo its transformations, previous to which it casts off its green coat and appears in one of ochre-yellow color."

The chrysalis is generally of a pale wood color, smoother than the *Asterias*, and with rather larger and sharper ear-like projections. In Massachusetts, Dr. Harris says, there is only one brood in a season; the eggs laid and the butterflies appearing about the same time that the *Asterias* appears. With us, especially in the southern part of the



state, there are probably two broods, the second passing the winter as chrysalids.

The caterpillars are said to eat the leaves of the lilac, spice-bush, and prickly ash, quite as well as sassafras. They do not usually occur in sufficient numbers to do serious injury.

#### PAPILIO TURNUS, Linn.—The Turnus Butterfly.

We have another butterfly belonging to this genus, larger than those before described, in which the ground color of both wings is bright yellow, instead of black. The principal ornamentation is in black, and is distributed as follows, supposing the wings to be expanded: A narrow border of black around the edges of the wings next to the body and the costal or front edge, but the black border along the outer margins of the wings is broad and contains a row of more or less conspicuous yellow dots; in the hind wings these dots are rather large lunules. The yellow space surrounded by this black border is marked by four black bands running from the costa backward, as follows: the first crossing both wings to near the anal angle, where it turns and unites with the smaller black border; the second reaching the second vein below the discal cell on the front wing; the third crossing the end of the discal cell, the fourth about the same length as the third.

The marginal sinuses in both wings are edged with yellow, and it has two orange spots near the anal angle, with the same blue spots that are found in the *Asterias* butterfly.

Besides this, in the more southern part of the State, there is found a dimorphic female variety, called *glauca*, that has the wings black, with the yellow marginal dots smaller, and the blue spots on the hind wings more prominent. The black bands that cross the wings are plainly to be seen on the underside. The sides of the body, in the ordinary form, are yellow, but in this black form, the whole body is black, as well as the wings.

The caterpillar of the Turnus butterfly lives upon the leaves of the apple, wild cherry and thorn, and folds them up in the same manner as does that of the *Troilus* butterfly. When full grown it is from two to two and a half inches in length, of a green color above, with light dots in rows, and a yellow eye-like spot, with a black center, on each side of the third segment, a yellow band across the fourth segment, and the head, underside and legs pink. The chrysalis is brown, formed in the usual way of the rest of the genus, and has a conical point on the breast.

#### PAPILIO CRESPHONTES, Cram.—The Cresphontes or Thoas Butterfly.

This butterfly, the largest and most beautiful species of the genus found with us, is more generally known as *Papilio Thoas*, or the Thoas butterfly.

It occurs more abundantly in the Southern States, where its larva feeds on the orange tree, but here it is regarded as a rare insect, and, according to a recent article, by Wm. Saunders, in the Canadian Entomologist, feeds on *Dictamnus fraxinella*, an ornamental garden herb, and Hop Tree (*Ptelea trifoliata*) as well as Prickly Ash (*Zanthoxylum Americanum*), and all plants related to the (Citron) Lemon and Orange, upon which it feeds in the south.

I found last fall two of these Caterpillars feeding on a shrub of Prickly Ash in my yard, over which a *Cresphontes* Butterfly had been seen hovering some time before. They were found October 10th; were then two inches long, and only fed five days upon the leaves I gave them, when they attached themselves to the top of the box and in two days changed to chrysalids.

The following is Mr. Saunders' free translation of Boisduval and Le Conte's description of the larva:

"The Caterpillar is of a very mixed color; its under surface is brown as well as the feet. On the first four segments there is a white lateral and longitudinal band, beginning from the head. Between that band and that of the opposite side there is a large brown patch marked by large brownish black spots, and behind this, on the middle segments, there is a large white patch in the shape of a lozenge, which covers the back and a part of the sides, one of the angles of which reaches the first pair of membranous feet. On the middle of this band there are some brown spots. The posterior part of the body is covered by another large white patch marked anteriorly with some brown spots; the lateral part comprised between the lozenge-shaped and the last white patch, is of a uniform dark-brown color. It feeds on all the trees of the genus *Citrus*, and is, in some parts of America, a sort of plague to the cultivators of the Orange."

The Butterfly may be briefly described as follows: Wings black, crossed by two broad, interrupted, curved, yellow bands; the first running from the apex of each front wing obliquely across to near the middle of the hind margin where, with the yellow base of the hind wings, it forms a continuous band. The spots, from near the middle of where the first band crosses the fore wings, joins with a sub-marginal row on the hind wings to make the second band. Near the anal angle is an eye-like orange spot with a black center similar to that in the *Asterias* Butterfly. The end of the rather long tail is occupied by an ovate yellow spot, while there is a pair of yellow spots running from the first band to the costa at the end of the discal cell.

## PIERIS PROTODICE, Bd-Lec.—The Southern Cabbage Butterfly.

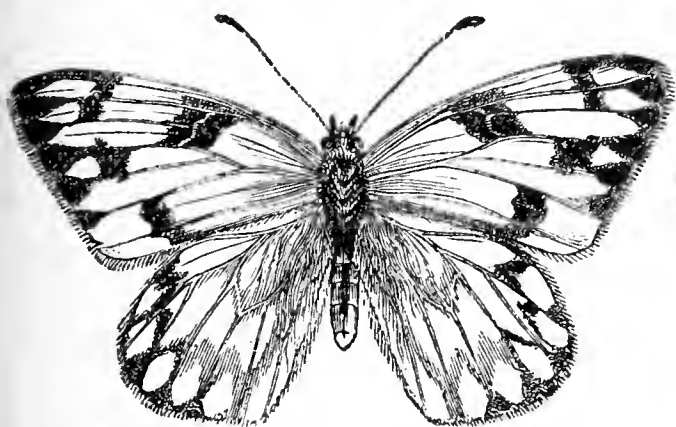
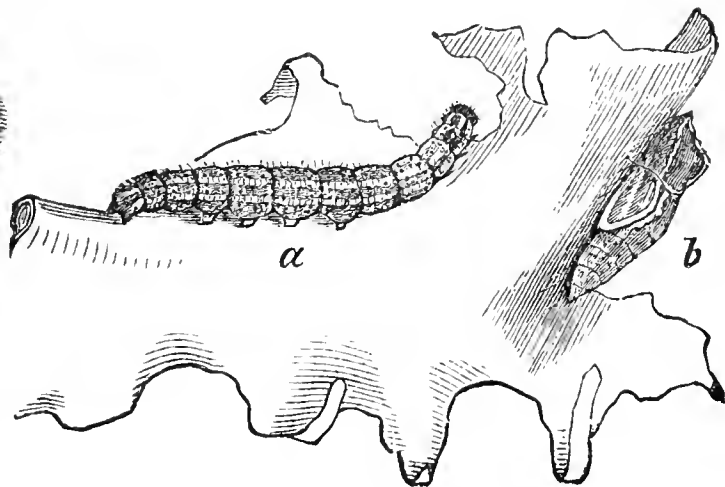


Fig. 32—Southern Cabbage Butterfly.

Fig. 33—*a*, Larva. *b*, Chrysalis.

Though called as above, it is very widely distributed, being found even in the high altitudes of the mountains; but for all that the name is appropriate, being more abundant in the warmer portions of the United States, and there often proving very destructive to the cabbage crop, taking the place, in that sense, of the Rape Butterfly, whose latitude is further north. It is quite common in Illinois, but it has been injurious here only to a limited extent, and that chiefly in the vicinity of the large cities. One of the reasons why it is not so abundant further north seems to be that the chrysalids are more susceptible to the influences of our long, cold winters, than some other kinds. This does not destroy the species, but only serves to lessen the number of chrysalids that pass the winter without injury, thereby lessening the number of individuals of the spring brood of butterflies. Thomas E. Bean, of Galena, speaks of this in Vol. 8, of the *Canadian Entomologist*, and I have observed the same thing for several years past in the southern part of the State. On account of this, it will probably never become so great a pest as the Rape Butterfly is wherever that species has been introduced.

The larva or caterpillar is of a greenish blue color, with four longitudinal yellow stripes, and covered with black dots. When newly hatched it is of a uniform orange color, with a black head, but it becomes a dull brown before the first moult. The longitudinal stripes and black spots are only visible after the skin has been cast the first time.

The chrysalis varies somewhat in color, but is generally a light bluish gray, more or less speckled with black, the ridges and prominences edged with buff or reddish. The two sexes of the perfect insect differ some in color. In the male the wings are white, with a large trapezoidal spot at the end of the discal cell of the fore wings, and an oblique interrupted black band near the outer border, with a little black on the veins at the outer end. The hind wings are without spots. The female is darker, the black of the fore wings more intense, with the hind wings tinted with grayish.

There are at least two broods of the worms in a season. They are to be found on cabbages, in all stages of growth, through the months

of July, August and September. The last brood pass the winter in the chrysalis state, and become the first brood of butterflies in the spring of the next year.

*Remedies*—Should this species become troublesome, hand or chicken picking may be resorted to as a means of destroying them. In feeding they are usually found in the outer leaves, and not boring into the heart of the cabbage, as is the case with the caterpillars of the Rape butterfly, and for that reason, a drove of chickens turned into an infested cabbage patch would do good service. Prof. Thomas has tried the experiment of allowing young chickens to run in his vegetable garden this season, and has found it of great advantage in reference to all species of insects feeding above ground. They soon learn, also, to follow the gardener when spading or hoeing, thus destroying many insects that are brought up from below the surface. Catching the butterflies with a hand net, as is sometimes recommended, but will not exterminate them, for they feed on mustard and mignonette, and hence, as the first is a wild plant, will occur where cabbages are not raised.

*Spec. Char. Larva.*—“Average length, when full grown 1.15 inches. Middle segments largest. Most common ground color green, verging into blue; sometimes clear pale blue, and at others deep indigo or purplish blue. Each segment with six transverse wrinkles, of which the first and fourth are somewhat wider than the others. Four longitudinal yellow lines, each equidistant from the other, and each interrupted by a pale blue spot on the aforementioned first and fourth transverse wrinkles. Traces of two additional longitudinal lines below, one on each side immediately above the prolegs. On each transverse wrinkle is a row of various sized, round, polished, black, slightly raised, piliferous spots; those on wrinkles one and four being largest and most regularly situated; hairs arising from these spots stiff and black. Venter rather lighter than ground color above, and minutely speckled more or less with dull black. Head same color as body, covered with black piliferous spots, and usually with a yellow or orange patch each side—quite variable. The black piliferous spots frequently have a pale blue annulation around the base, especially in the darker specimens.”—Riley.

*Butterfly*—Expanse of wings about two inches. In the male the fore wings are white, with a large black trapezoidal spot near the upper or costal edge, and an oblique band of black spots. At the end of the wing, beginning at the apex, are four or five somewhat triangular black spots on the ends of the veins. The upper side of the hind wings is entirely white, with sometimes a small group of black scales near the anal angle. The underside of the wings the same as the upper, with the marks on the fore wings paler, and the veins of the hind wings tinged a little with greenish or pale ochre yellow. The female differs from the male in being darker. It has the same spots on the fore wings, but the black at the outer margin extends as a border nearly across the wing, while the basal third of the wing is a light shade of slate color, that extends also on to the same part of the hind wings. The outer margin of the hind wings has as a border a row of triangular slate colored spots containing some black scales.



Inside of this is a zigzag line of slate or mostly black at the costal end. The underside of the fore wings have the same marks as the male, but the apex, and sometimes other places, tinged with greenish or ochre yellow. The hind wings show only a little of the marks of the upper side, but the veins are all margined broadly by ochre yellow that sometimes has a greenish tinge.

PIERIS OLERACEA, Bd. The Turnip Butterfly.

I do not know that this Butterfly is found to any extent in this State, but it is widely distributed over the northern portion of the United States, and is well known to be destructive to turnips, cabbages, etc. Dr. Harris' description of the insect is as follows:

"About the last of May and the beginning of June it is seen fluttering over cabbage, radish and turnip beds and patches of mustard for the purpose of depositing its eggs. These are fastened to the undersides of the leaves, and but seldom more than three or four are left upon one leaf. The eggs are yellowish, nearly pear-shaped, longitudinally ribbed, and are one-fifteenth of an inch in length. They are hatched in a week or ten days after they are laid, and the caterpillars produced from them attain their full size when about three weeks old, and then measure about one inch and a half in length. Being of a pale green color, they are not easily distinguished from the ribs of the leaves beneath which they live. They do not devour the leaves at its edge, but begin indiscriminately upon any part of its underside through which they eat irregular holes.

When they have completed the feeding stage they quit the plants and retire beneath palings, or the edges of stones, or into the interstices of walls, where they spin a little tuft of silk, entangle the hooks of their hindermost feet in it, and then proceed to form a loop to sustain the fore part of their body in a horizontal or vertical position. On the next day it casts off its caterpillar skin and becomes a chrysalis. This is sometimes of a pale green and sometimes of a white color, regularly and finely dotted with black; the sides of the body are angular, the head is surmounted by a conical tubercle, and over the fore part of the body corresponding to the thorax of the included butterfly is a thin projection having in profile some resemblance to a Roman nose."

The chrysalis state of the earlier broods lasts ten or twelve days, but the last brood do not come out till the following spring. Both wings of the butterfly are white without spots but dusky next to the body. The underside of the wings are sometimes quite variable, the tips of the fore wings being greenish or lemon-yellow, with the veins of that portion bordered with gray scales, and the hind wings covered all over with these two colors; or they may be less intense, though the gray scales along the veins in the hind wings is usually very distinct. The body is a little lighter than the preceding species, and the antennæ are tipped with light yellow instead of white. The expanse of the wings is about an inch and three-fourths.

*Remedies.*—The same remedies may be used that were spoken of in connection with the Southern Cabbage Butterfly, as the habits of the

caterpillar are similar. As they leave the cabbage when about to pupate, if boards and sticks are placed among infested plants, about two inches above the ground, the caterpillars when about to change will resort to them to undergo their transformations, and they may be collected by hand from the underside of the boards and destroyed. In case this is done the boards should be examined as often as once a week to ensure against any Butterflies hatching.

PIERIS RAPAE, Linn.—The Rape, or European Cabbage Butterfly.

As this noted garden pest has at last reached Illinois in its westward march, having been found at Maplewood, west of Chicago, last September, by C. E. Worthington, (†) some notes here on its history and the rank it takes as a destructive insect may be of interest.

It was introduced from Europe to Quebec about the year 1857, having been captured in 1859 by Mr. Bowles of that city. The railroads that lead out from there soon carried it to Boston and New York, and southward to Philadelphia and Washington. From these central points it has spread over the country, until in the Eastern and Middle States there is hardly a garden that is not visited annually by swarms of these Butterflies, and where the cabbages are destroyed by the caterpillar unless precautionary means are taken. Its ravages have not been confined to those localities, but it has been traveling westward, something after the manner that the ten-lined Potato Beetle has traveled eastward. Mr. Wm. Sanders, President of the Ontario Entomological Society, gives, in a recent address before that Society, the following facts in relation to its distribution :

“In 1863 specimens were sent to us from this district for determination, which was the first intimation we had of their existence in this country. By 1866 the butterfly had spread further west than Montreal, and east as far as Saguenay River. In 1869 it was reported as common in New Jersey, and by 1871 it had traveled east as far as Halifax, Nova Scotia, and west to the middle of the State of New York. It now embraces an area bounded by the shores of the Atlantic from the St. Lawrence to Virginia, and has overrun the whole country westward as far as Chicago.” I might give other quotations, but they would but corroborate those already given.

The following quotations relating to the amount and character of the damage done in a few localities, will give us some idea of the character of the pest that is upon us in the advent of this European importation :

From a work in 1875 by Packard, I get the following : “About Quebec it annually destroys \$250,000 worth of cabbages, according to Abbe Provancher. A correspondent of the American Agriculturist for November, 1870, states that it is estimated that the loss from this insect will, in the vicinity of New York alone, exceed a million dollars.” These are, of course, cases relating to its work in the vicinity of large cities, and where great quantities of cabbages are raised, but its work is none the less complete in smaller gardens.

† NOTE. Since the above was written a number of specimens have been taken at Carbondale, in the Southern part of the State, and at Springfield. C. THOMAS.

A correspondent to the Canadian Entomologist, from Peterboro, Ontario, writes: "In 1874 my cauliflowers and cabbages, during my frequent absence from home, were well-nigh eaten up by this garden pest, and such as were not actually devoured were rendered unfit for use by the quantity of excrement deposited between the leaves of the plants."

While visiting in Central New York in the summer of 1876, I had a chance to see the working of this insect in my father's garden, and can say that the above is not an exaggeration. The time was the latter part of August, when the heads of the late cabbages were beginning to form. The incipient heads were eaten through and through, there not being a single one that had escaped, while the white butterflies were flying about over the patch.

This caterpillar is a pale green worm, an inch and a half long, finely dotted with black; a yellow stripe down the back, and a row of yellow spots along each side, in a line with the stigmata or breathing pores. The eggs from which these are produced are laid on the under side of the leaves. There are at least two broods of the worms in a season, the first changing to chrysalids in June and hatching to butterflies in seven or eight days afterwards, while the second brood pass the winter in the pupa state. The chrysalis is variable in color, being sometimes yellowish brown or yellow, and passing thence into green speckled with minute black dots. The perfect insect is about the size of the turnip butterfly. In color the body is black in the male, the wings white, with the tip and a dot near the middle of the front wings black, and a black dash in the front edge of the hind wings. On the under side, there are two black dots on the fore wings, while the tip and the whole surface of the hind wings are lemon yellow. In the female the upper side of the wings are a whitish ochre, while the lemon yellow of the under side is more intense than in the male, and there are two dots on the upper side of the fore wings instead of one.

These caterpillars differ from both the foregoing kinds in their manner of eating. While the larvæ of the southern cabbage and the turnip butterflies feed mostly on the outside leaves, going but little, if any, into the head; these are much more destructive, as they have the habit of boring into the interior of the head. When about to change to chrysalids they, like the last, leave the cabbage and attach their chrysalids to the underside of sticks, pieces of board and stones that are above the ground, etc—anything that can offer a shelter and support.

*Remedies.*—As in the preceding, advantage may be taken of the fact that the full grown caterpillars leave the cabbages for some sheltered place in which to undergo their transformations, by placing boards, that are raised a little from the ground, among the infested plants. By examining these boards every five or six days and destroying the chrysalids, the future work of the worms may be very materially lessened. Where there are but few infested plants, the caterpillars may be destroyed by hand. As the worms work inside the heads more than either of the other species, chicken picking would be of but little service, as they would not find those that were doing the most

damage. Heads that are so badly infested that they are past recovery should be burned, as by that means all the insects that might be in them in the different stages of development as well as the eggs would be destroyed.

In addition to the above methods of attacking the insects in the worm and chrysalid state, the butterflies that are seen flying over the cabbages may be caught, thereby preventing the eggs being laid on the plants. For this purpose a net may be used made of musquito bar or other light material, fastened to a hoop of light wire attached to a stick about three feet long, for a handle. To be convenient to handle, the hoop should be about ten inches in diameter, and the wire not any heavier than is necessary to give it that degree of stiffness to keep its shape. The depth of the net should be twice the diameter of the hoop.

As with other insects, man is not obliged to do all the fighting in this case; some species of birds, it is said, devour the larvæ, and also the perfect insect; but the most effective foe to this species is a small Chalcis Fly (*Pteromalus puparum*) that seems to follow close in the wake of its host. It had been supposed that this valuable little parasite was only a native of Europe, and had been introduced into this country at about the same time as the Rape butterfly, but Packard is of the opinion that it is a native of this country, and preys also upon the other species of *Pieris*. The chrysalids of the butterfly that were infested by this parasite could easily be told by the livid and otherwise discolored and diseased appearance. In destroying chrysalids, such should not be destroyed, as by allowing them to remain, the parasites instead of butterflies will hatch from them, and then serve as so much additional help toward the destruction of the cabbage worms.

Besides this, one or more species of flies have been mentioned as parasitic to this species.

*Spec. Char. Butterfly*—Expanse of wings about 1.75 inches. *Male*—Ground color of both wings above white. The tip of the fore wings and a round spot near the middle black. The hind wings have a dash of the same color on the costa a little beyond the middle. Both wings dusky at base. Underside fore wings white, with black spots, the second near the hind angle, and the tip lemon yellow, the same color reaching a little on the costa toward the body. Hind wings uniform lemon yellow. Both wings sprinkled somewhat near the base with gray scales. There is a variety of the male that has the same markings, but the ground color above is lemon yellow.

*Female*—Differs from the male as follows: The color above is a light ochre yellow instead of white. The marks are the same, except a second black dot near the hind angle of the fore wings; underside, the lemon yellow on both wings is more intense, and extends along the costa and outer margin of the fore wings. The body is black above in both sexes but light beneath.



## CALLIDRYAS EBULE, Linn—The Danewort Butterfly.

This beautiful sulphur-yellow butterfly occurs sparingly in the southern part of Illinois, but it is not known to be injurious.

*Spec. char. Imago*—Expanse of wings from 2 to 2.75 inches. *Male*: Upper side of both wings citron yellow, with a thin indistinct border of yellow, more dull and dentate on the fore wings. The fringe, usually, with small ferruginous points at the ends of the veins. The underside a little deeper yellow than above, with a little ferruginous at the end of the discal cell on the fore wings and two silvery discal points circled by ferruginous on the hind wings. Body black above, abdomen yellow, at the segment a transverse black band bordered with yellow.

## COLIAS EURYTHEME, Bd—The Eurytheme Butterfly.

*Male*—Wings expand about two inches and a half. Ground color orange. Broad outer border to the fore wings extending a little on to costal and inner edges of the wing, and with yellow on the veins at the anterior part, slightly dentate within. Discal dot black, elliptical. Hind wings, border narrower, discal dot deep orange. Underside lighter orange, discal dot on fore wings not prominent, yellow in centre; on hind wings, ferruginous, silvery center; submarginal row of points on the veins quite dark in the fore wings, less so in the hind.

*Female*—Differs from the male in being variable in ground color from orange to almost white, the outer border in both wings being broader and more dentate within, and spotted with yellow, and the discal dot on the hind wings inclining to be double.

Body in both sexes black, partly covered with yellow hairs; the color, antennæ and the edges of the wings roseate; the knob of the antennæ tipped with orange.

*Larva*—"Length 1.40. Upper surface dark velvety green, finely folded transversely. On either side a narrow white line on which are regular patches of bright vermilion, some of which are occasionally shaded with orange yellow. Underside green."—Edwards.

## COLIAS PHILODICE, Godt—The Philodice Butterfly.

This species is smaller than the preceding, the wings expanding generally from an inch and a half to two inches. The ground color of the wings is bright sulphur yellow. The border in both sexes is like the preceding species, only narrower and less dentate.

*Larva*—"Green, slightly downy, paler or yellowish at the sides, and grows to the length of about an inch and a half."—Harris.

*Remarks*—The three foregoing species are our common yellow or sulphur butterflies that are found in all parts of the State. There are three broods annually of the butterflies, one appearing in April and May, another in July, while a third appears late in August. All of them in the larva state feed on the different species of clover, lupine, and some times may be found on pea vines, though I am not aware that they have ever been very injurious.

TERIAS NICIPPE, Cram.—The Nicippus Butterfly.

Expanse of wings a little over two inches. Upper side of both wings bright orange yellow, with a broad black border, sinuate within, reaching from the middle of the costa of the fore wings to the anal angle of the hind wings. The discal mark of the fore wings a line in length half the width of the cell. None on the hind wings. The costal edge of the fore wings has several whitish marks in the outer half. Underside fore wings paler than above with no black border discal mark as above. Hind wings yellow, a small black discal point and brown atoms scattered over the wing.

*Female*—Differs from the male in being paler and often of a yellow color, the black border of the fore wings suddenly ceasing a little before the outer angle and on the hind wings a little before reaching the anal angle.

*Larva*—"Pale green, with a dorsal ray more obscure, and a lateral white band, marked before with five yellow points."—Morris.

This insect is not very abundant with us and usually not regarded as injurious. Besides feeding on clover the caterpillar feeds on *Cassia* a kind of wild sensitive pea.

TERIAS LISA, Bâ.—The Lisa Butterfly.

This bright yellow little butterfly, one of the most common that flits along roads and over moist places during the summer and fall in the southern part of the State, is scarcely an inch and a half expanse with us, but is larger in the Southern States where it is more at home. It has on the fore wings a broad black outer border widest at the apex and a narrow border of the same on the hind wings. The border is less sinuate than the preceding species. Its larva is green with four longitudinal whitish rays, and feeds on leguminous plants.

NYMPHALIDÆ.

This family contains several groups or subfamilies of butterflies that differ somewhat in details of character but agree in the following points. In the perfect insect the palpi are usually close, flatter

and vertically, as long as the head, in front of which they ascend obliquely, quite hairy, at least below. Antennæ with the knob straight, or in a few species slightly bent. Shape of the wings various; the hind wings forming a gutter for the abdomen. The front pair of legs shortened so that there are apparently only four legs. Tarsi bifid except in the first species.

DANAIS ARCHIPPUS, Fabr.—The Archippus Butterfly.

This, one of our most common butterflies, expands 3.75 to 4.50 inches; the wings orange brown with a black border containing two rows of white spots extending from the middle of the costa to the anal angle. Besides these there are two oblique rows of five larger white spots in a black ground near the tip of the fore wing. The veins are black, the discal cell closed.

The males are distinguished by an elevated black spot contiguous to one of the veins near the middle of the hind wings. Body black with a few white spots on the thorax.

*Larva*—Whitish, transversely marked with bands of black and yellow. It has two pairs of fleshy, blackish processes of which the anterior pair are situated on the second segment, the others on the eleventh. The larva feeds on various species of milk-weed, or silk-weed as they are sometimes called.

ARGYNNIS DIANA, Cram.—The Diana Butterfly.

This species, more common in Kentucky and Arkansas, is occasionally taken in the southern part of Illinois. The wings expand about three and one-half inches. In the male, the wings are rich velvety brown from the base to beyond the middle, the border beyond deep orange, considerably dentate internally; this contains two transverse rows of black points in the fore wings and one in the hind wings. The female is marked the same, but the base of the wings is rather dark blue-black, having the border blue with black markings like those in the male, only more prominent, and an additional black line near the outer border.

ARGYNNIS IDALIA, Drury.—The Idalia Butterfly.

The larva of this species, like the other *Argynnis* caterpillars, feeds upon violets, and the butterfly occurs generally in the latitude of the northern part of the State.

The perfect insect expands from three to three and a half inches, and is much darker than the two following species, which are also common in Illinois. The fore wings are a deep orange, spotted with black and surrounded with a black border, which in the female con-

tains a row of white spots as well as an additional cluster of the same at the tip. Hind wings purplish black, with two rows of spots near the outer part, both of which are creamy white in the female, while in the male the outer row is orange; fringes spotted with white. Under side with two rows of pearly white crescents just within the black border, and four or five spots of the same near them upon the fore wings; paler than above. Hind wings brown, with about twenty pearly spots of different shapes.

ARGYNNIS CYBELE, Fabr.—The Cybele Butterfly.

Expands three inches and a half. From the base to the middle of the wings dusky yellowish brown, deeper in the female; beyond this reddish yellow inclining to yellow. This last is crossed by three transverse rows of black spots, the middle row forming a zigzag line; the spots of the second row are round, of the third crescents. Beyond these and just within the margin is a black line. In the discal cell are some marks which in the hind wings bear a resemblance to the figure 8. Underside of fore wings similar to the upper but lighter at the base. At the end of wings are silvery spots some of which rest on the black crescents. Hind wings with about twenty silvery spots arranged in two rows beyond the middle, the rest irregular.

ARGYNNIS APHRODITE, Tabr.—The Aphrodite Butterfly.

Differs from the preceding in the base of the wings being less dusky, the general color having more of a reddish cast, more prominent on the underside. The fore wings are reddish next to the base and on the inner margin, dark buff or yellowish-brown through the middle, while there is a brown patch at the apex and an outer border of the same color; hind wings, basal two thirds and outer border cinnamon brown, the rest the color of central part of fore wings. Silvery spots about the same as in the preceding species, though a little smaller. Expands from two and a half to three inches.

ARGYNNIS ALCESTIS, Edw.

This butterfly, closely resembles the preceding, and is found on the prairies in the northern part of the State.

EUPTOIETA CLAUDIA, Cram.

Expands about two and a half inches. Has much the appearance and color above of the Aphrodite Butterfly, but differs in being a



more dusky color, and in having a transverse band of rather dark buff through the center of the wings, and an ellipse of the same in the discal cell of the fore wings. The underside is more characteristic. The basal part of the fore wings is orange to the zigzag line, then a line of buff corresponding with that above, but lighter. Beyond this is a mixture of orange, buff and brown, with three of the black dots showing distinctly. Hind wings, the base yellowish brown instead of orange, and the outer part similar mixed, with a little light orange. The buff ellipse of the fore wings is repeated below.

PHYCIODES THAROS, Drury.—The Tharos Butterfly.

There are in New England and northern latitudes, two broods of this very abundant species, one appearing in June and the early part of July, and the second late in August and September; but probably further south, there are three to four generations in a season. The caterpillar feeds on the different kinds of aster. The butterfly expands an inch and a half in the larger specimens, is a tawny orange above, marked with black as follows: A black border to both wings, that is emarginate on the interior of the fore wings, and may be somewhat divided into two rows by a fine orange line; on the hind wings come next a row of black dots, then a black line that reaches across both wings; inside of this is a clear space a tenth of an inch broad, from which to the base of the wings are a number of black lines that run more or less into each other. Underside of the fore wings paler than above, broad, brownish black border, broken at the middle, in which crescent marks, next the edge, may be seen. Across the middle of the wing is another broken black line. Hind wings yellow, crossed by a number of irregular brown lines, a row of black points toward the margin, a dark brown spot on the costa, and dark brown partial outer border. The species is rather variable.

GRAPTA INTERROGATIONIS, Fabr.—The Semicolon Butterfly.

This species differs in the shape of the wings from those mentioned in that the apex of the fore wing is truncate, with the lower corner of this part quite a sharp angle. Below this is a deep, broad sinus and another less prominent point before the posterior angle of the wing. The hind wings also have a tail or point projecting from the middle part of the outer margin. The color of the wings above is reddish brown, ornamented with black and dark brown spots, and an outer border of brown. Some specimens have both wings of this color, while others have the greater part of the hind wings black. In the lighter specimens the outer edges of the wings are more or less glaucous. On the under side the wings are brown, with a silvery spot in the middle of the hind wings, the shape of a semicolon.

*Larva*—Deep brown, an inch and a quarter long; head, reddish black; the body round, pointed, and striated with yellowish and whitish; all the body, except the second segment, covered with blacked, forked spines. Along the feet a line of citron-yellow, and above the stigmata another of the same color, marked with a row of red spots.

The caterpillars feed on the leaves of elm and bass wood or lime trees, and the hop vine. Harris remarks that they sometimes occur in such numbers on the latter as to defoliate the vines. They may be taken from the vines and destroyed if they become numerous enough to be seriously injurious. There are two broods of the Butterflies in a season, the first in May, and the latter in August and September. Expands from two and a half to near three inches.

#### GRAPTA COMMA, Harris—The Comma Butterfly.

This butterfly, common in some parts of the State, is similar to the preceding, but may be known by its having a silvery comma in the middle of the hind wings, instead of a semicolon, and by its being smaller. The larvae feed on the hop and elm, and have also been found on a broad-leaved species of nettle. They are spined like the preceding, in color are white, mottled or striped with gray or ashen, and with red stigmata.

#### GRAPTA FAUNUS, Edw.

Expands two inches. Resembles the Comma Butterfly, but is smaller, the ground color more uniform reddish brown, and the outer border of the wings darker. Under side of both wings, dark brown next the base, with an irregular band across the middle. Beyond this the brown is paler and finely mottled with grayish white running more or less in veins, and some spots of olive-green near the border. In the middle of the hind wings a silvery letter G. The larva is said to feed on gooseberry leaves.

#### GRAPTA GRACILIS Gr.

Expands two and a quarter inches. Base of wings reddish brown, the outer half yellowish brown, the border scarcely darker, black spots as in the others. Under side of the basal half of both wings brown, crossed through the middle by a yellowish brown, irregular line. Beyond this the brown is lighter and mingled with a golden yellow, and crossed lengthwise by grayish white veins. Some dark in the outer border. In the middle of the hind wings a silver G like the last.

## VANESSA ANTIOPA, Linn—The Antiopa Butterfly.

This beautiful butterfly, occurring throughout this country and Europe, is two-brooded, the last brood, it is said, passing the winter in the perfect state, and flying abroad the first warm days of spring ere the snow is off.

The wings expand from three to three and a half inches. They are purplish brown above, with a broad buff-yellow margin, near the inner edge of which there is a row of pale blue spots.

The caterpillars live together in great numbers on the poplar, willow and elm, on which they may be found in June and August. They are black, minutely dotted with white, and with a row of eight dark brick-red spots on the top of the back. They are covered with spines on all but the first segment that are similar to those of the Graptas. They are not usually sufficiently numerous to occasion serious injury.

## PYRAMEIS ATALANTA, Linn—The Atalanta Butterfly.

The fore wings are truncate at the tip, but the angles less sharp than in the two preceding genera, and the sinus or indentation in the middle of the edge is not so deep. No point near the hind angle, and the hind wings not tailed. Color of both wings above black, with several white spots near the tips of the fore wings, and a broad orange-red band crossing the fore wings from the middle of the costa to the hind angle; and an outer border of the same on the hind wings, on which is a row of black dots. The two dots near the anal angle are centered with blue. There are no silvery marks on the underside. Expands from two and one-fourth to three inches.

The caterpillars are brown, more or less dotted with white, a black head, rough with elevated white points, white branching spines on the back, and on each side a row of yellow crescents. They feed on the leaves of nettles, each rolling up the edges of the leaf and fastening it with silk and living in the enclosure.

There are two broods in a season.

## PYRAMEIS HUNTERA, Drury—Hunter's Butterfly.

Expands from two and a quarter to two and a half inches. The wings are tawny or reddish brown above, variagated and spotted with black and white. Hind wings fawn-brown beneath, marbled and streaked with white, with two large eye-like spots near the hind margin.

The caterpillars feed on the leaves of thistles, sunflowers, holyhock, burdock and other rough-leaved plants. They are rough, spiny like the preceding.

*PYRAMEIS CARDUI*, Linn.—The Thistle Butterfly.

Expands from two and a half to two and three-fourths inches. Wings tawny or reddish brown above, with a tinge of rose, spotted with black and white. Hind wings yellowish-brown underneath, marbled with white, a little blue and a row of five eye-like spots near the outer margin. The caterpillars feed on the same kind of plants as the preceding.

*JUNONIA LAVINIA*, Cram.—The Lavinia Butterfly.

This specimen belongs to the Southern States and is found in the southern portion of Illinois. The wings are dark brown above, each with a large and a small eye-like spot on both sides. The fore wings have two orange spots in the discal cell, and a whitish band crossing obliquely and including the hind eye-like spot, and a reddish band on the hind wings near the outer margin. Underside pale. Expands two inches and a half.

*LIMENITIS URSULA*, Fabr.—The Ursula Butterfly.

The caterpillar of this butterfly is of a brownish color, more or less variegated with white on the sides, and with green above, and has two barbed brown horns on the second segment. It feeds on the willow, scrub-oak, Siberian crab, cherry and gooseberry. The butterfly expands from three to four inches, the wings of a blue black color, with the outer half of the hind wings blue. Around the scalloped outer margin are four alternate stripes of blue and black; the inner blue stripe the lightest, and about three small orange spots near the apex. Under side, the black duller, the blue border stripes lighter, and an additional border row of orange spots, with several orange spots near the base of the wings.

*LIMENITIS DISIPPUS*, Godt.—The Disippus Butterfly.

Expands from two and a half to four inches. The principal difference between this and the Archippus butterfly is, there is a black line a little beyond the middle of the hind wings parallel with the outer border, and the discal cells of both wings are open. Caterpillars, pale brown, more or less variegated with white on the sides and with green on the back, the barbed brown horns on the second segment, shorter than in the Ursula larva. Feeds on poplar, willow and plum, and there are two broods in a season.



APATURA CELTIS, Bd.—The Eyed Emperor.

The larvæ of this species may be found during the month of May, on the leaves of the hackberry (*Celtis*). When full grown they are a little more than an inch long, pea green, with a series of yellow spots along the middle of the back, and three yellow lines each side, the middle one undulating often obsolete on the anterior part of each joint, and containing a little lead colored dimple. The body largest in the middle, from which it tapers both ways, two horns at the anal extremity, and two branching antlers on the head. I took a specimen of this species in the College yard at Irvington, June 23, of the past season; yet the nearest hackberry trees, of which I have any knowledge, were more than two miles distant. The wings are pale russet gray, the outer half of the fore wings brownish, marked with about a dozen small white spots arranged in two lines, one or two near the summit oscellated with black and very small. The outer margin has a russet line, preceded near the hind angle by a black eye, centered with yellowish red, the spot on the line with the outer row of white spots. The hind wings are traversed towards the middle by two indistinct curved lines of blackish gray, and two more of the same color near the the inner margin. These lines are preceded by a curved row of six black eyes, of which the second from the anterior part is the largest. Underside whitish, with nearly the same markings as above.

APATURA CLYTON, Bd.—The Tawny Emperor.

The food plants of this species are the same as those of the Eyed Emperor, and the larvae are similar, but may be distinguished by the head being copal-yellow instead of black, and a dark mediodorsal line, and the middle of the three yellow lines on the side straight instead of wavy.

*Spec. Char. Imago.*—Expanse of wings, 1.75 inches. Hind wings and basal part of fore wings, brownish yellow, the outer part of the fore wings, the outer border of the hind wings, and a zig-zag, sub-terminal line on the hind wings, dark reddish brown. Beyond the center of each wing is a row of spots, white in the front half of fore wings, yellow the rest of the way, and black on the hind wings. Beyond this row, on the fore wings, are four white spots near the apex, and toward the hind angle a large black, eye-like spot, surrounded with the same color as the base of the wings, and three brown spots in the discal cell of the fore wings. Under side grayish brown, with the light of the upper side white. On the fore wings are two eye-like spots, surrounded with pale yellow, the apical one pupilled with white; on the hind wings a row of similar spots, pupilled with blue.

## PAPHIA ANDRIA, Scud.—The Goat-weed Butterfly.

This may readily be known by the following characters: The tip of the fore wings quite pointed and falcate; the hind wings tailed; the upper surface a reddish brown, quite red in the males; in the females an irregular band of an orange cast through both wings, the border dark brown, and the under side mottled copper. Expands three inches. This caterpillar is green and feeds on *Croton capitatum*.

## NEONYMPHA EURYTIS, Fab.—The Eurytis Butterfly.

Dark brown above, paler beneath. On each wing above are two eye-like spots, with double blue pupils enclosed in an ochre-yellow ring, the whole in a broad outer band, a little paler than the rest. Beneath, these marks are more prominent, with two additional eye-spots on each hind wing. Expands an inch and a half.

The larvæ vary from greenish gray to pale brownish yellow, thickly covered with whitish tubercles; feed on grass.

## SATYRUS ALOPE, Fab.—The Alope Butterfly.

Expanse of wings two and a half inches. Upper side blackish brown, the under side finely undulated with black. In the outer part of the fore wings is a light band containing two eye-like spots with blue pupils. These are repeated below. No eye spots in the hind wings. The caterpillar is pale green with dark green stripes, the head round and the tail ends in a fork.

## SATYRUS NEPHELE, Kirby—The Nephele Butterfly.

Darker and smaller than the Alope. Expands from an inch and three-fourths to two inches. Color dark brown, but paler beneath and finely undulated with black. The sub-marginal band on the upper side of the wings not plain, but plainer below on the fore wings. Two eye-like spots on the fore wings above, and one near the anal angle on the hind wings, the yellow circle indistinct. On the under side the eye spots are the same and very distinct on the fore wings, but on each hind wing there are six, two large and four small. Caterpillars similar to Alope. They feed on grass.

## LIBYTHEA BACHMANII, Kirtland.

Palpi as long as half the length of the body; black above, gray beneath. Fore wings broadly truncate at the tip, a deep, abrupt sinus back of the angle. Hind wings scalloped but not tailed. Color of wings above black, with three white spots near the tip of the fore wings, the largest beyond the end of the discal cell, and two larger orange patches toward the base. The hind wings have one orange patch near the middle. Under side fore wings orange in basal half, the rest black except the white spots of the upper side, and the tip which is lilac. Hind wings uniform lilac with a coppery reflection. Expanse, 1.75 inches.

## LYCÆNIDÆ.

This is a group of small, six-footed butterflies that are found about fields and the edge of woods in bright sunshine during the greater part of summer. The palpi are only moderately long, projecting obliquely in front of the head about as far as the length of the head, the last joint long and slender. The fore and hind wings are of nearly equal width, the latter sometimes with one or more very slender tails from near the anal angle. In color they are blue, brown, blackish or somewhat coppery above, but below, pale blue or yellow, or a combination of both, spotted with black, while a few *Theclas* are marbled black. Economically, they are comparatively unimportant, and I shall briefly mention only a few.

## THECLA HUMULI, Harris—The Hop-vine Thecla.

Wings, upper side, dusky brown, with a tint of bluish gray, and in the males an oval darker spot near the front edge. On the hind wings two thread-like tails, the inner one the largest and tipped with white, before which is a row of pale blue spots, interrupted by a large orange red crescent enclosing a small black spot. Beneath, slate gray, streaked with brown and white, and two orange spots near the anal angle, the one before the tails enclosing a black dot. Expands 1.10 inches. Food, plants of the larvæ, thorn, pine, beans and hop.

## THECLA STRIGOSA, Harris—The Streaked Thecla.

Wings above, dark brown without spots, save an orange spot on the female in front of the two slender tails. Under side pale brown,

crossed by four irregular white lines, and on the hind wings, near the outer margin, a row of deep orange-colored crescents, and a large blue spot near the anal angle. Expanse, 1.10 inches. Food plants of larvæ, oak, thorn and holly.

CHRY SOPHANUS THOE, Bd. and Lec.—The Thoe Butterfly.

Expands an inch and a half. Wings above coppery brown, the hind wings the darkest. Near the outer edge of the hind wings a row of orange crescents enclosing black dots, the crescents running together toward the anal angle. Black at the end of the discal cells, and a few black dots, besides, on the hind wings. Underside, fore wings orange, except the tips and base, which are the same, almost white, pale blue of the hind wings. An outer marginal band of deep orange to the hind wing, and both wings sprinkled over with black dots. Food plants of larvæ, prickly ash.

CHRY SOPHANUS AMERICANA, D'Urban—The American Copper Butterfly.

Fore wings, upper side, copper red, with about eight small, square, black spots, and the outer margin broadly bordered with dusky brown; hind wings with a few black spots in the middle, and a broad, coppery red band on the hind margin. Expands 1.10 inches. Larvæ—green, long, oval, slightly convex above; feed on sorrel. There are three broods in a season.

LYCÆNA PSEUDARGIOLUS, Bd. et Lec.—The Azure-blue Butterfly.

Expands from 1 to 1.10 inches. *Male*—upper surface, pale azure blue, the hind wings, except at outer margin, paler than the fore wings. *Female*—white; blue at the base of the wings, and sometimes a spot on the fore wings, with the costal and outer margin of both wings bordered with black. Under side bluish white, spotted faintly with black. There is also a form with the upper side of the wings black, thought until recently to be a dimorphic female variety. The larvæ feed on *Cornus actinomerus* and *Cimicifuga racemosa*.

LYCÆNA COMYNTAS, Godt.—The Comyntas Butterfly.

Wings in the males, violet blue; in the females, blackish, glossed with blue on the upper side, with whitish fringes. Near the anal angle of the hind wings is a little thread-like tail, with several blackish spots and two orange crescents near the anal margin. Underside, bluish gray, with black spots circled with blue. Expands one inch. The larvæ are oval, convex, downy, and a pale green color with three darker lines of the same, sides reddish and head black. Food plants, *Lespedeza*, red root, *Desmodium Marilandicum* and clover.



## HESPERIDAE.

A family of butterflies known as skippers, that differs considerably from the other families, having some characters that belong to the moths. The hind wings, when at rest, are open, while the fore wings are wholly or partly closed, though this is not an invariable rule. The bodies are short and thick; the head large, wide transversely; eyes prominent; palpi short, almost square at the end, thickly hairy; antennæ knobbed, but the knob is either bent strongly outward or hooked; legs, six, the hind shanks with two spurs. The caterpillars are without spines, spindle shaped; the head prominent, on account of the joints, back of the head being small. They are solitary in their habits, many of them enclosing themselves with silken threads in the leaves they eat, where they pass the larva state and change to chrysalids.

### PAMPHILA SASSACUS, Scudd.—The Sassacus Skipper.

The following is Dr. Harris' description: "Dark brown above; all the wings with a tawny-yellow spot occupying the middle of each, and with two or three little detached spots of the same color near the extremity of the first pair; beneath, ochre yellow, with small pale yellow spots near the tip, corresponding to those on the upper surface of the fore wings; and on the hind wings, seven small, square, pale yellow spots, namely, one before the middle, and the others in pairs behind it. Expands one and one-fourth inches." The caterpillar is green with a brown head. Feeds on scrub grass.

### PAMPHILA HURON, Edw.—The Huron Skipper.

Expands 1-25 inches. *Male*—wings above, brown, with the middle and base of both ochre-yellow, irregularly dentate in the outer part, the veins of the hind wings and the inner margin, also a spot near the apex of the fore wings the same color. In the middle of each fore wing is a large black spot, crossed obliquely by a gray dash, from which arises, towards the costa, darker gray hairs. Thorax and side of abdomen, olive. Club of antennæ abruptly bent at tip. *Female*—wings all brown, except on the fore wings, along the discal cell, hind margin, two spots near the apex and two more beyond the middle. No black center. Hind wings; an irregular yellow band extending from the base to near the outer margin, when it turns forward towards the apex, and a yellow stripe from the anal angle.

## PAMPHILA OTHO, Sm. and Abb.—The Otho Skipper.

Expands 1.25 inches. Wings brown with an olive tint in the posterior two-thirds. On fore wings are two double yellow spots placed as follows: One pair beyond the discal cell perpendicular to costa, the other below near the middle of the wing and oblique; spots repeated on the under side. No spot on the hind wings.

## PAMPHILA PECKIUS, Kirby—Peck's Skipper.

Expands about an inch. Dark brown above. *Male*—three ochre spots crossed by brown veins near the tip in the form of a triangle, the same color on the costal part from the base to the end of the discal cell. Below the last yellow space is a black stripe that extends from the base near the hind margin to the end of the discal cell. Hind wings with seven ochre spots, one near the middle and the rest in a sub-marginal row, the second and third from the costa the largest. Underside yellowish brown, the marks of the upper side repeated except the black of the fore wings, and the lower of the three terminal spots are much larger. The sub-marginal row of dots united into a band which joins in the middle, the central spot of which is much enlarged. *Female*—has on the fore wings only the terminal three spots, and on the hind wing the same as the male but less distinct. Underside similar to the male but darker.

## PAMPHILA CERNE, Bd. and Lec.—The Cernes Skipper.

This is also called *P. ahaton*. Expands 1.10 inches. Dark brown above. An oblique black dash in the middle of the fore wings, the basal half of the wing ochre-yellow, the posterior part dusky, but the part in front of the black dash clear and extending outward somewhat toward the apex on the costa. There are two other spurs of the yellow extending towards the outer margin, one in the middle of the wing and the other at the hind margin. Hind wings unmarked. Antennæ knob yellow on the inside; tip short. Underside, hind wings yellow sprinkled with gray-brown; fore wings, hinder part, gray-brown, fore part the yellow as above, the tip same as hind wings.

## PAMPHILA MANATAQUA, Scud.

Expands 1.25 inches. Wings above dark brown with an olive tint. Fore wings with a long, deep ochre spot in the middle of the wing below the costa, and an oblique row of light yellow interrupted spots

across the outer part. Hind wings unspotted. Underside but little lighter than above, spots the same.

*PAMPILA METACOMET*, Harr.—The Metacomet Skipper.

Expands a little over one inch. Dark brown above, slightly tinged with glossy olive; near the middle of the fore wings two light dots, and two very faint ones near the tip. Hind wings unmarked. The same spots and nearly the same color beneath. Inner tip of club of antennæ brown. The male has in addition, a black, oblique dash in the middle of the fore wings.

*AMBLYSCIRTES VIALIS*, Edw.

Expands one inch. Wings above, dark brown, with a very slight coppery reflection. Near the tip of the fore wings a row of three small white dots close together, extending from the costa backward. No marks on the hind wings. Fringe gray, with brown points at the ends of the nerves. Under side the same as above.

*PYRGUS TESSELLATA*, Scud.—The Tessellated Skipper.

Expands 1.30 inches. Wings above brownish black, spotted all over with white. These spots are arranged as follows: Two rows of small spots near the outer margin, a row of large spots crossing the middle of the wings, the rest arranged irregularly. Under side, the ground paler than above, the spots larger and more inclined to run into bands. Antennæ black, annulated with white, the black knob compressed, bent in the middle.

*THANAOS LUCILIUS*, Lintner.

Of these insects I have at hand only a single specimen, in poor condition, hence I will give only the prominent characters as they appear on this. Expanse 1.30 inches. Color, brownish black, with a slight purplish reflection; long brown hairs on the hind wings. About three-fourths of the distance from the base of the fore wing to the apex is a row of four white spots, separated by the brown veins, forming a line nearly perpendicular to the costa. In a line from the end of this row to the hind margin, parallel to the outer margin, is a fifth white spot, nearly half-way from the end of the row to the hind margin; and a sixth in the outer part of the discal cell. Besides

these, there are two rows around the outer margin of both wings of whitish spots, that are more distinct on the under side.

THANAOS JUVENALIS, Fabr—Juvenal's Skipper.

Expanse of wings 1.40 inches. Color, brownish black, with a slight purplish reflection; the hind wings with long hairs of the same color and gray hairs on the fore wings, so arranged as to form six more or less distinct transverse rows, with two rows and two more parts of rows, of black spots alternating with the gray. The six white spots of the fore wings arranged as in the preceding species, but this lacks the outer rows of whitish spots. White spots repeated on the under side with a faint indication of terminal and sub-terminal rows of white spots.

PHOLISORA CATULLUS, Cram.

Expands about .85 of an inch. Color of wings above, black, with a row of white points near the outer edge, sometimes faint, bending in from the edge towards the costa near the tip of fore wings; often a second row through the middle of fore wings, the dots remote. The bent apical part of the sub-marginal row repeated underneath. Body black; head white below, spotted above. Caterpillar, green, with a black head. Feeds on *Monarda* and some other plants.

EUDAMUS BATHYLLUS, Sm. et Abb.—The Bathyllus Skipper.

Expands 1.30 inches. Wings above, brownish black, the fore wings crossed obliquely from the middle of the costa to the hind angle by a row of white spots of different shapes, the one in the middle being out of line, and near the tip three or four more spots separated by the dark veins. Hind wings without spots. Underside, the same as above. Antennæ with the knob strongly hooked. The caterpillar feeds on wild bean.

EUDAMUS LYCIDAS, Sm. and Abb.

Expands 1.75 inches. Antennæ strongly hooked. Color of wings above, dark brown; the fore wings crossed from the middle of the costa to hind angle by a row of pale yellow spots, the third and fifth large, square, the fourth out of line; beyond the fourth is another small dot, and a row of small dots near the apex, as in the preceding species. Hind wings unspotted. Underside fore wings as above, the basal two-thirds mottled brown, the outer third white, mottled with brown.



## EUDAMUS TITYRUS, Fabr.—The Tityrus Skipper.

Expands from two to two and a half inches. Wings, upper side, rich dark brown, with the long hairs at the base dark yellowish-green; middle of fore wings crossed, as in the preceding, by four yellow spots; the second and third large, square. Beyond the division, between the second and third, is another smaller one. Three yellow spots near the apex, as in the preceding. Underside, fore wings as above; hind wings crossed in the middle by a broad silvery band. Antennæ hooked. The caterpillars are pale green, transversely streaked with darker green; neck and head red, with two large yellow spots on the latter. They feed on the leaves of the common locust and rose acacia, the leaves of which they fold together and in which they remain during the larva and chrysalis states.

## HETERO CERES.—Moths.

Antennæ not knobbed; wings never erect when at rest.

## SPHINGIDAE—Sphinges, or Hawk Moths.

These are known as Hawk Moths, or Humming-bird Moths, the latter name being applied on account of the humming-bird like manner in which they poise over flowers, into which they insert their long proboscis for the purpose of extracting the juices. The bodies are large, spindle-shaped; wings narrow, powerful when spread. The hind wings are not usually more than half the length of the fore wings, the hind angle of the fore wings projecting backward. When closed they are laid back like a roof over the body. Their flight is rapid and strong.

The caterpillars have sixteen legs, and on the top of the last segment there is usually a prominent horn, or in some cases only a tubercle. They transform in the ground, and the tongue-case of the chrysalis is generally free.

## SESIA (HEMARIS) DIFFINIS, Boisd.—The Clear Wing, or Bee Moth.

Expands nearly two inches. The thorax above, anterior part of the abdomen, and the segment near the posterior part, pale-greenish yellow. Middle of abdomen, outer border and veins of wings, dark brown. Base of wings, brown and yellow. Middle of wings, clear. Under side, body and feet, black; the first yellow in front, and some of the same color on the two segments of abdomen. Antennæ somewhat serrate beneath. Larvæ pale green; reddish beneath.

SESIA (HAEMORRHAGIA) THYSBE, Fabr.—The Thysbe Clear Wing, or Bee Moth.

Expands two inches. Similar to preceding, only the yellow is replaced by deep olive green above, and the brown is a reddish brown. Underside of the body, reddish brown; the fore part pale yellow. The larvae of these species feed on the snow-berry (*Symphoricarpos*) and similar shrubs.

THYREUS ABBOTTII, Swains—Abbott's Sphinx.

Our grape vines, as well as the Virginia creeper of the forest, are sometimes more or less defoliated by a reddish brown caterpillar, with a polished tubercle on the posterior part of the body instead of a horn, known by the name of Abbott's Sphinx. It is variable in its markings, being sometimes marked with numerous patches of light green, at others pale reddish brown marked with transverse striæ and a dorsal line of darker brown, with also a dark line along the side. These different colors were supposed to be sexual, and the one with the green patches was regarded as producing the male moth, but by breeding both kinds have been found to produce indifferently both sexes.

Not having a moth at hand I copy the following description from the American Entomologist, vol. 2. "It is of a dull chocolate or grayish brown color, the front wings becoming lighter beyond the middle, and being variegated with dark brown; the hind wings are sulphur yellow, with a broad dark brown border breaking into a series of short lines on a flesh-colored ground near the body. The wings are deeply scalloped, especially the front ones, and the body is furnished with lateral tufts. When at rest the abdomen is curiously curved up in the air."

DEILEPHILA LINEATA, Fabr.—The White-lined Sphinx.

The usual food plant of the caterpillar of this species is the common garden purslain, though it has been found on grape vines, turnips, buckwheat, water melon and apple leaves. On all but the first it is only an occasional visitor, and, unless for some reason it should be more numerous than usual, it need not be regarded as injurious.

The larva is variable in color, more usually yellowish green, with a sub-dorsal row of elliptical, crimson spots, bordered below with a pale yellow line and surrounded by black. Sometimes these spots are connected. Stigmata are red surrounded by black, and there is a horn on

the posterior part of the body. The other form of the larva is black, with a yellow line along the back and a series of pale yellow spots and darker dots in the sub-dorsal region. Length three inches.

The moth expands over three inches. Fore wings dark olive green, black in the middle, with white hairs at the base. From the base to the apex runs a broad line, white at the base, but the rest of its course creamy white. Veins white. Hind wings white with a wide band of rose color across the middle. Thorax dark olive, with five or six longitudinal white stripes. Abdomen a little lighter, a light line on back bordered with black, with a row of alternate black and white spots on the sub-dorsum; sides rose colored.

#### PHILAMPELUS PANDORUS, Hub.—The Satellite Sphinx.

There are two caterpillars very much resembling each other; the larva of this species, to which Dr. Harris gave the specific name *satellitica*, and the larva of the Achemon Sphinx, that are found in most all parts of the United States, on the wild and cultivated grape vines, and on the Virginia creeper. Harris, in his general description of them, says: "When young, they have a long and slender tail, recurved over the back like that of a dog; but this, after one or two changes of the skin, disappears, and nothing remains of it but a smooth, eye-like, raised spot on the top of the last segment of the body. Some of the caterpillars are pale green, and others are brown, and the sides of their body are ornamented by six cream colored spots of a broad oval shape, in the species which produces *satellitica*; narrow, oval and scalloped, in that which is transformed to the species called *achemon*." When full grown, the caterpillars are three inches or more in length. There is only one brood during the season; the forms coming to their growth in August or the fore part of September, and they come out as moths the following June and July. One that I received from Irvington, went into the ground September 15th. The moth expands from four to five inches. Head and middle of thorax, pale olive green, a patch at the shoulders, dark olive; abdomen pale brownish, tinged with green, with a dark patch at the base, and dark line at the side. Fore wings, pale olive gray, darker at the outer anterior parts; three dark olive patches, one at the tip, a small one at the posterior angle, the largest at the hind margin from base to the middle. Hind wings, paler; a large black or dark olive spot near the middle of inner margin; a submarginal band of the same, the anal part roseate or yellowish with dark spots.

*Remedies.*—These worms are kept from doing serious injury by hand picking.

#### PHILAMPELUS ACHEMON, Drury.—The Achemon Sphinx.

All that is necessary of the larval character or history of this species has been given with the preceding. The moth resembling

the other somewhat, is a little smaller, expanding from three to four inches. The color of the body is a more uniform olive gray, darker; the shoulder tufts darker. The fore wings are dark olive gray, with some faint brown marks, and three dark olive, almost black spots; as in the preceding, the one on the hind margin being square and in the middle. Hind wings, roseate in the basal half, a band of dark, then a border of olive.

*Remedies.*—The same as for the preceding.

#### DARAPSA MYRON, Cram—The Myron Sphinx.

The caterpillar of this species is usually spoken of as the "Hog Caterpillar of the vine," as it feeds on all our grape vines, and because the peculiar appearance of the fore part of the body suggests the fat cheeks and shoulders and the small head of a well kept hog. This caterpillar is by far the most common of the large caterpillars that are found on grape vines in this part of the United States, there being scarcely a season it is not found doing some damage in every place where vines are grown.

The eggs are perfectly round, of a uniform yellowish green color, and are glued singly to the underside of the leaf. The young worm that hatches from the egg is pale green, with a straight horn at the tail. It comes to maturity in four or five weeks, and is then either of a pale green color, with a light stripe each side, that unites with the one from the opposite side at the horn, and a dark spot on the front part of the dorsum of each segment, bordered by light, posteriorly; or a brown color, with the same markings. These colors do not represent different varieties nor difference of feed, but may be found in the different individuals produced from eggs from the same mother, as I have found by experiment. Length, when full grown, an inch and a half. When about to change, this caterpillar descends from the vine, and binding together loosely some leaves or other rubbish that may be at hand, transforms to a chrysalis, a little more than an inch long, of a pale yellow color, with the divisions between the joints and the stigmata brown, and some specks of the same color over other parts.

The moth expands about 2.25 inches. The fore wings and the body are a grayish lilac color, with olive green on the back, a narrow bar of the same across the wings, near the body, and a broad, irregular one across the outer part. The hind wings are red, with a little gray near the anal angle.

*Remedies*—Nature has provided, in the shape of a little black ichneumon fly, all the remedy that is generally necessary for keeping these worms in check. The eggs of these parasites are deposited within the body of the caterpillar while it is young, and, after hatching, they feed upon the fatty substances of their victim till the caterpillar passes the last moult, after which they push themselves through the skin of different parts of the body, holding only by the last segment, where they form their little white cocoons, each containing the pupa of an ichneumon fly. Worms found thus parasitized should not be molested, as they will themselves succumb to the influence of



the parasites, while the latter, if allowed to go through their changes, may do good service to the next generation of caterpillars.

*SMERINTHUS (PAONIAS) EXCÆCATUS*, Sm. and Abb.—The Blind-eyed Sphinx.

The caterpillar of this sphinx is, according to Dr. Packard, "apple green, with seven oblique, yellowish-white lines on the sides, and a bluish caudle horn." It feeds on the apple and some kinds of roses, but is not generally numerous. The moth has the dentate fore wings, rich brown, crossed by two broad bands of lilac-gray; the hind wings rose colored at the base, brownish in the outer part, a black, eye-like spot near the anal angle pupilled with blue. Body brown; antennæ pectinate beneath in the male. Wings expand three inches.

*SMERINTHUS (CRESSONIA) JUGLANDIS*, Sm. and Abb.—The Walnut Sphinx.

This caterpillar is bluish green, with a row of sub-dorsal and stig-matal reddish brown spots, and six oblique lateral bright yellow bands."—Packard. It feeds on walnut and hickory leaves.

The wings of the moth expand from two and a half to three inches, are both a pale lilac gray, and have no eye-like spots on the hind wings. The fore wings are somewhat clouded with brown in the outer part and also through the middle. Near the outer margin are two fine parallel brown lines, about a tenth of an inch apart, that cross both the fore and the hind wings; near the body, two similar lines that cross only the fore wings. Antennæ pectinate beneath in the male.

*CERATOMIA AMYNTOR*—Hub.—The Elm Sphinx.

This moth, called by Dr. Harris *C. quadricornis*, or the "four-horned Ceratomia," is one of the largest that is found on the elm, and is the only Sphinx caterpillar in this country that has thoracic horns or projections. When fully grown they are "about three inches and a half in length, of a pale green color, with seven oblique white lines on each side of the body, and a row of little notches, like saw teeth, on the back. The four short horns on their shoulders are also notched, and, like most other Spinges, they have a long stiff spine on the hinder extremity of the body."—[Harris.] They pupate in the ground, the single brood of the season passing the winter in that state.

The moth has an expanse of wings of three and a half inches. The general color is brown, light along the prothorax and costa of the fore wings, but darker through the middle except at the base, with four oblique, dark brown, elongate spots in this darker portion, the

last one reaching in a somewhat tortuous course the apex. Below this there is a sub-terminal, dark brown line, edged with light purplish, with one or two fainter dark lines each side, the same series of lines crossing the light portion of the wings nearly at right angles, and being lighter through this part. Hind wings duller, with a sub-marginal band of dark and a double medial band, that is faint. Abdomen with a dorsal and subdorsal dark brown line.

MACROSILA CAROLINA, Linn—The Carolina Sphinx, or Tobacco-worm Moth.

The caterpillar known as the Tobacco-worm so closely resembles the Tomato-worm that the one is often mistaken for the other. Like that species this one not only feeds on tobacco, being one of the principal chewers of that weed, but it thrives equally well on tomatoes, potatoes, etc. The larva is dark green, wrinkled transversely; the body paler on the back, with whitish dots and oblique white bands on the sides, edged above with bluish, and short, transverse, black stripes. Stigmata black, with a yellow point above and below, except the first and last, which are orange yellow, with a black central point; all edged with blue. The terminal horn is tipped with rust color. When full grown it is from three to five inches long, and descends into the ground and changes to a brown chrysalis, two inches and a quarter long, with the tongue-case, three-quarters of an inch, standing out on one side like the handle of a pitcher. The early brood of these worms, that transform to chrysalids in July, come out as moths in a little more than three weeks, but the late ones pass the winter in the chrysalis state.

The moth has both the wings gray, crossed by several wavy black lines. The band crossing the central part of the wings is indistinct on the hind wings, while there is a white spot at the base of the fore wings. The abdomen has a row of five orange spots surrounded by black on each side, and a black patch at the base. The antennæ gray above, white beneath, terminating in a hook. Expands four or five inches.

*Remedies.*—Where tobacco is raised, it is often a serious question how to circumvent the ravages of these gormandizers without so much of an outlay as to greatly reduce the profits of the crops. Hand picking is the means generally resorted to, both for tobacco and tomatoes, etc., in the garden. This is effectual, but is open to the objection that where the plants have to be carefully examined every day, the time consumed makes it an expensive operation. As a substitute for hand picking, it has been recommended to plant, or allow to grow, Jimson or Jamestown weeds (*Datura*) either among the plants or around the outside of the field. When these are in bloom, put a little poison, arsenic or strychnine, into the blossoms once in every two or three days. The moths that visit the field for the purpose of depositing their eggs, will be attracted by these flowers, of whose juices they are fond, and will be killed by the poison. A specimen of Ichneumon fly also preys upon the worm in a manner similar to that described as attacking the hog caterpillar, which is of great assistance in lessening their number.

MACROSILO 5-MACULATA, Haw. — The Five-Spotted Sphinx, or  
Tomato-worm Moth.

The caterpillar of this species is similar to the preceding; green, from three to five inches long, with oblique yellow stripes on the sides of the body. It feeds upon the same class of plants as the preceding, such as tomatoes, potatoes, tobacco, etc. Like that species it goes into the ground when full grown, and changes to a brown chrysalis, but the tongue case is longer than that of the tobacco worm. The moth is about the same size as the Carolina Sphinx, and similarly marked, but may generally be distinguished from that species by there being no white spot at the base of the fore wings, and two distinct angulated bands on the hind wings.

*Remedies.*—Whatever will apply as a remedy for the Carolina Sphinx, will be as efficient with this species.

ÆGERIDÆ.

A small but interesting family of moths that in the perfect or winged state resemble some of the *Sphingidæ*, but they may be known by their narrow and mostly transparent wings, bearing much resemblance to wasps or hornets. Most of the species are furnished with a tuft of hair at the extremity of the body which they can spread out, fan-like, at pleasure. They fly only in the day time, and seem to enjoy the hottest sunshine. The palpi project beyond the head, divergent, basal joints hairy. Antennæ longer than half the length of the fore wings, rather increasing in size from the base nearly to the tip, which is curved but not horned, pectinate in the males.

The larvæ are borers, living mostly in the stems and roots of plants. They are whitish, soft, slightly downy, more or less flattened on the under side, have sixteen feet, but no anal horn.

When full grown they transform inside the stems or roots that have furnished them food, into rather long, brown chrysalids inside of oblong oval cocoons made of the detritus of their passages, which is cemented together with a gummy secretion. The edges of the abdominal segments are armed with transverse rows of short teeth, by means of which they work their way partially through the hole previously made by the larvæ for exit when about to transform to moths.

ÆGERIA EXITIOSA, Say—The Peach-tree Borer.

The most widely spread of all these Ægrians, known wherever peach-trees are grown, is the Peach-tree Borer. In their general habits they resemble other wood-boring insects in that they live on the

substance of the wood, but they never penetrate into the heart-wood. Their presence may be known by the copious mass of thick gum mixed with their detritus; and they are more generally in that part of the tree at or just beneath the surface of the ground, though sometimes in the crotches or other parts. It is said, by Dr. Fitch, to be found in the plum tree as well as the peach, and Harris adds cherry trees.

The eggs from which these borers are hatched are deposited the latter part of summer upon the trunk of the tree, usually near the roots. When hatched, the larva eat their way downward in the bark and sapwood of the root, where it remains till the spring of the following season, when its course is towards the surface of the ground and the outside of the tree. In June or July it prepares a place of exit and transforms to a pupa in a cocoon composed of its chips and castings, mingled with gum, to come out as moth in July or August.

The two sexes of the moths differ enough to be easily mistaken for different species. The male has both wings transparent, with the fringes and a band beyond the middle of the fore wings, and the body steel blue, but the palpi, the edges of the shoulder tufts, and two narrow bands on the abdomen, pale yellow. Expands about an inch. The female expands about an inch and a half; has the fore wings border of hind wings, and body opaque; dark steel blue throughout, except a dark yellow band on the abdomen.

*Remedies.*—Among the many remedies that have been tried with this insect, that known as “mounding” seems to be the most satisfactory, a system that is in practice by some of our most successful fruit growers. To state the process briefly, in the spring before the moths emerge (April), a bank of dirt a foot deep is thrown round the tree and pressed firmly about the trunk. Each subsequent spring a little more earth is placed on the mound and pressed around the trunk as before. Mr. B. Pullen, of Centralia, states that they should not be mounded till they are four years old, but examine them in April and September of every year, previous to that age, and with a knife destroy all borers that may be found. This has been found to be an excellent preventive, but where trees are already suffering from them, the earth may be removed from the roots and a copious application of hot water made to the tree. This may be applied at any season, and will be very effectual in killing the larvæ or any eggs that may be present.

#### ÆGERIA PYRI, Harris.—The Pear-tree Borer.

The larvæ of this species lives under the bark of the pear-tree, and has a habit similar to the preceding. The following is Dr. Harris' description of the moth: “Its wings expand rather more than half an inch, are transparent, but veined, bordered and fringed with purplish black, and across the tips of the fore wings is a broad dark band glossed with coppery tints; the prevailing color of the upper side of the body is purplish black, but most of the underside is golden yellow, as are the edges of the collar of the shoulder covers, and of the



fan-shaped brush on the tail, and there is a broad yellow band across the middle of the abdomen, preceded by two narrow bands of the same color.

*Remedies.*—It is probable that similar measures will have to be taken for this insect, as the peach-tree borer.

### ÆGERIA POLISTIFORMIS, Harris—The Grape-root Borer.

The larva of this species bears a close resemblance to the Peach Borer, but is a little larger, being from an inch to an inch and three-quarters long when full grown. It is usually regarded as a Southern species, but is occasionally met with as far North as the southern part of Illinois, it being common in Kentucky, and Prof. Riley has found it in the vicinity of St. Louis. This Borer works further under the surface of the ground than the Peach Borer, but like that it works wholly in the bark and sap wood.

*Remedies.*—According to T. Glover, Entomologist for the Department of Agriculture, the larvæ are said to be shielded from the effects of outward applications by a coating of the bark, hence it would be difficult to reach them by this means with anything that would not injure the vines. But it is stated by various authorities that the variety of grape known as Scuppernong is free from the attack of this Borer. Advantage may be taken of this by grafting any desired variety on to Scuppernong stock, when the plants would be free from attack.

*Spec. Char. Meth.*—*Female*, head, including the palpi, orange tawny. Antennæ simple, blue-black, orange tawny above at their extreme base and tip, and below for their entire length. Thorax, black, varied with orange tawny and bright yellow on the lateral and posterior surfaces above and below for its entire surface. Abdomen, generally with the four basal joints black, and the rest orange tawny; sometimes almost entirely black—always with a narrow yellow ring at the tip of the second joint above, and generally with another such ring at the tip of the fourth joint. Venter, mostly black, with the tip of all the joints more or less edged with orange tawny, and with a short lateral pencil of orange tawny hairs springing from the tip of the penultimate joint, below, and reaching a little beyond the anus. Legs, orange tawny above, mostly black below, but with a yellow patch at the origin of the middle spurs on the hind tibiæ. All the spurs and tarsi more or less tinged with yellow. Front wings, brown black, with a more or less distinct clear space at base, longitudinally traversed by a nervure; hind wings, hyaline, with the veins, the terminal edge and the fringe, brown black. Expanse, 1.15 to 1.50 inches. The male differs from the female, first, the antennæ being pectinate four-fifths of the way to the tip; second, both thorax and abdomen are darker, and in addition to the pair of short anal pencils below, there is a pair nearly twice as long above; third, the short hyaline space straddling a black nervure at base is more distinct. Expanse, 1.10 inches.”—[Riley.]

## ÆGERIA CAUDATA, Harris—The Black Currant-borer.

“The larva of this lives in the stems of our wild black currant (*Ribis floridum*), and is not known to be found in any other species. *Spec. Char. Moth.*—Brown. *Male*, with the fore wings transparent, with a brownish border; fringe, sub-costal spot, antennæ, palpi, collar and tarsi tawny-yellow; hind legs yellow; end of the tibiæ and first tarsal joint fringed with tawny-yellow and black hairs; tail slender, cylindrical, nearly as long as the body, tawny-yellow, with a little tuft on each side at base. The *female* differs from the male in having the fore wings entirely opaque; the hind legs black, with a rusty spot in the middle of the tibiæ and fringed with black; caudal tuft of the ordinary form and size. Expands from an inch to an inch and three-tenths.”—Harris.

## ÆGERIA TIPULIFORMIS, Linn—The Currant-borer.

This is not a native of this country but is imported from Europe, probably along with the species of currant of which it is an inhabitant. Instead of working in the main stems and below the surface of the ground, this larva bores lengthwise through the twigs, causing them either to wither and die or to droop, frequently being broken off by a strong wind. Like the others, it takes a year to pass through all its changes, appearing as a perfect insect in June. Mr. Walsh was of the opinion that, unless they should occur in great numbers, they would be a benefit to the currant bushes instead of an injury, acting as nature's pruner to keep the bushes from running too much to wood. They could easily be kept in subjection by cutting off infested twigs and burning them before the moths issued.

The moth of this species is smaller than some of the others, and nearly the whole of both wings are transparent. It is a blue-black with yellow on the tips of the fore wings, and three transverse lines of the same on the abdomen of the female, the male having four.

The female deposits her eggs singly, near the buds; when hatched, the larva soon finds its way to the center of the stem. When full grown, it is whiteish, with brown head and legs. Before pupating, it prepares its place of exit by eating a hole through the side of the stem in the same manner as the other species.

*Spec. Char. Moth.*—Expanse from .75 to .90 of an inch. Color, blue-black. Wings transparent; the margins fringes and veins blackish; the fore wings crossed at the end of the discal cell by a blue-black band, and a broad one at the tip, streaked with copper color. Antennæ black; the underside of the palpi, the collar, the upper edge of the shoulder covers, and the narrow rings on the abdomen, golden yellow; the ends of the tibiæ and spurs the same color. The male differs from the female in having an additional yellow line on the abdomen between the second and third segments.

## ÆGERIA (MELITIA) CUCURBITÆ, Harris.—The Squash Borer.

This borer is from an inch to an inch and a quarter long, rather thick, white head, and a horny shield-like scale back of it, brown. The front part of the head is a little lighter than the rest and contains the usual inverted Y mark. The moth lays the eggs on the stalks of the vines close to the ground from the middle of July to the middle of August. When hatched the larva bores into the stalk, and occupies the center, coming to maturity the last of September or the first of October. At this time the cavity it excavates in the vine is so large that the vines wilt, and are often quite suddenly killed. To pupate, the larva either deserts the vine and spins a rude earthen cocoon in which it transforms, or it sometimes remains in the stalk and constructs a cocoon similar to the other Ægerians, remaining in this state during the winter. The moth that comes out the following summer may be readily distinguished from any of the other Ægerians by its hind legs being heavily fringed with orange and black hairs. The fore wings are opaque, the thorax is olive, but the abdomen is deep orange banded with black.

*Remedy.*—Where numerous, it has been recommended to gather the squash and cucumber vines in the fall and burn them. This will destroy such as pupate in the stalks, but will not interfere with those that leave the stalks to pupate elsewhere. A better way will be to examine stalks that show signs of the work of this insect and kill the larva.

## ÆGERIA ACERNI, Clem.—The Maple Ægerian, or Legged Maple-borer

The Maple-borer works very much after the manner of the Peach-borer, on the inside bark and sapwood, but unlike that it works above ground. It is a caterpillar, a little more than half an inch in length, and of nearly uniform size throughout; head brown, but the body pinkish white. It is usually found in such trees as have been injured, either by bruising the bark or where the Flatheaded-borer has been at work, very seldom molesting the smooth limbs or even the trunks that are smooth or uninjured, as the moth seems to prefer a cracked or roughened place for depositing her eggs. The cocoon is formed in a manner similar to that of the Peach-borer, and the chrysalis, when about to produce the moth, pushes itself out of the hole prepared before, as is the case with the other species.

The moth resembles somewhat the Currant Ægerian, but may be known from that species by the terminal bands of the fore wings being ochreous yellow, and the anal tufts of the abdomen deep reddish orange instead of black.

This insect is referred to frequently in agricultural journals as causing serious injury to maples, and seems to be generally distributed over the country. Dr. Allen Whitman, of St. Paul, Minn., sent some to Prof. Thomas from Iowa, the fore part of last September, with the

following statement: "Found them under the bark of a tree. They don't seem to bore the wood, especially where the bark is broken or marred." In 1872 Mr. Merton Dunlap, of Ford county, stated to the State Hort. Society that the borers had nearly destroyed the soft maples. They are also said to attack the ash-leaf maple or box elder. Prof. Riley reports having found them abundant at East Sumner, Ill., in 1867, Onarga in 1869, and I have had similar statements of their work from the vicinity of Chicago.

*Remedies*—The principal thing to be done seems to be to keep the bark smooth, as such trees are seldom attacked by this borer. White-washing has been recommended as also filling up all holes and fissures with mortar, so as to render the trunk as smooth as possible. Also rubbing with whale-oil soap, kerosene, etc.

#### ÆGERIA SYRINGÆ, Harris—The Lilac Borer.

Our lilac bushes are sometimes bored into by a caterpillar similar to the preceding. It may be found during the latter part of summer making its galleries through both sap and heartwood of limbs even an inch in diameter, leaving in its track its chips and excrementitious matter. From the notes of Miss Middleton, who reared this moth from larvæ taken from the lilac bushes here in Carbondale, they were first noticed the tenth of August, 1876, and made their cocoons the middle of May of the following season. The cocoons were slim, light brown, three-fourths of an inch long, and each joint of the abdomen armed, as in the other Ægerians, with short teeth with which it works its way out of its gallery before the moth issues.

*Spec. Char. Imago*.—The moths expand 1.20 inches; are dark brown, The fore wings are opaque, except a space about one-fourth the length of the wing at the base, which is clear. Hind wings are rather broad, clear, with the fringe at the posterior edge brown, rather heavy. The antennæ, palpi, ring back of the head, the veins in the base of the fore wings, the front and middle shanks, and the middle of the hind pair rust red. The hind legs are, below the red, first, a ring of black, the rest yellow. The female differs from the male in being larger, and having at the base of the abdomen a dark red band two segments in width. These emerged from the chrysalids May 26.

*Larva*—"Length (description taken August 8, 1876) 0.37 of an inch, body flattened and somewhat margined at the sides, fusiform in outline; head small, triangular, reddish brown; first segment pale yellowish brown above; other segments with a cellular dark-brown spot on each side leaving a pale median line. The lateral margin of each segment (each side) is furnished with a spine which points laterally, and has a triangular base but acute point; beneath pale yellowish white; six thoracic feet; width at widest part over one-third the length."—Thomas.



## ÆGERIA RUBI, Riley—The Raspberry Root-borer.

This species was first described by Prof. Riley in 1874, in his annual report as State Entomologist of Missouri. He states that for several years previous, complaint had been made that something had been working in the roots of raspberry bushes. Among mentions of this character that had been made is that of T. Engleman, of St. Clair county, to the State Horticultural Society in 1867: "Raspberries have failed here for several years in succession. I was under the impression that I was cultivating a tender variety which was killed in winter by the frost, but closer observation has convinced me that they are killed by a grub similar to the peach borer, which, like him, feasts upon their roots."

Mr. Walsh, in the spring of 1869, received specimens of this borer from Mr. Chas. Parry, of Cinnaminson, N. J., taken from blackberry roots, as is recorded in the first volume of the American Entomologist; and Prof. Riley found it in Denver in 1873. From this and other references that might be given it is evident that the insect is widely distributed, and had been doing damage to the raspberry and blackberry crop before the date of its naming.

According to Prof. Riley, "the worm attains an inch or more in length, is of a pale yellow color, with dark, reddish-brown head. It dwells mostly in the root, but its burrow often extends several inches above the ground. The moth has the front wings heavily bordered with rusty brown, and the body prettily marked with yellow and black and slightly tufted."

He further states that he knows of no remedy for its injuries other than to destroy them when found. The moths came out in August and September.

*Spec. Char. Moth.*—"Expanse of male 1.00, of female 1.25 inches. Front wings transparent, with a broad costal border extending half the width of the wing at base; a narrow, discal spot and more or less of the tip dull ferruginous; the inner border, the inner longitudinal vein, the intermediate space toward posterior angle, and sometimes its whole length, of the same color; veins brownish within and black without the discal spot. Hind wings perfectly transparent, or rarely with a few sparse, ferruginous scales; the transverse discal vein pale, the others pale at base, but black toward extremities; costa narrowly golden yellow, becoming darker toward apex. Fringes dark brown, those of hind wings appearing darkest by virtue of a dark wing border. Under surface somewhat paler. Abdomen stout, with a very slight anal tuft in the female, a stouter one in the male. Antennæ blue black, not enlarging toward tip; quite pectinate in the male. Palpi, a narrow ring around the neck, the sides of the collar, a broad band curving across the tegulæ and around the base of wings, a faint line across the middle of the thorax, two faint longitudinal lines between it and collar, legs, except outer base (sometimes whole length) of femora and tibiæ, hind third of abdominal joints, and a dorsal and lateral series of abdominal tufts or patches (the dorsal ones, especially

on the third and seventh joints, most persistent and conspicuous)—all golden yellow; the rest of the body black. The orbits are of a somewhat paler yellow, and the face either gray or bluish.”—Riley.

### ZYGÆNIDÆ.

This is a group of moths that in its different genera seems to connect the diurnal with the nocturnal lepidoptera, some of the former bringing to mind the butterflies, while others by their form and habit resemble the *Bombycidæ*. They are characterized by the following points: Antennæ either simple or pectinate, somewhat larger in the middle than at either end. Palpi small, not projecting more than the length of the head in front. Body moderately large; head distinct, rather large; distinct shoulder tufts; abdomen not projecting much, if any, beyond the anal angle when the wings are spread. Wings moderately long and narrow; scales powdery, thinly scattered over the surface, after leaving bare places.

The larvæ are sixteen-footed, short, cylindrical, obtuse at each end; head small, when at rest drawn partially into the first thoracic segment; segments short; more or less wrinkled or tubercled transversely; hairy or naked. In pupating some species spin a silken cocoon, others form one of hair, and others form none.

#### ALYPIA OCTOMACULATA, Fabr—The Eight-spotted Forester.

This is one of the four insects the larva of which, Prof. Riley, in his reports, has designated as the *Blue Caterpillars of the vine*, the other three being the Beautiful and the Pearly Wood-nymphs and the Grape-vine Epimenis. Though the moths differ so much, the caterpillars are near enough alike to be easily mistaken for each other, but by careful observation of the differences they are easily distinguished. Of the three this is the most common.

Though very generally distributed over the United States, it seldom is found in sufficient numbers to prove a serious injury to the vines. Prof. Riley states in 1874 that he had found it on the Concord, Taylor and wild *riparia* kinds of grape, but no other. It occurs in this State through the months of May and June, being found earlier in the southern part, and may be found as a second brood in September. While feeding it generally remains beneath the leaf, and can let itself down by a thread if disturbed, or, when full grown, it frequently conceals itself by resting within a folded leaf.

Prof. Riley describes the larva in the following general terms: “It is marked transversely with white and black lines, each segment having about eight light and eight dark ones. The bluish appearance of this caterpillar is owing to an optical phenomenon from the contrast of these white and black stripes. The head and the shield on the first segment are of a shiny, bright, deep orange color, marked with black dots, and there is a prominent, transverse, orange red

band, faint on segments two and three, conspicuous on four and eleven, and uniform in the middle of each of the other segments. In the middle segments of the body each orange band contains eight black elevated spots, each spot giving rise to a white hair. These spots are arranged four on each side, as follows: The upper one on the anterior border of the orange band; the second on its posterior border; the third just above its spiracles, on its anterior border,—each of the three interrupting one of the transverse black lines,—and the fourth, which is smaller, just behind the spiracles. The venter is black, slightly variegated with bluish white, and with the orange band extending on the legless segments. The legs are black, and the false legs have two black spots on an orange ground, at their outer base; but the characteristic feature which distinguishes it from the other two species (the Wood-nymphs) is a lateral, white, wavy band—obsolete on the thoracic segments, and most conspicuous on ten and eleven—running just below the spiracles and interrupted by the transverse orange band.”

The change to a chrysalis takes place in a slight cocoon, just below the surface of the ground, and the moth that is soon after produced is of a deep blue black, each fore wing marked in the middle by two light yellow spots, and each hind wing by two white ones. The shanks are orange, and the shoulder tufts are yellow.

*Remedies*—The fact that this and the following species of grape-eating insects are so widely distributed and yet so little damage is done by them, even where grapes are extensively raised, is evidence that but little need be done to prevent their attacks, as their parasitic foes are generally sufficient to keep them in check. As they all have the boring habit when about to undergo their transformations, broken corn-cobs or pieces of wood scattered about the base of the vines will serve as traps to allure them. These can, in the fall, be gathered and burned. Cleanliness in cultivation is a general antidote for these as well as many other kinds of insect foes.

#### PSYCHOMORPHA EPIMENIS, Drury—The Grape-vine Epimenis.

The caterpillar of this moth bears so close a resemblance to that of the Pearly Wood-nymph that they can scarcely, if at all, be distinguished from each other; hence, for all practical purposes, the description of that will answer for this. It works, as Prof. Riley says, “mostly in the spring, in the terminal buds, drawing the leaves together by a few weak silken threads. It always lies hidden within a sort of hollow ball made of leaves thus drawn together. It quits feeding by the end of May, bores into wood or other sufficiently soft substance at hand, neatly covering up its retreat, and remains hidden as a chrysalis till the next spring.” The moth that issues is velvety black, the fore wings sprinkled with light blue scales, forming a narrow band near the outer margin, and marked beyond the middle by a large yellowish white band. On the hind wings, in the same place, is a large dark, orange-red band. The band on the fore wing is indented in the middle. Expands a little over an inch.

*Remedies*—See the preceding.

## EUDRYAS UNIO, Hubn.—The Pearly Wood-nymph.

Expands nearly an inch and a half. The fore wings a pearly white, with a purplish brown stripe sprinkled with white along the costa from the base to beyond the middle and a terminal border of the same, through which passes a whitish band, dentate without and powdery within, with a few dark spots. This terminal brown border is lined on the inside by an olive brown line that extends along the hind margin, being interrupted in the middle of margin by a gray spot. Hind wings yellow with a terminal brown border similar to the fore wings but a little lighter, and a brown spot near the anal angle. Wings yellow underneath, with brown terminal border, two black spots on the fore wings and one on the hind.

The larva, when full grown, is about an inch long, with the body tapering from the eleventh segment to the head, the eleventh segment, as with the rest of this group, containing a prominent dorsal hump. On each of the segments there are three transverse black stripes, and then white ones each side of an orange stripe, the orange stripe the broadest and marked by six black spots. Head orange, spotted with black.

The grape-feeding habit of this caterpillar is doubted by many entomologists, but is affirmed by Dr. Fitch. Mr. Lintner, of Albany, N. Y., has found it feeding on *Epilobium coloratum*, while Mr. Kirkpatrick claims that it bores into the stems of *Hibiscus*. Last season (1877) I found two specimens of caterpillars on grape-vines that I took to be this species, but as I bred tachina flies from them instead of moths it is impossible to tell whether they were this species or the *Epimenis*.

*Remedies*—Same as the Eight-spotted Forester, if it should be found that this feeds on grape.

## EUDRYAS GRATA, Fabr.—The Beautiful Wood-Nymph.

This is similar to the preceding, but differs in the following particulars: The purplish brown stripe and border of the fore wings are darker, containing very little white, and the line between the border and the white, ground color of the wing, is green instead of brown, with the same color below the costal stripe. On the hind wings the border occupies only the anal half of the terminal edge, and there is no border underneath to either pair of wings. The larva is, when full grown, an inch and a half long; the ground color somewhat bluish, with six irregular black transverse stripes to each joint, three each side of an orange stripe. On each segment are about eighteen black spots, the six above the stigmata in the orange stripe, and against the black stripes each side. Head, yellow, spotted; the cervical shield same color, with eight spots in the transverse rows. The food plant usually given for this is grape vine, but I found them in Central New York, in 1869, feeding on a Virginia creeper that had been trained along the upper part of a piazza. It pupates by boring



a short distance into decayed wood or some other soft substance, or it may go into the ground.

*Remedies.*—Same as the Eight Spotted Forester.

ACOLOITHUS AMERICANA, Boisd.—The American Procris.

This insect has been placed by Dr. Harris, and others, in the genus *Procris*, by Walker in *Ctenucha*, but the more recent revisors of the family, have given it a place in the present genus. The moth is black, with narrow, ovate wings, expanding a little less than an inch; has a saffron collar, and a somewhat two lobed anal tuft. The antennæ are considerably pectinate, as also in the next species. The caterpillars are about half an inch long when full grown, yellow color, with a row of six velvety black spots to each segment. The eggs from which they hatch, are laid in clusters on the under side of grape leaves, upon which the young feed. When young, they feed together, arranging themselves side by side, like soldiers, and beginning at the edge of a leaf, eat their way across the leaf, standing on the uneaten portion. At first, they only eat the tissue, leaving even the fine veins, but as they increase in size, they eat all but the large veins. When full grown, they have not the same gregarious habit, but disperse over the vines, or when about to transfer, may forsake them entirely. I have not known them to be sufficiently numerous to cause serious injury to grape vines, never having but one or two colonies at a time; but if they should be troublesome, their gregarious habits would make it an easy matter to keep them in check by gathering and burning the separate leaves that contained them. Besides feeding on grape leaves, they also eat the leaves of the Virginia creeper.

CTENUCHA FULVICOLLIS, Hub.

Expands an inch and a half. Fore wings, slate colored, or blackish brown, yellow along the costal edge. Hind wings, opaque in the outer border; the rest transparent. Collar, orange; thorax, concolorous with the fore wings; abdomen, almost a steel blue; antennæ, pectinate.

BOMBYCIDÆ—Spinners.

A family of moths generally known as "Spinners" because many of them spin dense cocoons of silk in which the larvæ transform to chrysalids. The species that are now embraced in this family form several separate groups that have been called families by different writers in the past. Though differing in many respects these

groups are now by general consent brought together in this one family, and they agree in the following points: The head is small in comparison with the body, apparently sunken into the thorax, the mouth parts small or wanting, palpi seldom projecting any in front of the head, antennæ broadly pectinate. Body large, shoulder tufts prominent, sometimes the long hairs covering the top of the thorax. Wings often broad and falcate.

The larvæ are thick, usually more hairy than other moths, and often covered above and on the sides by wart-like tubercles from which arise tufts of simple spreading hairs. The hairs of many species are so roughened by minute points that in constructing cocoons the caterpillars weave them together, without silk, like felt.

While many of the species are ranked among the injurious insects, some, as the silk-worms, are beneficial, as upon them depend the silk industry that is carried on in various parts of the world.

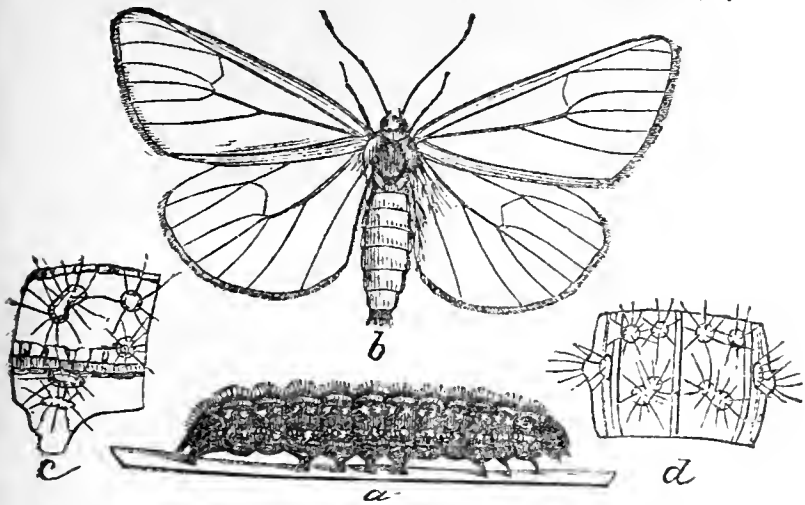
#### UTETHEISA BELLA, Linn.

Expands from an inch and a half to one and three-quarters. The fore wings are yellow, crossed by white bands containing black dots. Hind wings scarlet, edged with a black outer border, the inner edge of which is irregularly notched and toothed. This is known in Harris and the other older authors as *Deiopeia bella*, or the Beautiful *Deiopeia*. Common from July to September.

#### CALLIMORPHA FULVICOSTA, Clem.

Fig. 34—*Callimorpha fulvicosta* larva; left hand figure enlarged.



Fig. 35—*Callimorpha fulvicosta* moth and larva.

Expanse of wings two inches. Wings white with costal edge, head and front shanks yellow. This is merged with the following by Stretch in his revision of this family, being regarded as only a variety of *C. Lecontei*.

### CALLIMORPHA LECONTEI, Bd.

"White, the fore wings being almost entirely bordered with brown." The larva, according to Saunders, 1.10 inches in length; head rather small, black and shining, with a few short hairs. Body black above, with transverse rows of shining, wart-like tubercles from which arise tufts of short spreading hairs. On the back a bright yellow dorsal stripe and a wide band of the same color on each side of the body, the latter intersected with streaks and centered with a broken band of black. About half way between the dorsal and lateral stripes is a row of pale, whitish dots forming a faint broken line. Under surface dirty grayish white, with streaks and dots of brown, feet black, fore legs dirty white on inside, with a patch of shining black on the outside of each. Feeds on various herbaceous and shrubby plants.

### CALLIMORPHA INTERRUPTO-MARGINATA, Beauv.

Expanse two inches. The wings are yellow; the hind wings darkest, the fore wings bordered with dark brown, with a brown band from near the hind angle towards the middle of the wing. When the wings are folded, the brown of the hind margin and this cross-band bear a resemblance to an anchor. The brown border to the fore wings is interrupted at the apex and near the hind angle. Hind wings with a brown dot near the anal angle. Body concolorous with the wings, with a dark dorsal stripe.

### ARCTIA PHALERATA, Harris—The Harnessed Moth.

Expands a little over an inch and a half. The fore wings are black, marked with buff lines as follows: First, along the costa, two-thirds of the distance from the base; a second from the base to the middle of the outer margin. Near the middle of the wing this line

gives off a spur that runs to the hind angle. At the end of the second line and the spur, start two short parallel lines that run to the costa, the latter at the level of the first line. The third longitudinal line runs along the hind margin and, in the terminal fringe, round to the apex. Hind wings a more or less bright scarlet red, marked with several black spots in the outer border. Body, black stripe on the dorsum, with red each side.

The larva of this may be found in grass in the latitude of Southern Illinois, the fore part of May. It is a black, hairy caterpillar, an inch or more long, with transverse rows of wart-like tubercles, from which spring spreading tufts of short white hairs. Along the dorsum is a line of pale yellow, sometimes almost white. Those I reared the past season were fed on grass, corn, peach, elm and grape leaves, *Polygonum aviculare*, and Pepper grass (*Lepidium Virginianum*)—all of which they ate readily, except the first and last. The first spun its cocoon the 22d of May, from which the moth emerged June 16. As they are very abundant here in June and July, and then again in the fall, it is evident there are two broods in a season.

#### ARCTIA ARGE, Drury—The Arge Tiger Moth.

This expands two inches, but the wings are proportionally narrower than the preceding. The general color of the wings, light flesh, fading to buff. In the discal cell of the fore wings are two black dashes, the second or outer one somewhat kidney-shaped. Beyond the cell are four others, placed two and two, the last pair at the apex. Below the last, in the middle of the outer margin, are two more, with two more pairs of unequal size, and one of each pair triangular in the middle of the wing, and a row of three long dashes on the hind margin. Hind wings with several black dots near the outer margin, and three in the central part of the wing; a black line on the dorsum and near the shoulder tufts.

The larva is dark brown, with five pale or yellow longitudinal stripes, each segment bearing a transverse row of brownish yellow tubercles, from each of which arises a tuft of brown hairs. They are not so common here as the preceding species. Food plants, plantain, and, according to Abbott, it is sometimes destructive to corn in the Southern States.

#### PYRRHAETIA ISABELLA, Abb. et Sm.—The Isabella Tiger Moth.

The larva of this moth is known familiarly as the "Hedgehog caterpillar," from the fact that when taken up, it rolls into a ball, and the thick masses of hairs with which the body is covered, project outward in every direction like the quills of that animal. It is to be met with in gardens, walks, and other places during the last of August, seeking a place of shelter, in which it may pass the winter. It feeds upon the leaves of clover, dandelion, plantain, etc., until the approach



of winter, when it creeps under stones, boards, brush or anything that may give it shelter, making an oval cocoon of its hairs the following April or May, and comes out as a moth in June or July; but in warmer latitudes there are probably two broods instead of one. The hairs on the first four and last two segments of the body, are black, but the rest are dark red. Head and body, black.

This moth is of a uniform dark ochre yellow, with a slight brownish tinge on the fore wings, and a little pinkish on the hind. There is a row of black spots round the outer margin, and a dash of the same across the end of the discal cell of each wing, besides which there are two extra spots at the apex, and one in the middle of the fore wings. On the under side these marks are plainer. The body is rather robust; has a dorsal and lateral row of black dots. Expanse of wings two and a quarter inches.

#### LEUCARCTIA ACRÆA, Smith.

Larva when full grown measures an inch and three-quarters. It is clothed with long hairs, which are black or brown on the back and fore part of the body; of a lighter brown on the sides. The hairs grow in spreading clusters, from yellowish colored warts, that are in transverse rows across the body. The body is yellow, shaded at the sides with black, with a blackish dorsal line. Stigmata white, showing very distinctly through the hairs.

Expanse of wings of the moth from two to two and a half inches. *Male*: Fore wings rather narrow, usually white above, dotted with about twenty black dots, five of which, larger than the rest, are on the costa. Hind wings, deep ochre yellow, with four or five black dots. Antennæ and eyes, black. Head, thorax and tips of abdomen, white; the rest of the abdomen deep ochre yellow, with a row of black dots on the dorsum. All the under parts are deep ochre yellow, with the wings dotted with black; a row of black dots, in a white band, on each side of the abdomen, and a row of black dots under the center. The female differs from the male in being white, dotted with black as in the male, except the basal two-thirds of the abdomen, which is ochre.

The food plants of this species embrace the tender leaves of most of our cultivated plants, as well as many indiginous weeds and grasses. There are two broods of the caterpillars in a season. Were it not for the insect parasites, it would be a very destructive insect; and upon these we are chiefly dependent for its destruction. Hand-picking is the best means of destroying them where they become locally numerous.

#### SPILOSOMCA VIRGINICA, Fab.—The Virginia Ermine Moth.

The caterpillar of this species, called by Dr. Harris the Yellow Bear, is found from June to October on a great variety of plants, among which are peas, beans, cabbages, corn, grapes, etc., eating a great variety of young and tender leaves without apparent discrimina-

tion. It is about an inch and a half long when full grown, and varies in color from pale, creamy white to dark brown, many, when half grown, being foxy red, with darker extremities. The body tapers slightly from the middle to either end, and the hairs are from transverse rows of warts like the preceding.

*Spec. Char. Larva.*—In all the varieties the color of the under side of the body is dark, and there is sometimes a black line along the sides of the body, more or less interrupted, and a transverse line of the same color, more or less distinct, between the segments. Head and feet, ochre yellow; the head two-thirds as large as the middle segments.

*Moth.*—Expanse of wings from an inch and a half to nearly two inches. Wings white, with a black dot in the middle of the fore wings, and two on the hind wings, one in the middle and the other at the anal angle. In some specimens the wings may be wholly white, or there may be two or three black dots on each wing. The dots show plainer on the under side. The body is white, with a row of black dots on the back of the abdomen—another, each side, and an orange stripe between. Eyes, black; antennæ, blackish, slightly pectinate. Front thighs, orange.

*Remedies*—The same remarks that were made in regard to the preceding species apply equally well to this.

#### ECPANTHERIA SCRIBONIA, Stoll.—The Great Leopard Moth.

As the caterpillar of this species, for which Prof. Riley has suggested the very appropriate name, Large Black Bear, is occasionally found in the fall of the year, I will include a brief history of it here, drawing from the fourth Missouri report for the characteristics of the larva. It is "black, and so thickly covered with jet black spines, as to almost hide a series of roughened warts on each joint, from which the spines spring. When disturbed, it curls itself up, and then the sutures of the joints are seen to be reddish brown, in strong contrast with the rest of the body." The worm is said to feed mostly at night, on a species of wild sunflower, plantain, willows and black locust. It passes the winter in the larva state, very much like the Hedgehog caterpillar, feeds a few days in spring and then changes to a chrysalis in a loose cocoon, to come out in about two weeks in the moth state. Usually there is only one brood, but sometimes the caterpillar goes through its transformations and produces the perfect insect in the fall.

The perfect insect is the largest and most beautiful of the Arctians; the wings of the female expanding nearly three and a half inches. The wings and thorax are white, the fore wings and thorax covered rather thickly with white colored black spots of various shapes, hence the name Leopard Moth seems very appropriate. The hind wings have a terminal border of black spots, with two or three discal spots of the same. Abdomen steel blue, with a dorsal and lateral line of orange. The male is smaller, the spots duller, and the wings more pointed.

## HYPHANTRIA TEXTOR, Harris.

The moth expands about an inch, is white, and the wings free from spots. The antennæ are gray, somewhat pectinate; eyes black; front thighs, yellow; feet brown.

The larva, known as the Fall Web-worm, is one of the most common insects found feeding on the leaves of the trees and shrubs, and because of its covering the leaves and ends of the branches upon which it feeds, while young, with a cobweb like shelter, it is often taken for the Tent caterpillar (*Clisiocampa*.) It is a greenish worm, dotted with black with a broad blackish stripe along the top of the back, bordered each side by a bright yellow one. The three bundles of silky hairs that cover the body, proceed from tubercles which are black on the back and orange on the sides. Head and feet black.

In the latitude of Massachusetts there is only one brood of the worms in a season, the caterpillars pupating in September, and the moths issuing the following June and July; but in Southern Illinois they are double brooded. A brood that I found just hatching, the past season, the first week in June, changed to chrysalids the first week in July and gave forth moths the middle of the same month. The worms feed upon the leaves of hickory, wild black cherry, apple, crab, ash, elm, willow, oak, birch and sycamore, as given by Prof. Riley, besides which I have found them on osage orange, rose elder, grape and clover.

*Remedies*—When young they are gregarious, feeding under a web they have spun round several leaves. At this time the twigs containing them may be gathered and burned.

## HALESIDOTA TESSELLARIS, Smith—The Checkered Tussock Moth.

Wings expand nearly two inches; are pale ochre yellow, partially transparent, the fore wings crossed by five irregular pale brown streaks, and the thorax with one transverse and three longitudinal green stripes. The caterpillars feed on many of our forest trees, the sycamore excepted.

## ORGYIA LEUCOSTIGMA, Smith—The White-marked Tussock Moth.

Fig 36.

Male White-marked  
Tussock Moth.

As Dr. LeBaron, in his first report, gave a somewhat extended account of the character of this insect, it is not necessary to notice it at length here. At the time of his writing (1870), it appeared to be doing a great deal of damage to apple orchards in various parts of the State, and in its work presented a rather notable feature, that of not only denuding the trees of their foliage, but, as he says, "in almost every instance in which I have received specimens, complaint has been made of their gnawing the young apples." Since that time its numbers have been so few that, though widely distributed, being found everywhere on apple trees and

rose bushes, it has done very little damage, and the pretty caterpillar has ceased to be known by the masses as an enemy to be dreaded, but is rather an object of curiosity. They have been so scarce the past season that I only found two myself, and four more were brought to me by those curious to know what they were. This condition in the history of an insect so injurious at times and so widely distributed, is due to the number of insect foes it has. Dr. Fitch describes two and Prof. Riley seven more parasites that prey upon it.

The caterpillar is of a bright yellow color, sparingly clothed with

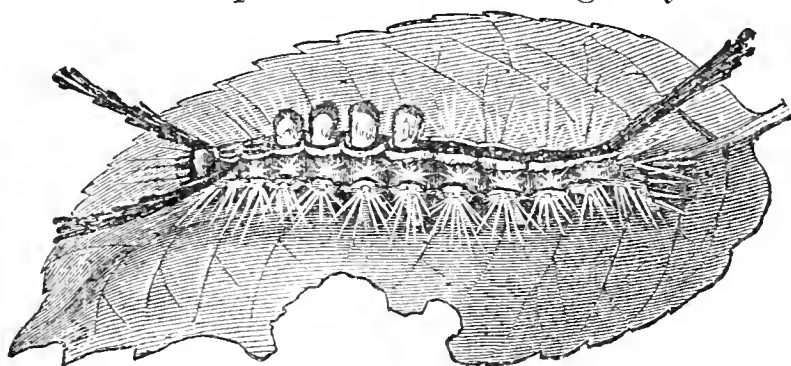


Fig. 37—Larva of White-marked Tussock Moth.

long and fine yellow hairs on the sides of the body, and having four short and thick brush-like yellowish tufts on the back on the fourth, fifth, sixth and seventh segments. On the first segment are two long, black, pencils of hairs that extend forward, somewhat diverging. From the top of the eleventh segment is a single black pencil extending backward. Head and two little retractile warts on the ninth and tenth segments coral red, and a narrow dorsal stripe of black or dark brown, with a wider lateral stripe a little lighter.

There are two broods of the worm, in June and September. They feed upon the leaves of apple, rose, oak, maple, elm, plum, pear, horse-chestnut, black walnut, larch and spruce. The cocoon is attached to a leaf, which is also attached by silken threads to the twig. The moths issue from the cocoons in about ten days from the time the larva enters the chrysalis state. The males have ashen gray wings, crossed by wavy, darker bands on the fore wings, on each of which is a small black spot near the apex, and a small white crescent near the hind angle. The body is small and slender, with a row of little tufts along the back. Antennæ, broadly pectinate. The female is wingless (having the mere rudiments of wings); body very thick, oblong, oval; antennæ small, and the legs weak. Male expands a little more than an inch.

*Remedies.*—Where they become numerous, the best time to destroy them is in the egg state, as the female deposits her eggs on the outside of her cocoon, they can be easily destroyed; as it is in this state that they pass the winter, and the cocoons can be seen when the trees are without their foliage. In destroying the cocoons care should be taken to destroy only those containing egg masses on the outside, as the others are either empty male cocoons or those that contain useful parasites. When the worms are found to be in possession of a tree or bush, from which it is desirable to dislodge them, shaking will bring them to the ground, when they may be destroyed.



## EMPRETIA STIMULEA, Clem.—The Saddle-back Moth.

*Spec. Ch. Moth.*—Expands about an inch and a quarter. Fore wings of a rich, deep, velvety brown, with a reddish tinge, darker through the center. Near the apex are two small white spots, and, in the male, two more near the base, below the median vein. Hind wings, pale reddish brown.

*Larva*—"Body, semi-cylindrical, truncated obliquely before and behind, with a pair of anterior, long, fleshy, subvascular, slenderly-spined horns, and a smaller pair beneath them, above the head; a posterior similar pair and a smaller anal pair beneath them. The superventral row of papulæ are rather large and densely spined. After the last moulting, the longer horns become moderate in length. The portion of the body between the anterior and posterior horns is of a fine bright green color, bordered anteriorly and superventrally by white, with a central dorsal, oval and reddish brown patch bordered with white, which color is again edged by a black line. The horns, papulae, and anterior portion of the body are reddish brown, with a small yellow spot between the anterior horns, while the posterior pair are placed in a yellow patch."—Morris.

The spines with which the horns are supplied, produce a sensation similar to that produced by nettles when they come in contact with any portion of the body where the skin is thin; this sensation, however, can seldom be felt on the palms. For this reason this caterpillar is one of several species that are familiarly known as *stinging caterpillars*. It feeds on a great variety of plants, among which are fruit trees, the rose and corn.

## LIMACODES LATICLAVIA, Clemens.

General color of fore wings, reddish fawn color; they are crossed beyond the middle by a slightly oblique white band, with their projections in the outer part, and a point on the inner side below the middle. The band is shaded on the outside by a brown band, broader than the white, with a line of the same from the costal end of the brown to the outer margin; hind wings smoky gray; expands .70 of an inch. The antennæ of the males slightly prectinate. This moth is attracted to houses by the light in July. The larvæ feeds on maple.

## THYRIDOPTERYX EPHEMERÆFORMIS, Haw.—The Basket-worm.

In many instances the cedar trees, as well as, occasionally, some others, have suspended from them—remaining throughout the winter—curious sack-like silken cases, pointed at each end, and covered over with bits of twigs and stems of the trees upon which the insects inhabiting them had fed. These are the cases of the basket or bag

worms, or, as they are sometimes called, cedar worms, because they are usually found on that tree, but also live upon a great variety of trees. Briefly their history may be told as follows:

The two sexes of this moth that issue from these cases in the fall vary greatly, the male having the wings sparsely covered with a coating of scales that come off soon after he issues from his case, leaving transparent bee-like wings, while the female is wingless and remains in her case or follicle till after she has paired with the male, when she deposits her eggs in the follicle, works her way out, falls to the ground exhausted, and dies. The eggs remain in this case throughout the winter to hatch out the next May. The first effort the young worm makes upon finding itself free from the egg is to spin a cone-like case of silk mingled with such other substances as may be at hand, which covers and protects all but the anterior part of the body. It carries this erect in the air as it feeds, adding to it as growth requires a more commodious apartment until it becomes too heavy to be borne in this way. After this the case is pendant. About the middle of the summer the worms attain their full size, when they quit the trees upon which they fed and wander about, and it is at this period only that they push their migrations beyond the treewhere the eggs were deposited. As the female is without wings and does not leave her case until after the eggs are placed in position, it is evident this restless disposition when the larva are full grown is the only provision nature has made for the diffusion of the species. After their wanderings cease they attach the follicle to a twig of some tree or shrub by a strong cord of silk and change to chrysalids; the male the smaller, showing the cases of the future wings, but the female having more of the shape of the caterpillar. At the proper season the perfect insects issue from there to deposit eggs that pass through the cycle of changes already given.

From the above it is evident that these insects are local in the character of their work, and as they must spread very slowly. It is also evident from the manner in which the eggs pass the winter that they may be easily managed by gathering these follicles at any time during the winter and burning them, as that will destroy the eggs and with them the prospect for the next brood of worms. They are not abundant in the northern portion of the state, being more of a southern than a northern insect; but they are more or less common in southern Illinois. The only complaint I heard from their depredations the past season was from Grand Tower where they did some damage to cedar trees.

*Spec. Char. Moth*—The wings of the male expand about an inch, and, as usually found, are almost devoid of scales so that they look more like bees than moths; body brownish, black, antennæ broadly pectinate to two-thirds of its length; female wingless.

## DATANA MINISTRA, Walker.—The Hand-maid Moth.

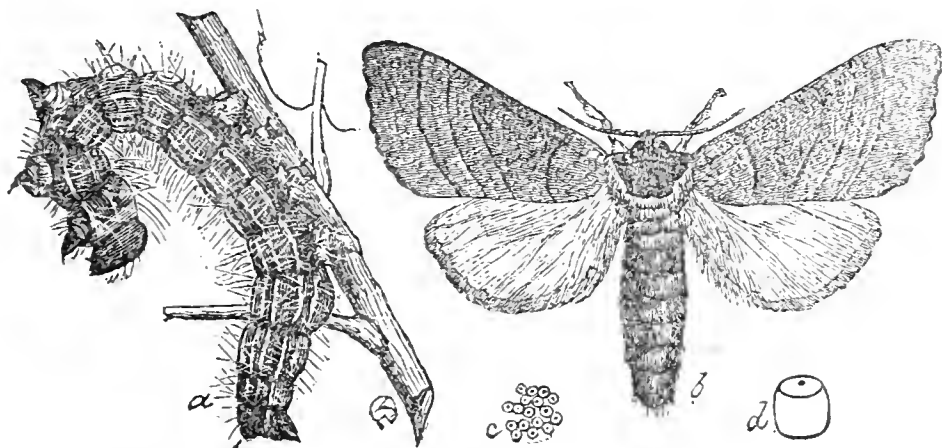


Fig. 38.—The Hand-maid Moth and Larva.

As Dr. LeBaron gave an extended account of this insect in his third report, a brief description will be all that is necessary here. The larva, called the Yellow-necked Apple Tree Caterpillar, is "black with four narrow pale yellow stripes upon the sides, narrower than the intervening spaces; upper side of the neck or first segment deep wax-yellow, hairs upon the body whitish, about as long as the width of the body." This description from LeBaron is from the variety that feeds upon the apple tree. Those that feed on the Sumach are described by the author as follows: "Body black, in some specimens, very dark red, with bright lemon-yellow stripes as wide as the intervening spaces. Top of neck black, sometimes with a narrow anterior margin or yellow." The variety that feeds on the black walnut differs from both of these as will be seen by the following: "Body wholly black without stripes, top of neck black, hairs pure white, twice as long as the width of the body." These descriptions were taken from the mature larvæ that fed upon the different trees mentioned. Previous to the last moulting there was much more resemblance between the different forms.

The wings of the moth expand nearly two inches. The fore wings, taking the apple feeding variety as the type, are of a reddish or russety brown, crossed by four transverse lines of darker brown, with traces of another between the third and fourth, and a faint wavy line from the apex towards the middle of the fourth. The first line is strongly arcuated, the others less so and oblique, and a dark spot below the costa in the second line. Hind wings lighter, unmarked. Head and a space extending round to the middle of the thorax above, darker reddish brown; the rest of the body concolorous with the wings. The principal difference between this and the other varieties is in the sumach form, the wings have more of a yellowish cast with the dot on the second transverse line more prominent; while the black walnut variety are much darker, being of a more smoky brown, with the space between the first and second lines quite dark, and the light places inclining to drab, and the head and collar quite dark reddish brown.

*Remedies.*—I quote here a portion of Dr. LeBaron's suggestions under this head: "Some seasons they have been so numerous that we have thought it necessary to take measures for their destruction. They are

eminently gregarious, and therefore easily controlled. They feed side by side, as closely together as they can stand, and when they are young a whole brood of them can be taken from the tree by removing a single leaf." Later in the season they come down to the trunk and larger limbs of the tree to moult. At this time they are bound together by a web, and a whole colony can be taken off and burned at once.

NOTODONTA (*Edemasia*) CONCINNA, Smith.—The Trim Prominent.

The caterpillar of this species, familiarly known as the Red-humped Prominent, has been found on the rose, thorn, cherry, plum, pear, and apple, but has figured most as an injurious insect on the last. It is very generally distributed, and is one of those generally sent to entomologists for identification, both by those who are attracted by its gorgeous colors, and by those who find it denuding their apple trees. Dr. Harris gives the following general description of its history:

"Different broods make their appearance at various times during August and September. The eggs from which they proceed are laid in the course of July, in clusters on the under side of a leaf, generally near the end of a branch. When first hatched they eat only the substance of the under side of the leaf, leaving the skin of the upper side and all the veins untouched; but as they grow larger and stronger, they devour whole leaves from the point to the stalk, and go from leaf to leaf down the twigs and branches. The young caterpillars are lighter colored than the old ones, which are yellowish brown, pale on the sides, and longitudinally striped with slender black lines; the head is red; on the top of the fourth ring there is a bunch or hump, also of a red color; along the back are several short black prickles; and the hinder extremity tapers somewhat, and is always elevated at an angle with the rest of the body when the insect is not crawling. The full grown caterpillars measure one inch and a quarter, or rather more, in length. They rest close together on the twigs when not eating, and sometimes entirely cover the small twigs and ends of the branches."

*Spec. Char. Moth.*—Color, light brown; the fore wings dark brown along the hind margin, and more or less tinged with gray before; a dark brown dot near the middle, a spot of the same color near each angle, a very small triangular, whitish spot near the shoulders, and several dark brown, longitudinal streaks on the outer hind margin. The hind wings of the male are brownish or dirty white, with a brown spot on the anal angle; those of the female are dusky brown. Body, light brown. Expands from an inch to an inch and a quarter.

*Remedies.*—Their gregarious habits suggest the means to be employed in their destruction. When gathered together on the limb at rest, or when young and feeding in close company, they may be collected by any convenient means and killed. They are quite generally distributed, but not very common, though where they do occur it is usually in large numbers, owing to the great number of eggs laid by a single moth.



NOTODONTA (COELODASYS) UNICORNIS, Lin.—The Unicorn Prominent.

This species, similar to the preceding, is frequently known in the larva state as the Unicorn Apple-tree Caterpillar on account of a prominent projection that rises in the shape of a horn from the back of the fourth segment. This feeds on dog-wood, plum, alder and winterberry (*Ilex*), besides the apple.

*Spec. Char. Moth.*—The top of the fourth ring rises in the form of a long horn, sloping forwards a little; the tail, with the hindmost feet, which are rather longer than the others, is always raised when the larva is at rest, but it generally uses these legs in walking. Head large, brown; sides of the second and third rings green, rest of the body brown, variegated with white on the back.

*Moth.*—Expands an inch and a quarter. Color of fore wings light brown, variegated with patches of greenish white and with wavy, dark brown lines, a small whitish space near the base, enclosed by two of the latter. Two of the greenish white patches are along the costa and the posterior margin. Near the middle is a short black mark. The hind wings of the male are whitish, with a dusky spot on the anal angle; in the females the hind wings are dusky.

#### EDEMA ALBRIFRONS, Smith.

This moth is of a gray color with small brown marks on the fore wings, but is chiefly characterized by a white stripe along the costa on the outer two-thirds of the wing. The larvæ, according to Prof. Riley, is "of a bluish white ground color, marked longitudinally with yellow bands and fine black lines, with the head and hump on the 11th segment either of a light coral or dark flesh color, and which generally carries the hinder portion of the body elevated in the air." They feed on oaks and are sometimes quite destructive.

#### TELEA POLYPHEMUS, Linn.—The Polyphemus Moth.

The group to which this species belongs forms as it were the central and most characteristic of the family. The wings are broad, the bodies large and the antennæ very broadly pectinate. The larvæ are known as silk worms because the silk of many species is readily wound from the cocoons, and forms the source of supply of that article. For this reason they are as a group regarded as beneficial rather than injurious insects, though some of them occasionally injure forest trees and orchards.

As a silk worm this one has not been found profitable for the reason that the silk cannot be readily reeled off. The larvæ feeds upon a variety of trees among which the oaks, hickories, elm, basswood,

walnut, butternut, and thorn are generally given. Though feeding on such a great number of trees, and being found over so wide a range of country as it is, no complaint has been made so far as I am aware of its occurring in sufficient numbers to do a great amount of damage. The moths leave the cocoons in May or the fore part of June and deposit their eggs on the under side of leaves from which the caterpillars hatch in ten or twelve days. The worm moults five times, coming to maturity in September. When full grown it is a large apple-green caterpillar, "fleshy, striped obliquely with white on the sides, with angulated segments on which are tubercles, giving rise to a few short hairs." It spins a compact oval cylindrical cocoon about an inch and three quarters long, the outside of which one or more leaves are fastened as though parted, in which it soon changes to a chrysalis. In the autumn these cocoons fall to the ground with the leaves.

The moth expands from five to six inches, and has the antennæ of the males broadly pectinate; the female less so. The wings are dull ochre-yellow, more or less clouded with black in the middle. Near the middle of each wing is a transparent, eye-like spot, divided transversely by a slender line. This spot is circled by a yellow and black line, the latter supplemented by a lilac line on the side next the base. In the hind wing the black on the side next the base is wider than the transparent spot, and the lilac is next to the yellow. Near the margin is a dusky band, edged with reddish white in the outer part, and two black spots near the apex, supplemented with the same. Costa, gray.

#### ACTIAS LUNA, Linn.—The Luna Moth.

The Luna silkworm, the caterpillar of this species, feeds principally "on walnut and hickory, but is also found on sweet gum, beech, birch, and even willow and plum," and it resembles the Polyphemus silkworm. It is a pale and very clear, bluish green caterpillar, with a yellow stripe on each side of the body, and the back crossed between the segments by transverse lines of the same yellow color. On each segment there are about six minute, pearl-colored warts, tinged with purple or rose color, and from which arise a few short hairs. At the extremity of the body are three brown spots, edged above with yellow.

When full grown it draws together several leaves, fastens them with silken threads, and spins inside the hollow a cocoon very much resembling the cocoon of the preceding species. Like the other, it falls to the ground with the leaves in the fall. As a silkworm this species can have but little value, for the reason that the cocoon is so compact and thin that it could be unwound with difficulty.

The moth has an expanse of wings of about four and a half inches, the antennæ pectinate, broadly so in the males. The hind wings, instead of being round, have the anal part extended into a broad tail, curving somewhat outward, an inch and three-quarters beyond the rest of the outer margin. In color the wings are delicate green, with an eye-like spot on each wing, consisting of a small clear center, the encircling colors being rare, yellowish and black costa, and collar purplish brown.

Although widely distributed, and a few are found every season, this is not a common insect.

*CALLOSAMIA PROMETHEA*, Drury.—The Prometheus Moth.

This species of our native silk worm is also found in Illinois, though it seems to be less common in some localities than either of the species already mentioned, or the *Cecropia*. It has a wider range of food plants, having been found, by various persons, on most of our deciduous trees and shrubs, as well as upon pine and arbor vitæ. The eggs laid by the moth on twigs, hatch from the last of June to the fore part of July, varying with the latitude. The caterpillars attain their growth in August or September, when they measure two inches or more in length, by half an inch in diameter. The caterpillar "is very plump, and but very little contracted on the back between the rings. It is of a clear and pale bluish green color; the head, the feet, and the tail are yellow; there are about eight warts on each of the rings; the two uppermost warts on the top of the second and of the third rings are almost cylindrical, much longer than the rest, and of a rich coral red color; there is a long yellow wart on the tip of the eleventh ring; all the rest of the warts are very small, and of a deep blue color. Before making its cocoon, the caterpillar instinctively fastens to the branch of the leaf that is to serve for a cover to its cocoon, so that it shall not fall off in the autumn, and then proceeds to spin on the upper side of the leaf, bending over the edges to form a hollow, within which its cocoon is concealed."—Harris.

The two sexes of the moths differ somewhat in color and in the pattern of their marking. The wings of the male are longer and narrower than the female. In color they are smoky or amber brown, while those of the female are more of a reddish brown. Both sexes have a pale wavy line crossing the middle of the wings, and a pale clay colored border along the outer margin, and in both the basal half of each wing is much darker than the other. Near the apex of the fore wings is an eye-like spot, black in its apical part, circled with pale blue on the side opposite, and with a zigzag white line from this eye spot to the apex. The female has a "pale angular spot, shaded outside with black near the middle of each wing, which is only occasionally faintly indicated on the underside in the male." Antennæ about twice as broad in the males as the females. The insect passes the winters in the chrysalis state, the moths issuing the following May or June. Expands four inches.

*SAMIA CECROPIA*, Linn.—The *Cecropia* Moth.

In our latitude few insects attract more attention from those unacquainted with entomology than this magnificent moth. It is our largest species, some specimens expanding nearly seven inches. It issues from the cocoons, that have remained attached to twigs and other objects during the winter, in May, earlier or later as we go

south or north. The ground color of the wings is a "grizzled dusky brown" with the outer margins clay yellow; a wavy dull red band, edged inside with white, crosses each wing beyond the center, nearly parallel with the outer margin. Near the center of each ring is a white kidney-shaped spot, shaded on the outside with red and edged with black; near the apex of each fore ring is an eye-like spot similar to that of the preceding species, and a whitish arcuated band edged without with black near the base, with more or less of dull red between the band and the body. Inside the apical zigzag, white line, is a space that has a distinct shade of lilac; the thorax dull red, abdomen banded with dull red, white and narrow black bands. The sexes differ only in the larger abdomen and less broadly pectinate antennæ of the female.

The full grown caterpillar measures three or more inches in length and is of a clear light green color, "on the top of the second ring are two large globular coral red warts, beset with about fourteen very short black bristles; the two warts on the top of the third ring are like those on the second but rather larger; on the top of the seven following rings there are two very long egg-shaped yellow warts, bristled at the end, and a single wart of larger size on the eleventh ring; on each side of the body there are two longitudinal rows of long light blue warts, bristled at the end, and an additional short row, below them, along the first five rings."—Harris.

The cocoon is attached longitudinally to the side of a twig or other substance. They are on an average three inches long by about an inch wide in the widest part, pointed on both ends. The cocoon in this species is double, the outer portion resembling stout brown paper from which the inner is separated by loose silk.

Where these worms are numerous the great amount of vegetable matter that is required to keep them through the gnawing period makes them destructive to the trees upon which they feed. Like the other species the *Cecropia* is a very general feeder, but is found more frequently, perhaps, on the apple and maple trees, which, if small, a brood of them may entirely denude of their foliage. A few small trees may easily be protected from such wholesale denudation by hand-picking. It is not usual, however, that any remedy other than those provided by nature need be resorted to, for there are several parasites that prey upon this and the other species mentioned, so that, though common insects in species, in individuals they are usually rare. One of these parasites, Prof. Riley names the Long-tailed Ophion (*Ophion macrurum*, Linn.), a yellowish brown, Ichneumon fly, about an inch long. Out of several cocoons recently found, only one was apparently free from this parasite.

#### SAMIA CYNTHIA, Hub.—The Ailanthus Silk-Worm Moth.

As this species, originally from China, has been introduced into some portions of Illinois, and as the *Ailanthus* tree upon which it feeds is hardy and becoming somewhat a favorite ornamental tree through the State, a mention of this species here may be justified.



The moth expands about five inches. The wings are a rusty greenish yellow and are crossed beyond the middle by a white band; edged within with black, and without by a broader band of lilac. Near the base of the fore wings is an angular white band, the angle turned outward, on the hind wings an arcuated band, the convex portion turned inward. Near the middle of each wing is a large transparent crescent, edged with white and yellow on the concave side. The eye-like spot and lilac space at the apex similar to the preceding.

*EUCRONIA MAIA*, Drury—The Buck or Maia Moth.

Expanse of wings from two and a half to three inches. Wings black but so thinly covered with black scales as to appear much like black crape. Crossed in the middle by a white band, which contains the discal spots. The band on the hind wings is twice the width of the fore wings. The caterpillar is brownish black covered with more or less conspicuous small oval wart-like elevations from which arise branching spines, and a lateral yellow stripe. The dorsal spines on the middle segments fascicled and rusty colored. It feeds on oak.

*HYPERCHIRIA IO*, Fabr—The Io Moth.

Expands three and a half inches. The fore wings are light purplish brown, blended with yellow a little in the outer part; the purple rather predominating. They are crossed by two or three rather indistinct wavy bands, have several dark spots at the end of the discal cell, and yellowish brown hairs at the base of the wing and on the thorax. The hind wings are bright with a large blue eye spot edged with black, in the center containing a straight white pupil, and border of purple that is reddish along the inner margin but yellowish along the outer. Inside of this is supplemented by a line of black.

The male differs from the above in being smaller and brighter colored, being of a deep yellow, marked somewhat like the female. The larva is a green caterpillar covered with branching spines that arise from tubercles of which there are six to each segment. It feeds upon a great variety of plants, among which are corn, sassafras, locust, willow, etc.

*CITHERONIA REGALIS*, Fabr.—The Royal Walnut Moth.

Expands five or six inches. The fore wings are olive green, veined with red, with two large yellow spots near the apex and several smaller ones in other parts of the wing. The hind wings are orange red, spotted with yellow and olive.

The caterpillar is green, four or five inches long when full grown, with six tubercles or horns to each segment, some of which are great.

ly enlarged. The first segment has two, a quarter of an inch long, the second and third segments have each four prominent orange horn-like prominences two or three times as long as those on segment one. The eleventh segment has one horn larger than the rest on the segment. It feeds on black walnut, butternut, hickory, persimmon and sumach.

*EACLES IMPERIALIS*, Hub.—The Imperial Moth.

The wings of this species are broader than the preceding, the larger specimens expanding five and a half inches. They are a rich yellow color, spotted with purple brown and each ring crossed by bands of the same as follows: one oblique from the apex to the hind margin merely straight, the other wavy arcuated near the base.

The caterpillar, which feeds on the buttonwood, is when full grown "from three to four inches in length, and more than half an inch in diameter, and, for the most part, of a green color, slightly tinged with red on the back," there are a few very short hairs scattered over the body. It is but slightly tubercled.

*DRYOCAMPA RUBICUNDA*, Fab.—The Rosy Dryocampa.

This delicate moth with rosy fore wings crossed by a broad yellow band is the parent of a caterpillar that occasionally proves very destructive to the red and silver maples. This caterpillar, called the Green-striped Maple Worm, is striped longitudinally with two shades of green lines. On the top of the second segment there are two black horns projecting backward on the eleventh segment. The posterior part of the body is rose colored. There are two broods of the worms in a season, the first in June or July, the second in August and September, the latter passing the winter in a crysalis state. The crysalids are subterranean. The moths expand from an inch and three quarters to two inches and a quarter; the fore wings are rose colored, crossed obliquely by a broad yellow band, with, at times, some of the yellow in the outer margin. The hind wings are pale yellow with a short rosy band beyond the middle; the body is yellow, antennæ, short, broadly pectinate in the male. It is subject to the attack of several parasites so that it is seldom numerous more than a single season in a given locality. There is a variety of this species with the wings nearly white.

*DRYOCAMPA (ANISOTA) SENATORIA*, Sinith—The Senatorial Dryocampa.

This is somewhat larger than the preceding and the wings are broader. It is of an ochre yellow color, the wings tinged with purplish brown, and a narrow oblique band of the same crossing each

band. In the middle of each fore wing is a characteristic round white spot. Expands, male an inch and three quarters; female two inches and a half and more. The larva is black with four narrow ochre yellow stripes along the back and two on each side; the whole body with tubercles, the second segment containing two prominent ones; feeds mainly on oak.

*GASTROPACHA, (TOLYPE) VALLEDA*, Stoll.—The Valleda Lappet Moth.

In the summer of 1867, Messrs Perkins and Coneydon, of Onarga, sent two specimens of this caterpillar to the editors of the *Prarie Farmer*, with a request for information as to what they were and whether they were injurious or not, stating that they were found on apple trees, that they had been exhibited at a meeting of the horticultural society of that place, but no one could identify them. The editor of the entomological column after giving the name states that they never become numerous enough to be greatly injurious. There is quite a difference in the size of the sexes of this species, the males measuring from an inch and a half to an inch and three quarters, while the females measure two and three quarter inches. The fore wings are gray, crossed by two double slightly wavy white lines at the end of the first and second thirds of the length of the wing, and a single line of the same near the outer margin. The hind wings have only the outer line. The body is white with a brown dorsal line on the thorax, and the back of the abdomen dark grey; the hairs on the body are rather longer than in the most moths. The larva is hairy and is liable to be mistaken for an excrescence on the bark of the apple tree on which it feeds.

*CLISIOCAMPA AMERICANA*, Harris.—The American Lackey Moth.

The larvæ of this, the American Tent Caterpillar, is well known as one of the worst enemies to the orchard where they are allowed unmolested to fill the trees with their tent-like webs and quietly strip them of their foliage. There is scarcely a year that they do not appear in apple and some other kinds of trees, and some times in such numbers as to prove a serious injury to the trees unless measures are taken to destroy them. It is fortunate however that they may easily be destroyed, for the habit they have of returning each night from feeding to the nest renders their destruction in the morning easy. All that is necessary to accomplish this is a forked stick with which the whole nest may be swabbed out and the worms can be crushed under the foot.

The eggs of this species are deposited in a circle round a small twig the latter part of June or the fore part of July, where they remain till the following spring, protected from the influences of the weather by a coating of a gummy substance. It has been found that the larvæ develop in the eggs before the cold fall weather and remain dormant through the winter, ready to come out with the first appearance of the leaves.

The caterpillars when full grown are two inches long, "hairy, with a dorsal white stripe, with numerous fine crinkled black lines on a yellow ground, united below into a common black band, with a blue spot on the side of each ring." The moth expands an inch and a quarter to an inch and a half. The wings are ashy reddish brown, with two white lines crossing the fore wings obliquely. Between these the color is a little lighter.

CLISIOCAMPA SYLVATICA, Harris—The Forest Lackey Moth.

Expands an inch and a half or more. This is a lighter moth than the American Lackey, the wings being brownish yellow, the fore wings covered obliquely by two oblique brown lines similar to the white lines of the *Americana*. The larva, known as the Forest Tent Caterpillar, is sometimes destructive to apple and oak trees.

*Spec. Char. Larva.*—"The general color of the whole body is light blue, clear on the back, and greenish at the sides; the head is blue, and without spots; there are two yellow spots and four black dots on the top of the first ring; along the top of the back is a row of eleven oval white spots, beginning on the second ring, and two small elevated black and hairy dots on each ring, except the eleventh, which has only one of larger size; on each side of the back is a reddish stripe bordered by slender black lines, and lower down on each side is another stripe of a yellow color between two black lines. The under side of the body blue black."—Harris.

XYLEUTES ROBINIÆ, Peck.—The Locust tree Caterpillar or Moth.

This insect belongs to a group of this family of moths that differs in some respects from those described before. While the caterpillars of the others eat the leaves of trees, shrubs and various other plants, the larva of this moth, frequently known as the Locust Borer, lives wholly within the tree which furnishes it food. Briefly, the natural history of this insect is as follows:

About the first of July the eggs are deposited in the crevices of the bark, usually of old trees instead of young ones. When young, the worms are dark brown with large heads. They bore into the trees in various directions, but chiefly in an oblique direction upward and downward, increasing the cavity as they increase in size, and lining it with silk as they go. When full grown they measure two inches and a half or more in length, with about a third of an inch in thickness. They are reddish brown above and white beneath, with the head and top of the first segment brown and hard. There are a few short hairs from minute warts scattered over the body. When about to transform it spins a close cocoon a short distance from the orifice it has prepared for the exit of the moth, and changes to a brown and amber colored chrysalis. On the upper side of each abdominal segment are two transverse rows of tooth-like projections, with which



the chrysalis works its way out of the tree to such a distance that the moth may escape. The moths issue from the trees the last of June or the first of July.

The two sexes of the moths differ in size and color. The female expands from two to two and a half inches. The wings are gray, marked with irregular black lines and dots, the color and cell-like arrangement of the gray giving the insect something of the appearance of the *Neuroptera*. In the male the fore wings are darker than the same in the female, and the hind wings are ochre-yellow, while the wings expand only an inch and a half.

*Remedies*—It is difficult to provide remedies for these borers after the eggs have been laid. As they are the color of the bark it is difficult to detect them to destroy them, and it is not easy to reach the worms after they begin their work. A few trees may be protected by the application of soft soap the last of June, or the moths may be watched for on the trees early in the morning during the time they may be expected to appear, as they are at that time sluggish. Besides the locust they are said to attack the oaks and crab apple.

#### NOCTUIDÆ.—Owlet Moths.

This family is more uniform in the different groups than the preceding. The head is distinct, not sunken into the thorax as in Bombycidæ; palpi stout, projecting in front of the head, but not more than the length of the head; antennæ filiform, slightly ciliate, or in the males of some species slightly pectinate. Body robust; thorax with more or less prominent shoulder tufts, usually distinct dorsal tufts, and prominent transverse tufts on the prothorax; abdomen with a line of dorsal tufts in some genera, and the males with more or less prominent anal tufts. The fore wings are small, narrow, when at rest lie like a flat roof over the back; hind wings broader, when at rest are folded so as to be covered by the fore wings. The common name, Owlet Moths, is given them because they fly at night, though if molested they will fly a short distance in the day time. They are attracted by a light at night, and form a majority of the moths that are thus drawn to lamps in houses.

The larvæ are cylindrical, tapering somewhat from the middle toward each extremity, are striped and barred in various ways, and all but *Catocala* and a few allied genera have sixteen legs. The *Catocala* have fourteen legs and loop up the body when they walk, in a way similar to the Geometrids. The chrysalids are sometimes in earthen cocoons under ground, as other leaves or other substances are fastened together by silk above the surface, while in other species the chrysalids are naked under grass or something for a shelter, or are formed in the stalk of the plant, within which the caterpillar has lived.

As a class the caterpillars of the Owlet Moths are injurious to vegetation, though some of them living upon useless weeds need not be

considered in the study of economic entomology. Among those that are seriously injurious are the various species of cut-worms, stalk borers, etc. The beautiful moths of the genus *Catocala* find a large place in collectors' cabinets while the injury their larvæ may do to trees is but little thought of.

ACRONYCTA (APATELA) AMERICANA, Harris.—The American Maple Moth.

In Harris' "Insects Injurious to Vegetation," this species is described under the above name and the caterpillar is stated to feed on maple, but occasionally on elm, linden and chestnut. The editors of the *American Entomologist*, in answer to a correspondent from Burlington, Iowa, state in the first volume that it was commonly found on both the cottonwood and poplar. Like many other caterpillars they are subject to the attack of parasites so that they do but little damage.

*Spec. Char. Larva.*—Greenish brown or nearly black; head subquadrate, bifid above, chestnut brown; each segment above with a transverse, oval, greenish yellow spot, having a transverse, depressed line in the middle; about four elevated black dots on each side of each ring; and the body beset with a few long black bristles dilated at the end; feet black. The segments have deep incisions between them; the long black spear-headed hairs grow from the skin and from warts; there are two longer than the rest on each side of the yellow spot on the first ring, and one on each side of the spots on the fourth to the ninth rings inclusive, and the same on the eleventh and twelfth rings; but there are none on the second, third and tenth rings. The spiracles are black.—Harris.

*Moth.*—Expands two inches and a half; fore wings light gray, with the basal transverse anterior, or *t, a*, and transverse posterior or *t, p* lines rather plain, the last very much angulated, double with the included space white, crossed by a black line near the hind angle forming the *psi* character so common in this group; fringe gray with black points; hind wings of the male brownish gray, the female darker.

NOTE.—In describing the fore wings of owlet moths there are a few characters, very convenient to use in designating locality of marking on the wings, that may be so much of a scientific character as to need explanation for the common reader. There are four transverse lines, a transverse shade, and two spots arranged as follows: Beginning at the base of the wing the *basal* line, or *basal half* line, as it reaches only half-way across; second, the *transverse anterior*, or, as it is often abbreviated, the *t. a.* line, about a third of the distance from the body; third, the *orbicular* or round spot; fourth, the *transverse* shade, not always present, but about in the middle of the wing; fifth, the *reniform* or kidney-shaped spot; sixth, the *transverse posterior*, or *t. p.* line, about two-thirds the distance from the body; seventh, the *subterminal* line, near the outer margin wing.

## ACRONYCTA (APATELA) LEPUSCULINA, Gue.—The Cottonwood Dagger

In his second report Prof. Riley described this species under the name *Acronycta populi*, stating that the caterpillar lives upon the cottonwood, not unfrequently stripping the trees of their foliage. I have occasionally found the moths, but have not found them sufficiently numerous to do serious damage. The moth has light gray fore wings, with a broken black band near the outer margin, and three or four other black spots in the middle portion. The hind wings are white, with black points in the fringe.

"This caterpillar, when full grown, rests curled round upon the leaf, and is easily recognized by its body being covered with long, soft, bright, yellow hairs, which grow immediately from the body, part on the back and curl round on each side. It has a shiny black head, black spots on the top of joints 1 and 2, and a straight black brush on the top of joints 4, 6, 7, 8 and 11. There are two broods of these worms each year, the first brood appearing the last of August and throughout September, and passing the winter in the chrysalis state."—Riley.

## ACRONYCTA (APATELA) OBLINITA, Abb. and Lin.—The Smeared Dagger.

Frequently during June and August or September, a caterpillar, covered with red bristles proceeding from crimson red warts, with a bright yellow band along the side, may be found on smart-weed, and occasionally on some shrubs and trees, among which are the apple, and the grape-vines. This is the larva of the Smeared Dagger, a gray moth with white hind wings; the fore wings rather narrow.

On account of the insect parasites to which this species is subject, it seldom becomes sufficiently numerous to do much damage. When they do, hand-picking will serve to check their ravages. Recently Mr. J. S. Rogers, of Marengo, sent to this office two chrysalids of this insect found attached to apple twigs, with a request for information as to what they were, and whether they would be likely to prove injurious. Both of the chrysalids sent had been parasitized, from one of which the parasite issued in a few days under the influence of the warm room in which it was placed.

*Spec. Char. Larva.*—Prevailing color, black. Each joint with a transverse, dorsal, crimson red band across the middle from stigmata to stigmata, and containing six warts, each furnishing ten or twelve or more stiff yellow or fulvous bristles, and the two dorsal ones being farthest apart. A subdorsal, longitudinal, yellow line, interrupted by the transverse band and at incisures, in such a manner that the black dorsum appears somewhat diamond-shaped on each joint. A broad, wavy, bright yellow, stigmatal line, containing a yellow, bristle-bearing wart in middle, on each joint. Lateral space occupied with different sized, pale yellow spots, largest towards the dorsum.

Head, chestnut brown. Venter, crimson black, with bristle-bearing warts of the same color. Stigmata, oblong oval and pale. Thoracic legs, black; prolegs with black extremities.—Riley.

*Moth.*—Expanse from 1.35 to 1.50 inches. Fore wings rather narrow, pointed, light gray marked with darker gray and the black points into which the usual transverse lines are broken, the t. p. line being the only one that is distinct, and that strongly angulated. Terminal dots good size, black. Hind wings white, a few small black terminal dots. The shoulder tufts tipped a little with black. Antennæ brown, white above in the basal half.

### CUT-WORMS.

The following species of *Agrotis*, *Mamestra* and *Hadena* are, with the exception of one or two introduced for comparison, known to be in the larva state injurious to cultivated crops and are generally called cut worms. For a general description of their habits and history and for explanations of some terms used in connection with the caterpillars, see the same subject under Corn Insects. The remedies for this class of insects that are not already given in the article referred to, will be given at the close of the group.

#### AGROTIS C-NIGRUM, Linn.—The Black C Rustic.

The larva is the Spotted Cut-worm.

This species is commonly distributed, and often takes a prominent place in cutting off plants in the garden and fields. While it feeds in those places it evidently lives as readily upon grass, and possibly upon the leaves and buds of trees. By referring to my note book I find that I took two specimens last season at Irvington, one a chrysalis without any cocoon hid in the grass at the roots of a soft maple (*Acer dasycarpum*), April 28, and a few days after a caterpillar at the roots of a peach tree. C. E. Worthington, of Chicago, and Thomas E. Bean, of Galena, mention this species as occurring in both those places.

Since writing the above, and before this goes to press, I have had a chance to make further observations on this species. They were found the present season (1878) in greater abundance as an early cut-worm, than any other species, in time varying from March 13th to April 2d. All except one of those found between these dates had passed the last moult. As this has been an unusually early season, they may be looked for ordinarily a month later. When full grown, they are an inch and a quarter long, with the color, as found this year, an almost uniform dark greasy gray, lighter underneath, with two rows of elongated black patches along the back. These patches occupy the posterior two thirds of each segment, and are more distinct on the posterior part of the body than the anterior. Previous to the worm casting



its skin the last time, there is a fine yellow line just outside these patches. In the lighter specimens, and as found last year, the ground color on the back, between these black spots, is variegated a little so as to show a faint diamond shaped spot on the middle of each segment, the two darkest points being at the posterior and anterior parts of the segments. Sometimes the ground color has a slightly brownish tinge, which, under the pocket lens, shows that it is caused by minute brown spots. In these specimens the black elongate patches are nearly obsolete on the anterior part of the body.

The moth has blackish-purple fore-wings, brownish in the males, with a black C-like spot in the middle, the open part toward the front edge, and filled with a carneous spot that reaches to the edge of the wing. In pupating, this species seems averse to following the established rule of writers, of changing to a chrysalis in an oval earthen cocoon. Out of quite a number reared this season, the first two pupated in brown, silken cocoons attached to the sides of the rearing cage, one about midway up from the bottom, and the other near the surface of the dirt. Another changed to a chrysalis on top of the dirt without forming any cocoon and without any protection, though there was rubbish not two inches from it where it might have sought shelter. All the rest pupated in the ground, "in oval earthen cocoons."

In habit they are general feeders, like the rest of the cut-worms, but from the fact that the brood upon which my observations were made, pupate so early but little damage can be done by them to either garden or field crops, save in the case of those fall sown, such as lettuce and spinach, that are intended to be used early, for they are out of the way before most vegetables, etc., are planted. But as the chrysalis state lasts only a short time, corn, and other crops, may be injured by the same brood. There must be two or more broods in a season.

*Moth.*—Length .70 of an inch. Expanse of wings 1.60 inches. Ground color of fore wings dark purplish ash gray, all markings on the back and outer portion of the wings nearly obsolete. The basal, t. a. and t. p. lines black, faintly double, the first and last indistinct, except near the costa; subterminal line only a few buff scales. Orbicular large, buff with a lilac tinge, clearly defined below, but instead of coming together above, its sides widen out like a broad letter V, the color reaching to the costa, where it is a little darker, and extending from the t. a. line to above the reniform. This is so bordered below with black as to bear a resemblance to the letter C. The reniform has a small space in its costal border of the same carneous color, and there are a few scales of the same on the posterior margin below the basal line, and between the basal and t. a. lines, though these are not always present. Ante-apexal spot black. Hind wings smoky, darker at the apex, veins only slightly darker than the rest. Head, prothorax and thorax concolorous with the fore wings, with a brown line on the prothorax bordered each side with buff, the thoracic tufts tipped somewhat with brown. The male differs from the above in having a dash of purplish brown band across the wing from the t. a. to the sub-terminal line, much lighter in the sub-terminal space, and the thoracic tufts being darker, and the lines on the prothorax lighter, the brown somewhat olive tinted.

## AGROTIS BICARNEA, Guenee.

Of the larva of this species I know nothing. As it is occasionally found in the State and resembles somewhat the female of the preceding, I will point out the differences that the two may not be confounded. It differs in the fore wings being darker, almost or quite a purple black, lacks the carneous spot in the orbicular but has a small carneous spot between the ante-apical and the t. p. line, another larger between the basal and t. a. lines below which is the black claviform. The hind wings are darker.

## AGROTIS SUBGOTHICA, Haw.—The Gothic Dart.

The larva is the Dingy Cut-worm. This species is found over quite a wide range of territory, as given by Grote, from the Atlantic district to Colorado. Of its ravages, Prof. Riley quotes Mr. Horace Starkey, of Rockford, as stating that they were quite destructive to gardens in the vicinity, and C. E. Worthington makes, in a recent communication to me, a similar statement. Glover in one of his reports, speaks of them as having the habit of cutting off plants by night and dragging them to the mouth of their retreat to feed upon the next day, while they lay hid from observation. They are, when full grown, about an inch long, and marked similar to the Western Striped Cut-worm. They remain in the larva state till about the first of July before they change. The moths that issue about the first of September, are gray, the orbicular open and included in a light streak extending along the costa, the reniform or kidney shaped spot yellow, black each side of the stigmata, which is separated from the claviform by a light median stripe, the hind wings white with a little white around the border.

*Spec. Char. Larva.*—Length one inch, similar marked to that of *A. herilis*, with the colors darker and more dingy, the longitudinal lines less conspicuous, and the dorsum pale buff color.—Riley.

*Moth.*—Expanse of wings 1.35 inches. Ground color of fore wings gray with a smoky tinge, flecked with white scales along the costal and hind margin, the medial vein distinctly white. Orbicular open in front and of the same color as the front margin. Orbicular large, buff, each side of the stigmata brownish black, those parts each side of the orbicular united below, the edging to the stigmata bright black, claviform black, reaching to the middle of wing, interrupted by the t. a. line. T. p. line only marked by four or five black points extending inward in the middle part of its course. Terminal spaces, except the apex, and anteapical, smoky black, not very dark. Hind wings pearly white, bordered with a narrow dark border that reaches nearly to the anal angle. Antennae pectinate in the males.

AGROTIS TRICOSA, Lintner.—The Perplexing Dart.

This species forms a connecting link between the Gothic Dart and the Master Dart, the three forming a group that are closely related. Of the larval history of this I know nothing, but presume it differs very little from the larvæ of the other species of the group. The following description is from a specimen kindly furnished me by Mr. Lintner of the New York State Museum.

*Spec. Char. Moth.*—Expanse of wings 1.50 inches. Ground color of fore wings a little darker than *subgothica*, marked the same with this difference: the costa is dark but the space below, including the open orbicular, is light gray; the median vein not white; the reniform paler buff; the hind margin without white scales, but the basal half of marginal space blackish; the claviform broader, indistinct beyond the t. a. line; the terminal space but little darker than the ground color; the antepical supplemented by a purple shade towards the base of wings. The hind wings are smoky white with the outer border smoky black, occupying a fourth of the wing.

AGROTIS HERILIS, Grote.—The Master Dart.

The larvæ is the Western Striped Cut-worm.

This caterpillar, resembling the Striped or Corn Cut-worm, described by Dr. Fitch, was named the Western Cut-Worm by Prof. Riley, not because it was confined to the west, for it is commonly distributed, but to distinguish it from the other species. It is about an inch and a quarter long, of a dirty white or ash gray, inclining to buff on the back, with three broad dark lines and two narrow light ones on the sides, and a light one, edged on each side with dark, along the middle of the back. The moth resembles the preceding species, with the exception of the posterior and outer portions of the fore wings being dark lilac-gray, and the hind wings nearly uniform smoky black. This species may be found in fields and gardens in the spring, but they enter the ground and change to chrysalids in May or June, from which the moths emerge the fore part of September.

*Spec. Char. Larva.*—Length 1.25 inches; general color dirty white or ash-gray, inclining, in some instances, to carneous; dorsal line whitish, edged on each side with dark; three lateral dark, broader stripes, the lower one the broadest, separated by two pale ones. Quite often an indistinct glaucous white stripe under the lower broad dark one; piliferous spots good size, either black or brown, from each arises a short, stiff hair; a few hairs from other parts of the body; head shiny black, or in some individuals finely speckled with white, especially at the sides, with the usual inverted Y mark. Cervical shield of the same color as the head, with a white stripe in dorsal and sub-dorsal regions. Under side dull white; legs marked with smoky brown.

*Moth.*—Expanse of wings from 1.40 to 1.60 inches. Ground color of fore wings, dark lilac-gray. The marks similar to the two preceding

species, except that there is little or no variation in the costal region, or along the posterior margin, but a light line runs through the center of the wing from the base to near the t. p. line, and the black spots around the stigmata lack the brown or smoky appearance. Reniform buff. The t. p. line is indicated by a series of black crescents, but not points. Hind wings almost uniform smoky black.

*Remarks.*—In reference to the synonymy of this species and *A. subgothica* Aug. R. Grote, whose catalogue I am following in the Noctuidæ, says (Bul. Soc. Nat. Sciences, Vol. 1, page 100), "This is the *Agrotis subgothica* of American agricultural publications, such as the 1st Missouri Report, Page 82, Fig. 29. It is not the *Agrotis subgothica* of English writers, which is *A. jaculifera*, Guenee, Stephen's figure of *Agrotis subgothica*, Plate 22, Fig. 3, and description, page 126, Haust. 11, is decisive. The peculiar discoloration of the reniform spot distinguishes *A. jaculifera*, and the paler hind wings, greater extent of pallid shades on the fore arms and smaller size are characteristic and are all well rendered by Stephen's illustrations. When I was in France M. Guenee stated to me that he had discovered the fact that his *Agrotis jaculifera* was the same as the *Agrotis subgothica* of English writers, and also that he believed that the form so described as *Agrotis herilis* was a distinct species; the latter contrary to the statement made in the Species General. *Agrotis subgothica* is figured on Plate 1, Fig. 11, of the 1st Missouri Report correctly, but under its synonym, of *Agrotis jaculifera*, which latter name I retained for the species in determining the Noctuidæ of the collection of the American Entomological Society, whence Mr. Riley received his determination. I was not then able to examine the English authors, who first noticed our species from specimens accidentally introduced into their country. Mr. Riley's figures of *A. herilis*, above cited, have been copied with erroneous determination by eastern writers."

The above was published in 1873, the Missouri report referred to by Mr. Grote in 1869. At the time the above quotation was written Mr. Grote referred the specimens of the group now presented by three species *A. subgothica*, *A. tricososa* and *A. herilis* to the two species *subgothica* and *herilis*. The next year 1874, Mr. Lintner in his Annual Report of N. Y. State Museum of Natural History, described the medium forms as a new species under the name of *Agrotis tricososa*.

#### AGROTIS TESSELLATA, Harris.—The Checkered Rustic.

The larva is the striped or corn-cut worm. The moth here designated as the checkered rustic, was described and named by Dr. Harris in his valuable work, "Insects Injurious to Vegetation," but it has only recently been determined that this moth is the parent of the cut-worm described by Dr. Fitch in his second report as the Striped Cut-worm, and in his ninth report where it is more extensively described as the Corn Cut-worm.

NOTE.—In my part of the article on garden insects in the last State Horticultural Report, owing to the haste in which it was prepared, I have used Prof. Riley's figures under the name of *A. herilis*. As soon as I came to examine the figure I saw I had made a mistake, that the figure was really Mr. Lintner's *A. tricososa*, but it was then too late to make the correction in the article referred to.



In the last mentioned report he gave the insect the name *maizi*, as a variety of an European species, *agrotis nigricans*. Of the doubt that has existed in relation to Dr. Fitch's *maizi*, Mr. J. A. Lintner, of the New York State Museum of Natural History, kindly sends me the following note, under date of January 21st, 1878, and from him I obtained a female specimen of the moth from which the specific description is taken. Mr. Lintner says:

"Fitch's *A. nigricans*, v. *maizi*, I find to be *A. tessellata*, Harr. There has been a doubt, up to the present, what his *nigricans* was, but I have satisfactorily determined it, and will probably publish a note in relation to it in some papers of mine now going through the press."

In relation to the habits of this cut-worm Dr. Fitch says:

"In June, severing the young indian corn, and other plants, half an inch above the ground, by night, and by day hiding itself slightly under the surface; a thick, cylindrical gray worm, an inch and a quarter long, with rather faint, paler and darker stripes, the top of the neck shining black, with three whitish stripes."

This habit of drawing its food to the mouth of its retreat is not confined to this species, but is common to many whose rapid growth during the latter part of the larva state seems to require that their food be taken oftener than it would be if they ate only during the night.

The following is Dr. Harris' general description of the moth:

"Fore wings dark ash colored, and exhibit only a faint trace of the transverse, double, wavy bands; the two ordinary spots are large and pale, alternate with a triangular and a square, deep black spot; there is a smaller black spot near the base of the wing. The hind wings are brownish gray in the middle, and blackish behind. It expands one inch and one quarter."

The moths appear about the first of July, and the eggs are soon after laid on the ground at the roots of grass, weeds or other vegetation, upon which the young are to feed the rest of the season. By the time the frosts and cold nights of fall occur, the worms are about half grown. They now descend several inches into the ground, where they remain torpid during the winter to come forth when the warm days' of spring, that have started vegetation, have also warmed them into life.

*Spec. Char. Larva.*—"Cylindrical, usually about an inch in length when disinterred beside plants in our gardens and corn-fields, upwards of an inch and a quarter when fully grown. Ground color dirty white or ash gray, occasionally slightly tinged with yellowish; the tops of its neck shining black, with three white or pale longitudinal stripes; a whitish line along the middle of the back, between two dark ones; on each side three dark stripes, separated by two pale ones, whereof the lower one is broader; often a somewhat glaucous white stripe below the lower dark one, and all the under side below this dull white. Head and neck shining black, inverted V mark white, and continuous across the shield; on each side of the neck a dull whitish stripe; legs and prolegs mottled with brown."—Fitch.

*Moth.*—Expanse of wings 1.30 inches. Ground color of fore wings dark ash gray, marked with black and tinged with brown beyond the transverse shade. Basal t. a. and t. p. lines double, the last only faintly so; the sub-terminal line light gray, shaded each side with

dark ; the transverse shade distinct as a wavy line below the stigmata. Orbicular large, light gray; reniform large, the centre concolorous with the wing, but the outside lighter; the two spots alternating with black spots, the first triangular, the second quadrate, the third narrow, brownish in the lower part. Terminal space, except the apex, a little darker than ground color. Below the orbicular a short, curved black spot, the end of the otherwise obsolete claviform. Hind wings smoky, bleached with outer border. Head and thorax concolorous with the fore wings, the prothorax with a narrow gray line, in front of which is dark brown to the head.

AGROTIS SCANDENS, Riley.—The Climbing Rustic.

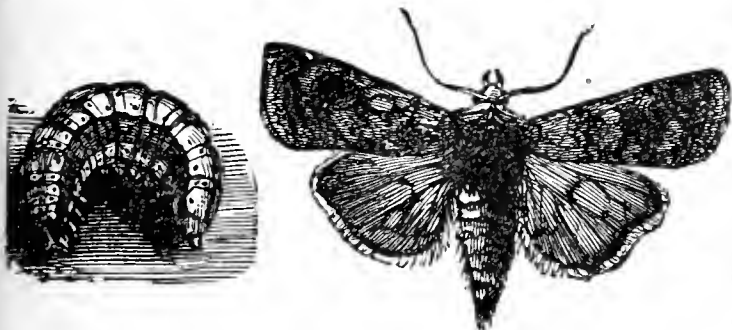
In the first Missouri report, Prof. Riley gives quite an extended history of this species with an account of depredations in orchards in various places, among which was that of Mr. J. W. Cochran of Calumet, Ill. Mr. John Townly of Marquette county, Wisconsin, sends a communication to the *Practical Entomologist*, published March 1867, wherein according to Mr. Walsh the depredations of the same worm are recounted. The worms climb up small trees or shrubs at night to the height of eight or ten feet and eat or cut off the flower and leaf buds, descending to the ground again and burrowing at the foot of the tree where they remain during the next day. When trees are large and tall they would be much less damaged by these worms, but much damage is often sustained by them in orchards of young or dwarf trees in season when they are numerous. The general color of the worms is, "a very light yellowish gray, variegated with dirty bluish green, and when filled with food it wears a much greener appearance than otherwise. In depth of shading it is variable however, and the young worm is of a more uniform dirty whitish-yellow, with the lines along the side less distinct but the shiny spots more so than in the full grown ones." The moth is a light yellowish gray on the fore wings and bluish tinge towards the outer margin, and the transverse lines with the exception of the subterminal, only indicated by marks on the costa, and a small black spot in the middle of the wing.

*Spec. Char. Larva.*—Average length when full grown 1.40 inches, ground color very light yellowish gray, variegated with glaucous in the shape of different sized patches, which are distinctly seen under the lens, to be separated by fine lines of the light ground color. A well defined dorsal and less distinct subdorsal and stigmatal line, crossed by these patches becoming larger and darker; another and still less distinct line of the same kind under stigmata. The dorsal line frequently with a very fine white line along its middle, especially at sutures of segments. Piliferous spots in the normal position, those above black, those at the sides lighter, stigmata black; head and cervical shield tawny, the latter with a small black spot each side, the former with two in front, and two eye spots each side; caudal plate tawny; speckled with black; venter and legs glaucous; bristles fine and small. Filled with food it wears a much greener appearance than otherwise, while when young it is of a more uniform

dirty whitish yellow, the lines less distinct but the piliferous spots proportionally larger; head quite variable in depth of shade.—Riley.

*Moth.*—Expanse of wing 1.35 of an inch. Ground color of fore wings light yellowish gray with a bluish tint, distinctly so on the terminal space. The transverse lines only indicated by a few scales on the rims and marks on the costa. The stigmata concolorous with the wing, imperfectly edged by a fine brown line, the lower part of the reniform containing a black spot, subterminal line rather distinct, light with a dark shading each side. Hind wings very pale, and lacking the bluish tinge of the fore wings. Thorax concolorous with the fore wings, the line on the prothorax very faint.

AGROTIS MESSORIA, Harris.—The Reaping Rustic.



The Reaping Rustic.

the moth *Agrotis messoria* in his work, "Insects Injurious to Vegetation." Since that, Grote and Robinson, in a contribution to the first volume of the American Entomological Society's transactions, called it *Agrotis repentis*. In the number of the Prairie Farmer for June 2, 1866, Prof. Riley described the caterpillar as the Dark Sided Cut-worm, and a year later, or June 22, 1877, in an article to the same paper, with further observations, he described the moth as *Agrotis cochranii*, or the Cochran Rustic.

The habit of the caterpillar is the same as that of the Climbing Rustic, though it is evident from my observations that many species possess a climbing and ordinary cutting habit. This is probably the case with this species, from the fact that the larva from which Dr. Harris reared the moth which he described, was one of several that were taken from the ground among cabbages, potato-hills, the corn field and flower garden.

The general color of the larva is dingy ash gray, with the sides darker than the rest of the body. The top of the body has a little inclination to a shade of flesh color, while on each segment there are eight small, black, shining spots, from each of which arises a short hair. When full grown it is a little over an inch in length. The moths issue from the ground in July and August. The following is Dr. Harris's description of the moth:

"The fore wings are reddish gray, crossed by five wavy blackish bands, the first two of which, and generally the fourth also, are double; the two ordinary spots, and a third oval spot near the middle of the wing, are bordered with black. The hind wings are whitish, becoming dusky brown behind, and have a small central crescent, and the veins dusky. The head and thorax are chinchilla

gray; the collar is edged with black, and the abdomen is light brownish gray. It expands an inch and four-tenths."

*Spec. Char. Larva.*—Length 1.07 inches. Slightly shagreened. General color dingy ash gray, with lighter or darker shadings. Dorsum light, inclining to flesh color, with a darker dingy line along its middle. The sides, particularly along the subdorsal line, are of a darker shade. On each segment there are eight small, black, shiny, slightly elevated points, having the appearance of black sealing wax, from each of which originates a small black bristle. The stigmata are of the same black color, and one of the black spots is placed quite close to them anteriorly. Head shiny and of the same dingy color as the body, thick and almost joining at the upper surface, becoming thinner below and diverging toward the palpi. The upper surface of first segment is also shining like the head. Ventral region of the same dingy color, but lighter, having a greenish tinge anteriorly and inclining to yellow under the anal segment. Legs of the same color. It has a few short bristles on the anterior and posterior segments."—Riley.

*Moth.*—Expanse of wings 1.50 of an inch. Ground color of fore wings gray, varying in shade from yellowish to dark ash gray, the markings dark brown on the light, or black on the dark specimens. The basal t. a. and t. p. lines distinct, double, the included space the ground color; the subterminal line light, less prominent than usual; the transverse shade distinct as a rather broad line. The stigmata concolorous with wing, the surrounding line rather light; the reniform with a slightly darker shading each side; terminal space, darker than the rest of the wing. Hind wings whitish with a darker terminal border. Head and thorax concolorous with the fore wings, a narrow, dark line in the prothorax; the abdomen of the color of hind wings.

#### AGROTIS YPSILON, Ratt.—The Lance Rustic.

The larva is the Greasy or Black Cut-worm. This species, pretty well distributed over this country and Europe, was described by Dr. Harris as *Agrotis telifera*, and is also known under the synonym of *Agrotis suffusa*. In my correspondence during the past season it is as often reported from various parts of the State as any other species, especially in its damage to corn.

The worms vary considerably in color from an almost uniform dark greasy gray color with a faint stripe of dull dirty yellow along the back, to a dull leaden brown inclining to black. The latter form is known as the Black Cut-worm. When mature the worm is about an inch and a half long. The last of May or the fore part of June the worm changes to a chrysalis, and the most prominent characters of the moth that appears a month later are, the fore wings light brown shaded with dark brown, with a dark brown lance-shaped spot running from the reniform outward part way to the outer margin of the wing, contrasting strongly with the light brown surrounding it.

*Spec. Char. Larva.*—Length from 1.50 to 1.60 inches; ground color varying from a dark greasy gray to a dull leaden brown; only a faint



trace of dorsal line, subdorsal more distinct. Between the dorsal and subdorsal regions, in the lighter specimens, is a faint dirty yellow shade. Between the subdorsal and stigmata are two other distinct pale lines. Piliferous spots black, head light brown, with a dark brown spot each side and dark brown above. Inverted Y mark light brown: cervical shield dark brown, a faint stripe in the dorsal and subdorsal regions. Under side of body dull lead color; legs brown.

*Moth.*—Expanse of wings 1.76 inches; ground color of fore wings carrying a brownish gray to dark brown, different specimens varying greatly, the general character being the subterminal space brownish gray, with the front edge of the wing dark brown, the rest of the wing a little lighter brown. The basal t. a. and t. p. lines, as well as the transverse shade, obscure, except in the posterior part of the wing in the lighter specimens. The subterminal line light edged with dark very strongly angulated, two of the points opposite the reniform black, the first almost or quite met by a similar lance-shaped point from the upper part of reniform, the line in this region much deflected towards the reniform, the rest of its course nearer the outer margin than usual, terminal space, except the apical, dark, anti-apical not prominent; head brown, prothorax and thorax lilac gray, a light and a dark brown line on the former. Antennæ pectinate in the males.

#### AGROTIS SAUCIA, Hub.—The Unarmed Rustic.

The larva is the Variegated Cut worm. This species is the *Agrotis inermis* of Harris, and the *Agrotis Ortonii*, of Packard. This is also widely distributed, and it is probable that we have no other species that is more voracious or is a more general feeder. While some kinds of cut-worms are not found much out of certain situations, this may be sought in any place, during its season, with a good prospect of finding it. There seems to be no cultivated crop that is free from its attacks, and when these are not at hand it readily preys upon weeds that are found in the fields and by the roadsides. From my notes of observations during the past season I find that the first time this worm made its appearance at Irvington, where I was then located, was May 14, 1877, and that in a hot-bed. In a few days they were to be found in the gardens and fields. Towards the last of the month they appeared in their attack upon a patch of early cabbages, in a new role. They had ascended the stalks and eaten their way through the incipient heads, that were now forming, in various directions, and lay coiled up in the moist places they had eaten for themselves during the clear almost cloudless days, instead of hiding in the earth as usual with cut-worms. In this instance they exhibited some of the characteristics of borers, not eating from the edge of the leaf but truly boring through several thicknesses of leaves that were packed together into heads two or three inches in diameter.

My observations on the prevalence and destructive habits of this insect in the vicinity of Irvington, are but an index of what might be produced from other parts of the State. I have received the moth from A. S. Van Winkle, of Trenton, Clinton County, as the moth of

one of the destructive cut-worms in field and gardens at that place. C. E. Worthington, of Chicago, mentions it as one that does considerable damage in that vicinity. Other instances might be given.

The general color of these worms is flesh gray, with elongate patches on the sides, a creamy stripe along the stigmata or breathing pores, and triangular black patch just before the anal extremity of the body. On the top of each segment is a bright yellow point which is especially distinct in the anterior part of the body. Besides these marks the upper surface is irregularly mottled with fine dark spots. As the worm increases in size it grows lighter, and the light stripe along the side is frequently a series of blotches instead of a line.

The moths vary considerably in different individuals. The general color of the fore wings is dark brownish gray, with the front part in some specimens, almost black, while in others this space is dull golden buff, with dark brown or black points along the edge of the wing. In the dark specimens the stigmata are darker than the ground color, with hardly a trace of the double wavy bands, but in the light specimens these two spots are lighter than the ground color and the transverse bands show plainer.

There are probably two broods of the worms in a season, the first changing to chrysalids the last of May and issuing as moths twenty days later, but how the second pass the winter is a question not fully settled. Prof. Riley states in his writings that it is probable they hibernate in the moth state and deposit eggs in the spring on the twigs of different trees and shrubs. The 6th of last April I captured a fresh specimen, which should indicate that they pass the winter in the chrysalis state.

*Spec. Char. Larva.*—Length from 1.50 to 2.00 inches. General color varying from light to dark gray, finely mottled with light brown and very dark brown or black. The eleventh segment is slightly raised, and contains a triangular black or dark brown mark. There is usually no continuous dorsal line, but a little back of the middle of each segment is a more or less bright yellow point, generally the brightest in segments 3, 4 and 5. On some of the older and paler specimens these points are not perceptible in the posterior part of the body. In the subdorsal region a series of elongate black or dark brown spots, in length nearly one-half the width of the segments, each beginning at the anterior part of the segment. The space between the dorsal and subdorsal regions and thence to the stigmata is mottled with dark, the sides a little the lightest. Below the stigmata is a yellow or carneous stripe, in the lightest specimens broken up into elongate spots. Piliform spots not prominent, mostly of the same color as the body, a very short hair from each. Under side, legs and prolegs, glaucous gray, speckled. Head light gray, speckled; the centre of the eyes clear, on the inner edge a dark band. Cervical shield nearly obsolete.

*Moth.*—Expanse of wings 1.80 inches. Ground color of fore wings grayish brown more or less marked with dull buff and smoky black. Different specimens vary much. In some the front part of the wing is smoky black, with the rest of the wing yellowish brown, rather dark; in others the costal space to the antiapical is buff, with a slight grayish tinge to the brown of the rest of the wing; in another form there is a buff band from the base along the costa to the

anti-apical, and thence to the hind margin, the rest of the wing quite dark, the orbicular being absorbed in the buff; in another this is varied by the buff and the brown in the central part of the wing being lighter. In all the forms the reniform is dark, edged a little with buff in the front part; but the orbicular is light in all except the first. The transverse lines are usually indistinct except on the costa; hind wings whitish with a pearly luster, the border and veins blackish. The thorax concolorous with the fore wings; the abdomen rather dark gray.

AGROTIS CLANDESTINA, Harris.—The Clandestine Owlet Moth.

The larva is the W-marked Cut-worm. According to Dr. Packard, this is one of the most abundant species of this group in the Middle and New England States, and it is widely distributed outside of that region. Besides the usual cut-worm habit it has of attacking the products of gardens and fields, it has, according to Prof. Riley, the climbing habit, but in this preferring low trees and such bushes as current and gooseberry.

Prof. Riley first gave a detailed description of this caterpillar with the name characteristic of its appearance, but the moth is one of the four or five described by Dr. Harris in his "Insects Injurious to Vegetation." The general color of the larvæ is ash gray inclining to dirty yellow on the back and upper sides, with the black and brown spots on the back so arranged as to bear a general resemblance, when seen from behind, to the letter W, though this is not apparent in the thoracic segments. In the young worms the color is a more decided gray and the W marks are less distinct.

The moth which comes out the latter part of June, has the fore wings generally of a dark ash color, with only a faint trace of the double transverse lines that are found in most species. The stigmata are small and narrow, the orbicular, or the one nearest the body being oblong oval and connected with the oblique kidney-shaped spot by a longitudinal black line. The hind wings are smoky, and the body is darker than in most species.

*Spec. Char. Larva.*—Length when full grown 1.15 inches. General color ash-gray, inclining on the back and upper sides to a dirty yellow. Finely speckled all over with black and brown spots. Along the dorsum there is a fine line of a lighter color, shaded on each side at ring joints with a darker color. Sub-dorsal line light sulphur-yellow, with a band of dirty brownish yellow underneath. Along the stigmal region is a wavy line of a darker shade, with flesh colored markings underneath it; but the distinguishing feature is a row of black velvety marks along each side of the back, on all but the thoracic segments, and bearing a general resemblance, looking from the end to the head, to the letter W. Ventral region greenish gray; prolegs of same color; thoracic legs brown-black. Head black, with a white line in front, resembling an inverted Y, and white at sides. The thoracic segments frequently have a greenish hue.—Riley.

*Moth.*—Expanse of wings 1.70 inches. Ground color of fore wings dark gray. The basal t. a. and t. p. lines faint, double, black, the last

strongly angulated. The stigmata small, narrow, but little lighter than the ground color; the orbicular oblong oval, the boundary line black; the reniform oblique, less clearly defined, a longitudinal black line connecting the two. Subterminal line and transverse shade obsolete; a row of black round points. Hind wings smoky, the rims and outer border a little darker. Head dark brown, prothorax a little lighter shade of the same color; thorax the color of the fore wings, tinged a little with brown; abdomen dark ash gray.

MAMESTRA SUBJUNCTA, G. and R.—The Subjoined Mamestra.

The larva is the Speckled Cut-worm. In his first report Prof. Riley states that he had at two different times found the larva of this species in gardens about St. Louis hiding under cabbages, and that he also received the same species from Mr. A. Bolter, of Chicago, who found it in Wisconsin. According to his description the caterpillar is chiefly known by being speckled, as with pepper and salt, when viewed with a pocket lens; the ground color flesh gray, with a tinge of rust in the middle of each segment. The moth has the fore wings dark gray, the usual spots large and distinct, and two reddish spots on each wing, one at the base, on the front half, and the other beyond the reniform, sometimes shading into that spot. The hind wings are smoky.

*Spec. Char. Larva.*—Average length, 1.60 inches. Color, carneous gray, inclining to ferruginous in the middle of each segment. Minutely speckled as with pepper and salt. A lateral stigmatal stripe, somewhat lighter than the rest of the body. An interrupted dorsal and subdorsal white line, these lines being quite distinct on the posterior half and indistinct on the anterior half of each segment. Two distinct spots, anteriorly, on the dorsum of each segment; the other spots obsolete. Head, light shiny brown, with two outwardly, diverging, darker marks. Segment 1, with the three longitudinal white lines and a white anterior edge, shaded on the inside with dark brown. Anal segment, with a white transverse line, somewhat in the shape of a drawn-out W, and a deep shade above it. Venter, glaucous. Legs of the same color.—Riley.

*Moth.*—Expanse of wings, 1.60 inches. Ground color of fore wings dark gray, tinged slightly with brown in some places, and two distinct, reddish brown spots, one at the base of the wing, anterior part, including in its middle part the basal line; the other beyond the reniform, including a portion of that spot and reaching to the subterminal line. T. a. and t. p. lines double, the first arcuated below the orbicular, the second strongly bent outward beyond the reniform; subterminal line light, forming an M in the middle, the points reaching the outer margin of the wing. Orbicular and reniform a little lighter than ground color, edged with black, the reniform with a dark annulation. From the base a medium black line reaches nearly to the t. a. line; another from the claviform reaches to the t. p. line; subterminal span rather light. Hind wings smoky, dark outer border. Head and thorax concolorous, with fore wings, a black trans-



verse line on frontal and prothorax; abdomen smoky; the dorsum of the thorax tufted, the abdomen slightly so in the female; the male with large, rusty-yellow anal tufts.

MAMESTRA RENIGERA, Steph.—The Figure 8 Minor Moth.



Fig. 41—Figure 8 Minor Moth.

The larva is the small White Bristly Cut-worm. In his first report, Prof. Riley says of this: "During the month of August in North Illinois, a small dirty white cut-worm may frequently be found in flower gardens, where it doubtless

feeds for the most part on the roots of various flowers. \* \* \* During the fore part of August it descends deeper into the ground, and soon changes to a very bright shiny, mahogany brown chrysalis, from which, in about three weeks afterwards, the moth emerges."

Comparing the above with my observations, there must be two broods of the insects in a season. During the latter part of May last, I found a number of these caterpillars in a peach orchard under dead grass, along with the larvæ of several other species of owlet moths. They were fed on the same material as the other cut-worms, which they ate readily. The first pupa was formed May 31st, just beneath its food on top of the dirt, without any cocoon; the rest were subterranean. The first moth emerged June 16th, others following from day to day, till July 6.

The caterpillar is, when full grown, about three-fourths of an inch long, and is of a drab or yellowish gray color. The moth is small, expanding only about an inch, has the fore wings dark gray, with three mossy green patches, the first near the base of the wing, less distinct than the others, the second covers all but the white boundary line of the reniform, the third is near the hind angle.

*Spec. char. Larva.*—Length, about .75 of an inch. Color, drab or yellowish gray. On the back, a broad band a little lighter, with a line of elliptic spots down the center about one-third the width of the body. These spots consist, when examined with a glass, of four longitudinal lines, the two center full, while the two external run to points at the juncture of the segments, but are full width in the middle of the segments. From the subdorsal region to the stigmata, there are three lines, as follows: First, a dark brown line, then a very narrow light line, and last a dark drab or yellowish gray. The substigmatal line is light gray, the under part of the body dark yellowish gray, legs brown, prolegs with dark at the base. Head and cervical shield, darker than the general color. On each segment there are stiff yellowish bristles arising from the usual piliferous spots.

*Moth.*—Expanse of wings 1.10 inches. Ground color of fore wings dark gray; in fresh specimens often very dark, with a purplish tinge, except the central part, where the tinge is brown. In these the transverse shade is absorbed in the brown tinge. In lighter specimens the gray has less of the purple tinge, and the brown in the middle of the

wing is less marked, and the transverse shade is distinctly shown. The basal and the other lines present, but not very distinct. Orbicular partially obsolete, the reniform mossy green, bordered with white, the white in the lower part showing very distinctly. Claviform black below the orbicular, green from the t. a. line to the base of the wing; subterminal space lighter than the rest, containing a mossy green patch next the t. p. line near the hind margin. Subterminal line fine white, wavy; the terminal space rather broad, and containing white terminal points. Hind wings rather dark smoky, with a blackish outer border.

HADENA DEVASTATRIX, Bruce.—The Devastating Dart.

The larva is the Glassy Cut-worm. The caterpillar of this species when full grown is about an inch and a quarter long and has the body a translucent glassy green with the head bright venetian red, and the cervical shield dark brown. The fore wings of the moth are rather dark, slightly yellowish gray, the usual lines and marks dark brown. At the extremity or outer part of the wing is a transverse light line, from which several dark brown points extend inward. The reniform is partly surrounded with white, while there is sometimes a little of the same round the orbicular. This species was first described by Mr. Bruce from a moth bred from a pupa found a few inches under ground in a cabbage patch. From this circumstance the caterpillar has since been called a cabbage cut-worm, but Prof. Riley states that one bred by him buried itself in the earth and fed entirely on the roots of grasses, though other food was at hand.

*Spec. Char. Larva.*—Length 1.80 inches. Color translucent glassy green, with a tinge of blue, usually a very deep bluish dorsal line. Four distinct piliferous spots on each segment, each with a slight annulation. Two other minute simple spots without hairs on the anterior edge of the segment. Head bright venetian red, with black jaws, and a small black spot each side. Cervical shield very distinct, hard, polished and of a dark brown. Caudal plate less defined and more dusky. The body is lighter posteriorly than anteriorly, and the dorsal line is most distinct along the middle segments.—Riley.

*Moth.*—Expanse of wings 1.60 inches. Ground color of fore wings dark gray, slightly yellowish; the basal, t. a. and t. p. lines black, double, the included space no lighter than the ground color; the transverse shade usually distinctly marked; the subterminal line light yellowish gray, nearly parallel with the outer margin, shaded with brown inwardly with three or four points from the middle; terminal points black; stigmata concolorous, the reniform and sometimes the orbicular partly bordered with white; claviform almost obsolete, hind wings smoky, a blackish outer border; thorax concolorous with fore wings, the line on prothorax not very distinct.

## HADENA ARCTICA, Boisd.—The Amputating Brocade Moth.

The larva is the Yellow-headed Cut-worm. This species is the *Haena amputatrix* of Dr. Fitch, the caterpillar of which he named as above the Yellow-headed Cut-worm. This species is pretty widely distributed over the northern portion of both this country and Europe. The larva is of a pale smoky color with a bright tawny yellow head. The moth is nearly two inches across the wings when they are open, has a row of little tufts along the back of the thorax and abdomen, the middle portion of the fore wing reddish brown, while the rest is gray tinged, somewhat with brown in places, a space near the ends of the wings lighter than the rest.

*Spec. Char. Moth.*—Expanse of wings 1.50 inches. Ground color gray, with the middle of the wing from the t. a. to the t. p. line a rich reddish brown, in the lighter specimens nearly a wine color; the same sprinkled more or less over all the parts of the wing; basal line double, black or purplish black, the included space gray; the t. a. and t. p. lines not prominent only as they form the boundary of the brown space, subterminal line buff, bordered on the inside by a buff brown shading; stigmata gray, the orbicular mixed with a reddish brown, the reniform white in outer part; costa to the apical space black, mixed with gray; apical space and the subterminal space a lighter gray than the rest of the wing. Hind wings smoky the blackish outer border rather clearly defined. Head and thorax concolorous with the fore wings, the abdomen with the hind wings, a row of tufts along the dorsum of both tipped with reddish brown; the males with rather large and anal tufts.

## REMEDIES AGAINST CUT-WORMS.

These may be conveniently classed under two heads, as in Part First. Natural remedies, or those natural enemies or parasites that feed upon the caterpillars, and artificial remedies.

*Natural Remedies.*—Like other vegetable feeding insects these caterpillars are subject to the attacks of many insects and other enemies that materially assist in keeping them in check. Of these a class of two-winged flies that feed upon them internally are important. Prof. Riley speaks of several times breeding a species from the "Pale Cut-worm," and I have bred a similar if not the same species.

A great number of eggs are deposited beneath the skin by the female fly. The maggots from these eggs live upon the fatty substances of the worm until they attain their growth, when they issue through the skin and spin little white cocoons which they attach loosely to any substance at hand. I have seen twenty-five of them issue from a single cut-worm. After the maggots have all issued, the worm is much shrunken and shriveled, and soon dies. In sixteen or

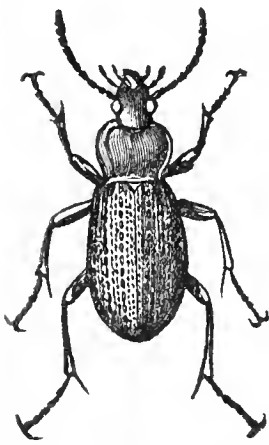
seventeen days the little flies hatch and are ready for an attack upon other worms.

Prof. Riley also mentions another large, yellowish brown four-winged fly (*Paniscus geminatus*, Say). This species deposits a single egg in each caterpillar, the maggot of which remains in the caterpillar till it enters the ground to change to a chrysalis, when it succumbs and the maggot spins its tough black cocoon.

There are many species of insects that more speedily destroy cut-worms by attacking them from without. Among these may be mentioned the Spined Soldier-bug (*Podisus spinosus*, Dallas), that is a general cannibal, preying not only on cut-worms but several other species of insects.

The Homely Geopinus (*Geopinus incrassatus*, Deg.) is known to attack and destroy the climbing cut-worms. This is a beetle about half an inch long and of the color of thin glue.

Another beetle, the Fiery Ground-beetle (*Calosoma calidum*, Fabr. See Fig. 42.) in the grub or larva is so ferocious in its attacks on cut-worms as to obtain from Dr. Shimer the name of "Cut-worm Lion." These larvæ are flattened, of a black color, have six legs near the head, and a pair of strong jaws extending in front. They will pursue the cut-worms to their underground retreat and seize them wherever they can find them, a Cut-worm Lion sometimes attacking and killing a cut-worm twice as large as itself. The beetle is black, about an inch long, with three rows of coppery spots on each wing case. It is probable that there other species of the ground beetles *Calosoma calidum*. that have a similar habit.



I have also found a mite (*Uropoda Americana*, Riley) preying on the Variegated Cut-worm. This is not a true insect but belongs to the group in which spiders are found. This little parasite is about the size of a small pin-head, broadly oval, depressed, the body in one piece, and yellowish brown in color. It attaches itself to the body of the worm by an appendage on the under side of the body for that purpose, and cannot easily be detached when once it has attached itself to the worm. Some kinds of spiders are also known to destroy cut-worms. Poultry are often efficient in destroying cut-worms and many other insects about a garden; and birds generally are of service, but as cut-worms are mostly hid beneath the surface during the day, the amount of service done by them is limited.

*Artificial Remedies.*—Without doubt the most effective means of destroying cut-worms where the infected area is small, as a garden, is to hunt and kill them wherever their work indicates their presence. In fields this is impracticable, but the fall plowing, if there is any reason to suspect their presence, will do much towards ridding the ground of those species that pass the winter in a state of torpor, or even in the chrysalis state. To be effective this must be done after the cool fall weather has caused the worms to become torpid, or they will prepare for themselves a new shelter. If ground is covered pretty well with dead grass or weeds, burning this just before plowing in the spring, will destroy a great many as they hide under such material when at hand in preference to going into the ground, and the fire will kill them.



In a garden a few plants may be protected by placing around the stalks when they are set out, a leaf, piece of smooth paper, or a paste-board box, letting them extend down a little below the surface. The leaf or paper may be wrapped about the plant when set out. Making a smooth hole with a stick beside the plant has been recommended. In this case the cut-worms, rather clumsy insects, fall into the hole, and if the sides are smooth they cannot get out, and may be killed. In corn fields where trouble is to be apprehended from them it is always safe to plant a little more seed than is expected to be needed, as by that means a few spears may be spared from the hills without serious injury to the field.

PRODENIA (LAPHYGMA) FRUGIPERDA, Guenee.—The Fall Army-worm Moth.

This species has been named by Prof. Riley *Prodenia autumnalis*, and under its varying forms var *fulvosa* and var *obscura*. It was first brought to our notice as an injurious insect in vol. 2d of the American Entomologist, the caterpillars having been sent to the editor by Mr. E. Daggy, of Tuscola, who stated that they ate into the heart of young corn plants in Central Illinois, besides feeding externally on the leaves. It was first named, in the place above referred to, *Prodenia Daggyi*, in honor of Mr. Daggy, but in a subsequent article, when the habits of the caterpillars had become more fully known, the name *autumnalis* was substituted for *Daggyi*.

Besides eating corn, it has been found that they eat wheat and rye and grass, as well as some other substances, and that when they are numerous they do considerable injury. As the common name would indicate, they have the army worm habit, and may be controlled by the same means that are employed for the army worm.

The general color of the caterpillar is variable, generally black when young, but when full grown varying from pale brown or dirty green, with more or less of pink or yellow admixed, mottled with crimson and yellow and the markings in brown. Back brownish, with a narrow line in the middle, bordered each side by a darker shade. On each side is a dark line that is bordered above with yellow. Below the stigmata, or breathing pores, is a line, either buff or flesh colored, bordered above with a wavy yellow line.

The moth is variable. The fore wings are narrow, with the general color mouse gray, variegated with smoky brown, reddish yellow and white; a patch of the latter color, more or less distinct, at the apex. The hind wings are pearly white, with a narrow outer border of dark.

PRODENIA COMMELINÆ, Guen.—The Spider Owlet Moth.

This species is found throughout the State, and, bearing a resemblance to the preceding, may be easily mistaken for it, but there is this difference—the fore wings incline more to a purplish gray, the ordinary lines are deep brown, and are more clearly defined. The

white of the hind wings is not so clear, and the veins are quite dark to the body. The larva, having more the appearance of a cut-worm than the Fall Army-worm, has two triangular dark patches on the back of each segment. They do not congregate in multitudes when feeding. Though quite a general feeder, I have not known it to occur in sufficient numbers as to be regarded as injurious. I have seen one specimen from the northern part of the State, with a paper on the pin marked, "Corn Cut-worm Moth," but there is nothing further from which we may draw any conclusions in regard to this particular case.

NEPHELODES VIOLANS, Guen.—The Violet Nepelodes.

Several times during the latter part of April, and through May, I found, while hunting for other insects, a robust naked caterpillar hid under dead grass. When full grown this larva was an inch and three-quarters long, the space above the stigmata consisting of four broad, dark brown stripes, alternating with three narrow, grayish-yellow ones. While in confinement these caterpillars fed upon corn, grass and knot-grass (*Polygonum aviculare*), which they ate without seeming to prefer one more than another. In habit the larvæ resembled cut-worms, feeding mostly at night and hiding during the day, sometimes under the rubbish of the box, at others in the dirt. There seems to be but one brood in a season, pupating in June and the moths issuing the following September. The moth has dark, purplish-brown fore wings; the middle of the wings a more distinct brown; the hind wings a smoky-brown base, with the outer portion blackish. There is, when the insect is fresh, quite a distinct purplish cast over the whole body.

I have no evidence that this insect ever becomes sufficiently numerous to be injurious, but, as it seems to be a general feeder upon some plants that are beneficial to man, and as it is spread over a wide range of country, it may do so. In that case we may judge from its cut-worm habits that the remedies that serve to keep them in check will answer for this.

*Spec. char. Larva.*—Length 1.75 inches. Form robust; the head four-sevenths the width of the middle of the body. Above the lower edge of stigmata are four broad dark brown longitudinal stripes, alternating with three narrow grayish yellow ones, the latter being in the dorsal and subdorsal regions, and lighter at the extremities of the body than in the middle; the two lateral stripes are slightly mottled with a lighter color, especially back of the stigmata; under part of the body yellowish gray; head the same, marked a little with brown. Cervical shield dark, almost black, with the light lines narrow and bright.

*Moth.*—Expanse of wings 1.75 inches. Color of the fore wings, head, prothorax and thorax above, and the underparts of the body, a rich dark brown, tinged with purple, with a little grayish in some specimens. In the center of the fore wings is a brown speck, without the purple, that reaches from the t. a. to the t. p. line, and includes the reniform and orbicular. Hind wings are blackish slate colored in the

outer part; smoky at the base, and have rare colored fringes in fresh specimens. The only lines that show plainly on the fore wings are the transverse shade and the subterminal line; the terminal space lighter than the rest of the wing. Male antennæ pectinate, the female simple; anal tufts of the male ferruginous. The abdomen has very small dorsal tufts on its basal half.

GORTYNA CATAPHRACTA.—Grote.

Of the larva of this species I know nothing except that it has been found as a borer in the thorns and thistles. The moth expands a little over an inch and a half, has the fore wing from the base to the t. p. line bright yellow, spotted with yellow brown scales. The space beyond that line, except the yellow apex, is mouse gray speckled a little with yellow scales. The reniform, orbicular, and a spot below the orbicular are clear yellow spots, or with but dark scales. The hind wings and body are mouse gray. The moths are to be found in September.

GORTYNA NITELA, Guen.—The Stalk-Borer Moth.

This insect has been so numerous during the past few years as to attract a great deal of attention as well as do a great deal of damage, principally to corn. As a corn insect its ravages have been, the past season, confined to the northern half of the State. Besides the items given by Miss Smith in her article on this insect, I have the following in a letter from Mr. E. Hall, of Athens, Menard county.

"A worm called here the 'Heart Worm,' has thinned the corn on new lands and on foul fields to a considerable extent. We see a little of this every year, but this year it has been quite destructive. Its habit is to find a lodgment, in the heart, so-called, of the stalk from the time it first appears above the ground until it is to the jointing age. This is the worst enemy in the insect line we have this year for corn."

In regard to the fields most infested by them, E. R. Boardman, M. D., of Elmira, Stark county, says: "They have done considerable injury to the corn crop in that section. They were worse on grounds that had been in oats the previous year. Our oats crop proved a failure and many did not cut them but plowed them under in the spring and on these lands they were the worst."

This insect not only bores into the stalks of growing corn, but many other plants. The caterpillar is of a lived hue when young, with light strips along the body, the one on the side being interrupted towards the head. When full grown it generally becomes lighter, with the longitudinal lines broader. It becomes full grown some time in August, when it forms its chrysalis in the stalk. The moths issue the latter part of August or in September, and hibernate during the winter to deposit their eggs the following spring upon the plants that

are to furnish food for the larvæ. The moth is in color a mouse gray, with the fore wings being finely sprinkled with yellow scales, and having an arcuated pale line running across the outer third.

*Remedies*—To prevent future crops being destroyed, the stubble of infected plants may be gathered and burned while the worms are yet in them, or before the moths emerge. We may conclude, from such experience as is given in the above extracts from letters, that land that is kept clean will be comparatively free from these insects. A few choice plants in the garden or flower garden, that show by their wilting the presence of this or some other stalk borer, may be saved by finding the locality of the insect in the stalk and carefully cutting it out.

*Spec. Char. Moth.*—Expanse of wings from 1.10 to 1.50 inches. General color of the body mouse gray, the fore wings with a very light lilac tinge and finely sprinkled over with bright yellow scales, except the subterminal space, which is free from yellow scales, except a few at the hind margin; the most notable feature being this lighter space edged internally by the yellow t. p. line, which is scarcely wavy. The other lines indistinct, unless it be the subterminal, which is indicated by a series of yellow dots, with the darker shading that usually accompanies this line. The reniform and orbicular scarcely darker than the space surrounding, the second with another spot below it; thorax with prominent anterior and posterior dorsal tufts; basal part of the abdomen and anal extremity of the male slightly tufted.

#### GORTYNA NEBRIS, Guen.

The only difference between this species and the *nitela* is in this: the wings are usually a little lighter, and the reniform and orbicular, with sometimes the spot below the orbicular contain white or yellowish white spots. The habits and coloration of the larvæ are similar, but the chrysalis is formed in the ground.

#### ACHATODES ZEÆ, Harris.—The Spindle-worm Moth.

This species, first described by Dr. Harris, has about the same range as the more common *Gortynas*, and as the caterpillar has a similar habit it is quite probable that a portion of the destruction to corn attributed to the Stalk Borer is due to this insect. Like the Stalk Borer the Spindle-worm enters the stalk through a small hole while the corn is small, and by the time the tassel should appear the withering leaves show the mischief that is being done inside the stalk.

The caterpillar is, when full grown, an inch or more in length and of the "thickness of a goose quill," of a yellowish color, with the head, the top of the first and last segments black, with a double row across each of the other segments of black piliferous spots. The chrysalis is formed in the stalk in the cavity the worm has eaten out. The moth that issues from it in August has gray fore wings with



streaks of reddish brown inclining to rust red, along all the veins, about three somewhat irregular transverse lines of the same; and a large patch at the apex. Hind wings smoky.

*Remedies.*—The habits being similar to the Stalk Borer, similar remedies may be employed as with that species.

*Spec. char. Moth.*—Expanse of wings 1.25 inches. The fore wing less pointed at the apex, and the hind margin proportionally longer than in the genus *Gortyna*. Ground color of fore wings gray, streaked along the veins with reddish brown, with somewhat transverse lining of the same at the base, the transverse shade and the shading of the subterminal line, the t. a. and the t. p. lines indistinctly the same. At the apex, on the hind margin in the subterminal space, and inside the t. a. line, are three "rust red" or orange red spots. Stigmata obscure. Hind wings smoky brown, not very dark. Thorax tufted as in *Gortyna*; all but the basal segment of the abdomen of the male tufted; the female less conspicuous, the tufts, except the anal, tipped with reddish orange. The male is a little smaller than the female.

LEUCANIA (HELIOPHILA) HARVEYI, Grote.—The Wheat-head Army-worm Moth.

The caterpillar of this species has been found several times feeding upon the heads of wheat and other small grains and grasses in various parts of the Northern United States in such numbers as to do a great deal of injury, and give rise to the name Wheat-head Army-worm. There are two broods of the moths in a season, the first in May, that lay eggs from which the worms are produced that eat the winter wheat from the time it heads out till it is in the milk state; the second brood the last of July. The caterpillars from these attain their growth in September, and pass the winter in chrysalis state.

The full grown larva is a little over an inch long and is striped with sulphur yellow, straw yellow and light and dark brown, as follows:

"A broad, dark brown line along the back, divided along the middle by a fine white line generally obsolete behind; beneath this broad line, on each side, a straw yellow line half as wide; then a light brown one of the same width as the last, and becoming yellow on the lower edge; then a narrower dark brown one, containing the white spiracles; then a sulphur yellow as wide as the third; then a less distinct light brown subventral one, the venter being pale yellow. The head is large, straw-colored, and with two attenuating brown marks from the top to the lower face."—Riley.

The moths are smaller than the regular army-worm moths, expanding scarcely an inch and a half. The fore wings are straw color or light ochre yellow, with a brownish ash colored longitudinal stripe along the costa and another through the middle of the wing, the latter expanding T-like at the outer end so as to reach from the apex to the hind angle. The distinguishing feature is a white line that runs from the base along the median vein and crosses the second dark band obliquely in the middle and bends downwards towards the hind angle.

*Remedies.*—This insect is widely distributed, and under ordinary chances for its development is kept from becoming excessively numerous by the insect parasites that prey upon it. If, as is sometimes the case, it be developed in great numbers because of favorable circumstances, little can be done to fight it in the worm state, but the full brood that pass the winter in the chrysalis state may be destroyed by plowing and harrowing the ground late in the fall. This will break up the earthy cell or cocoon that is around the chrysalis, and allow the latter to be mixed with the loose dirt. The rains will cause this to stick to the chrysalis, and that, in connection with the freezing that follows, will cause them to perish.

LEUCANIA (HELIOPHILA) PHRAGMITIDICOLA, Guen.

This species, found more or less common in Illinois, resembles the preceding, but differs as follows: The fore wings are rather dark straw color, with an indistinct dark stripe through the center, and the outer margin a little darker than the general color. The median vein and all the veins in the outer third of the wing are whitish, while between the veins in the outer half are faint dark lines. The larva is striped, more robust than the Army-worm or the preceding, and feeds on grass.

LEUCANIA (HELIOPHILA) UNIPUNCTA, How.—The Army Worm Moth.

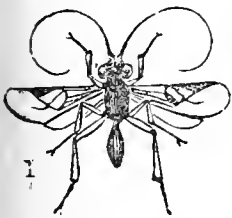
This insect is found both in the larva and moth state, more or less common every season, but it is not usual for it to appear in sufficient numbers as to do very much damage to crops, only at intervals of several years. This is owing, in part, to a want of proper climatic influences for its development, and to the destruction of the broods succeeding these great migratory hordes by the rapid multiplication of its insect parasites.

There are two, and probably in the latitudes of Southern Illinois, three broods of the worms in a season; the first, or spring brood, that produces moths in June; second, a brood of worms that produces moths the last of July or the fore part of August; the third brood would be found the last of August or in September. The last brood pass the winter either in the chrysalis or moth state. At present the evidence seems to indicate that they do not hibernate uniformly in either of these methods. The capture of faded and rubbed specimens in the winter or early spring would indicate, as has been claimed by Prof. Riley, that they issue from the chrysalids in the fall, but I have taken fresh specimens in April which would indicate that if, as is intimated in the sixth report, they do hibernate as moths, they may also pass the winter as chrysalids. The moths, after pairing, deposit the eggs between the sheath and stalks of grass or secrete them in the folds of the blade.

The caterpillars are when full grown dingy black, striped longitudinally as follows: "On the back a broad dusky stripe; then a narrow black line; then a narrow white line; then a yellowish stripe; then a narrow sub-obsolete white line; then a dusky stripe; then a narrow white line; then a yellowish stripe; then a sub-obsolete white line; belly, obscure green."

The moths have the fore wings light reddish brown or fawn color, with a dusky oblique stripe from the apex, and a small white spot in the middle of the wings. Hind wings blackish, darker in the outer parts.

Fig. 43.



*Remedies.*—Ordinarily the insect enemies of this species serve to keep it from becoming sufficiently numerous as to do serious damage. When they are numerous, burning meadows where that can be done will destroy them, or ditching will stop their migration.

*Spec. Char. Moth.*—Expanse of wings 1.75 inches. General color of fore wings light reddish brown or fawn color, a little lighter along the costa, spotted more or less with fine black scales. The stigmata small, tinged somewhat with a lighter rusty shade, sometimes a spot of the same shade near the apex. The transverse lines obsolete, but there is an oblique dusky band from the apex to the hind margin, the last part of its course sometimes indistinct and indicated by points on the veins. The distinguishing feature and one that gives rise to the specific name, is a white spot on the median vein below the reniform; hind wings dark smoky or blackish, darker in the outer border. Male antennæ slightly pectinate, female simple.

#### PYROPHILA PYRAMIDOIDES, Guen.—The Copper Underwing.

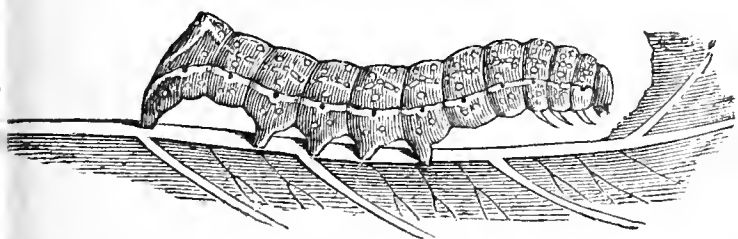


Fig. 44—Larva of Copper Underwing.

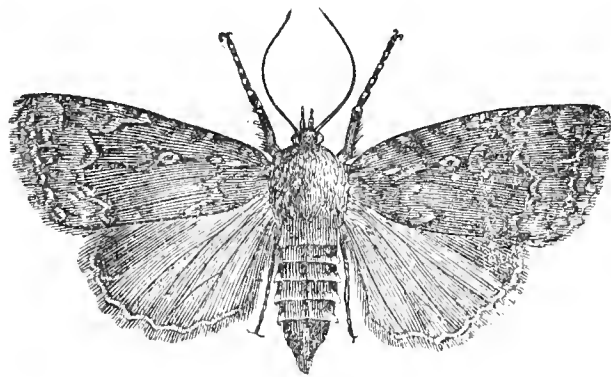


Fig. 45—The Copper Underwing.

This species is usually known by the name *Amphipyra pyramidoides*, and the larva is called the Green Cream-spotted Grape Worm. As its name indicates, it is a grape-eating insect, though not confined to that plant, for it feeds readily on the plum, pear, thorn, raspberry, rose, red bud, peach and poplar. They are seldom sufficiently numerous to be very destructive, though from articles in Vols. 6 and 7 of the Canadian Entomologist, it seems they have been so in some parts of that province.

The caterpillar, when full grown, is about an inch and a quarter long, light green, head rather small, the posterior part of the body thickest, the eleventh segment somewhat pyramidal on the back

There is a faint white, dorsal line, a little broken into segments; a fainter subdorsal line, more interrupted; and a bright yellow line. containing the black stigmata or breathing pores, the space above between these lines spattered with a creamy white.

The worm changes to a chrysalis in a cocoon formed by fastening around itself a leaf of the plant upon which it feeds, and lining it with silk; the change occurring in May or June, and the moths issuing a little more than a month later. One that I reared the past season fastened together a rose leaf and a petal, in which it pupated.

The moth is one of the most easily recognized of this family. The fore wings are dark brown, with the wavy, transverse line toward the outer part quite light, the space beyond this lighter than the rest; the hind wings copper color, with a coppery brown band along the front edge.

*Remedy.*—Hand-picking.

#### CERAMICA PICTA, Harr.—The Painted Ceramica.

This insect has until recently been called *Mamestra picta* or the Painted Mamestra, and the caterpillar on account of its peculiar striping is known as the Zebra Caterpillar. The larvæ is a general feeder, eating readily the leaves of cabbages, turnips and other garden vegetables, and has been found at times to do considerable damage. Dr. Packard states that twice within his recollection has it been extremely destructive to the ruta-baga crop in Massachusetts. In the account given of it in the Sixth Report is a record of its ravages on raspberries in the northern and western parts of the State and in Iowa, as well as of its pea-eating propensity.

From Miss Middleton's notes of the transformations of those sent here by Mr. O. B. Galusha, are obtained the following items: "The young larvæ were received June 1, 1876, changed to chrysalids in the ground the 27th of the same month, and came forth as moths the following May."

The following is the description of the larvæ from the Sixth Report: "The worms when fully grown are nearly two inches long and beautifully colored. They are marked their entire length with very distinct stripes, alternating black and yellow, arranged as follows: A rather broad, deep velvety black medium stripe along the back, slightly margined on each side with white; on each side of this black stripe there is a bright yellow stripe about equal in width to the former; in the middle of this on each segment there is a small black dot; next below there comes a rather broad blackish stripe, composed of minute white and black transverse and somewhat netted; next below this is another bright yellow stripe; below this and just above the legs is a narrow white stripe, profusely sprinkled with black dots. The head, ventral surface and legs are pale reddish brown or tawny. The surface of the body is almost entirely free from hairs."



## SCOLIOPTERYX LIBATRIX, Germ.

This is an interesting species on account of the shape of its wings differing from most of the Owlet moths. The fore wings have the outer margin scalloped, with a prominent point or angle in the middle. They are yellowish gray, with a tinge of reddish orange quite prominent in the outer part, and are crossed by three transverse light lines, the first single, one-third of the distance from the body; the second double, at two-thirds the distance; the last, a wavy line, less distinct, running from the apex to the hind angle. An orange band runs from the base to the middle of the wing, where it turns a little to the costa. The costa and rims light gray. Hind wings smoky, with a central arcuated line. Expands an inch and three quarters.

## HYLINA (LITHOPHANE) CINEREA, Riley.—The Ash Gray Pinion.

Prof. Riley, in his 3d Missouri Report, says of the larva of this species: "There is a pale green worm, with cream-colored spots, and a broad cream-colored lateral band, which I have for several years known to be common on the apple, poplar, hickory, and some other trees, the leaves of which it devours, but which last summer attracted unusual attention by its being frequently found boring into apples and peaches, and as I also commonly found it hiding in and feeding upon one of our large oak-apples (the *spongifica*) we may conclude that it is a very general feeder, and that it is fond of boring."

"This worm is found during the months of May and June, and when fully grown burrows beneath the surface of the ground, where it forms a very thin cocoon of filmy silk, with the earth adhering to it on the outside. It changes to a mahogany brown chrysalis, and generally issues as a moth during the September or October following, though in northern Illinois I have known it to remain in the chrysalis state through the winter, and not issue as a moth till April."

The moth is of a dull gray on the fore wings and front part of the body, with the orbicular about the size and shape of the reniform, the lower part turned obliquely outward; sometimes the spots are clearly defined, when they are edged with black, at others they are indistinct; the transverse lines are inclined to be obscure. Hind wings nearly uniform smoky brown.

## LITHOPHANE LATICINEREA, Grote.

This species very closely resembles the preceding in the moth or perfect state, but may be distinguished from it by the following characteristics: The gray has a slightly brownish tinge in the centre of the fore wings, the oblong orbicular is constricted in the middle so as to be somewhat 8-shaped, both this and the reniform are slightly discolored with brown, the transverse lines are distinctly double, the included space light gray.

## ANOMIS (ALETIA) ARGILLACEA, Hub.—The Cotton-worm Moth.

This species is widely distributed over the continent, having been taken in South America and the West Indies as well as the United States and Canada. The larva is the well known cotton-worm of the South or wherever that plant is raised, and the species is usually known by the name *Anomis sylina* of Say.

The cotton-worm has sixteen legs, but the first pair of abdominal legs are smaller than the rest and are of but little use in walking, so that instead of gliding along when it walks it loops up the back like the measuring-worm. The most common color is light green, with black dot along a yellowish subdorsal line, and with black dots beneath.

The moth has the fore wings a nearly uniform reddish brown with a dark oval discal spot centered with two pale spots. The head and thorax are of the same color, but the hind wings are smoky brown with a slight bronze reflection. The abdomen above is of the same color, not tufted.

According to the best authority there are three broods of the worms in the South, appearing from June to September, but as we go north the number probably lessens and they would be in their northern limit single brooded. The female deposits from 400 to 600 eggs, which hatch in two days. The worms at first feed upon the soft parts of the leaves, but afterward eat not only portions of the leaves but also buds, blossoms, and the calyx leaves at the base of the boll, thus causing the lobes which hold the cotton to fall entirely back and allow the cotton to drop at the slightest touch. They cast their skins five times and come to their growth in fifteen or twenty days. The pupa is formed by folding a leaf together and lining it with silk, from which the moth emerges in from seven to fourteen days.

*Remedies.*—As cotton is but little raised in Illinois, there is not much prospect of extensive damage from this insect. Where it does occur, the use of Paris-green, in the same manner as employed for the Ten-lined Potato Beetle, will probably be as serviceable as any of the many remedies that have been recommended.

## PLUSIA BALLUCA, Gey.—The Hop Plusia.

We may judge from Rev. C. J. S. Bethune's article in the report of the Entomological Society of Ontario, for 1872, that this insect is confined to the cooler portions of the country, being, as he says, "essentially a Canadian insect," but probably found to some extent where its food plant, the hop, is cultivated, though it has not, as yet, done serious damage.

When full grown the caterpillar is a green brown, nearly an inch and a quarter long; the body thickest in the middle, with only three pairs of abdominal legs, so that it loops a little in walking.

The moth has the fore wings almost entirely covered with bright metallic green scales, darker below the middle and paler toward the hind angle, and are crossed by two oblique dark lines. Hind wings are dusky gray without markings. It expands an inch and three-quarters. The larvæ pupate in June, and the moths issue the last of July or the fore part of August.

*PLUSIA BILOBA*, Steph.

This beautiful species is more or less abundant in the early part of the season, but the larva is unknown to me.

*Spec. Char. Moth.*—Expanse 1.50 inches; the outer margin of fore wings scarcely angled or scalloped. Fore wings rich brown, with an orange tinge, marked with fawn color along the outer two-thirds of the costa and in the outer end and between the basal and t. a. lines, the whole wing containing a rich metallic luster. Most of the basal, t. a. and the lower portion of the t. p. lines silvery. Orbicular obscure; reniform, the upper portion obscure in outline, but containing a dark dot, the lower portion containing a nearly circular silver annulation. In the center of the wing is a silvery mark reaching nearly from the t. a. to the t. p. line, rounded outwardly, somewhat pointed next the body, bilobed in front; length three times the width.

*PLUSIA PRECAUTIONIS*, Guen.—The Thistle Plusia.

This species feeds chiefly on the thistle, and could hardly be called injurious, except that it also feeds on the Holyhock.

*Spec. Char. Moth.*—Expanse 1.50 inches, the shape of the fore wings very much like the preceding. Color of fore wings purplish brown, varying from quite a distinct purple with brown spots to grayish purple with the spots more of a grayish brown, containing as in the preceding a rich metallic luster. The transverse lines contain more or less distinct traces of fine silver threads, the two spots are obscure, the silver mark in the center is medium size and in the shape of an inverted j, the dot toward the outer part of the wing. Hind wings all brown, the outer border blackish, an indistinct central arcuate line.

*PLUSIA BRASSICÆ*, Riley.—The Cabbage Plusia.

In August and September the leaves of cabbages are sometimes eaten by a pale green caterpillar, marked with still paler, more aqueous lines. Besides the six true legs near the head, it has only six abdominal legs placed well back, for which reason it is a "semi-looper span worm," though not belonging to the family of span worms. When full grown it weaves a very thin, loose, white cocoon, either

between the leaves of the plant upon which it feeds, or in some sheltered place, where it changes to a chrysalis. The chrysalis varies in color from yellowish green to brown, is soft and tender, has several curled bristles at the end and considerable of a protuberance at the end of the wing cases. The moth that issues from this has the fore wings dark gray tinged with brown, with a bright silvery interrogation-like mark in the middle part of each wing. The male differs from the female in having a tuft of golden hairs on each side of the abdomen, toward the tip.

*Remedies.*—These worms may be sought and killed by hand if the patch is small, or poultry may be allowed the range of the patch. As the worms fall to the ground with the slightest jar, they may be shaken to the ground and then killed with the foot or a stick. Prof. Riley recommends the use of a wash made of cresylic soap, with which the cabbages are to be drenched. Brine may be used.

*Spec Char. Larva.*—Pale yellowish translucent green, the dorsum made lighter and less translucent by longitudinal opaque lines of whitish green; there consist each side, of a rather dark vesicular dorsal line, and of two very fine light lines, with an intermediate broad one. Tapers gradually from segments 1 to 10, descending abruptly from 11 to extremity. Piliferous spots white, giving rise to hairs, sometimes black, sometimes light colored; and laterally a few scattering white specks in addition to these spots. A rather indistinct narrow, pale stigmatal line, with a darker shade above it. Head and legs translucent yellowish-green, the head having five minute black eyelets each side, which are not readily noticed with the naked eye. Some specimens are of a beautiful emerald-green, and lack entirely the pale longitudinal lines.—Riley.

*Moth.*—Expanse of wings from 1.25 to 1.50 inches. General color of fore wings dark-gray, inclining to brown, the transverse lines pale yellow, inclining to silvery, and in the middle of the wing the silver mark somewhat U-shaped, with an oval beyond the outer part, the latter sometimes attached to the U. The terminal space is lighter than the main part, the outer margin dentate. Hind wings smoky distinct blackish outer border.

#### HELIOTHIS PHLOXIPHAGUS, G. & R.—The Phlox Heliothis.

Prof. Riley states in the *Prairie Farmer* that there are two broods of the larvæ of this species, known familiarly as Phlox worms, the first appearing in July and becoming moths by the middle of August; the second passing the winter in the chrysalis state. The female deposits the eggs singly on all portions of the plant, and the caterpillar feeds upon the buds and leaves, entering the ground when full grown to become chrysalids.

Some time the fore part of last November Mr. Frank H. Kimball of Rockford, sent some specimens of the moth to this office to be identified, stating that they had been very injurious to flower garden in his vicinity. When replying to his communication it was asked what particular flower or plant was injured by the worms. Thi



elicited a second letter from Mr. Kimball in which he stated that the only plant injured was the Drummond Phlox, that the worms first ate the leaves and then the buds, leaving nothing but the bare stalks, giving in this instance the state of affairs in his own yard. On the seed farm of Geo. S. Haskell the Phlox was entirely destroyed.

The moth resembles the armed *Heliothis* but is smaller and the black marks are more prominent. The wings are pale clay yellow with a black mark in front of the middle and another near the apex of the fore wings; the hind wings with a black outer border and black spot in the middle, the border having a light spot in its center.

*Remedies.*—Where phlox is raised on a large scale it is probable no remedy will do better service where the worms are already at work than the usual preparation of Paris green that is used for the Ten-lined Potato Beetle. Hand or chicken picking may do for a few plants. It is probable that turning the ground up in the fall by plowing or spading will be the best preventive remedy against their ravages the second year. This operation serves to break up the earthen cells that contain the chrysalids thereby mingling the latter with loose dirt when they will not be able to withstand the effect of the winter rains and frosts.

*Spec. Char. Moth.*—Expanse of wings 1.25 inches. Ground color of wings and body light clay-yellow, the hind wings and abdomen a little the lightest. The basal and t. a. lines not discernable except by dots on the costa, the t. p. line marked by black scales on the veins. From the transverse shade to the subterminal line is a space of a darker shade than the rest of the wing, inclining more to ochre. The place of the orbicular indicated by a black dot; the reniform black, annulated with a brown shading that reaches to the costa, ante-apical brown or brownish black. Hind wings contain a large black discal spot and a wide black outer border containing an oval light spot in its center.

#### HELIOTHIS ARMIGERA, Hub.—The Armed *Heliothis*.

The larva of this species is known as the Boll-worm or Corn-worm, the former being the name by which it is designated in the south where, as its name indicates, it eats into and destroys the bolls of growing cotton, the latter name being given it chiefly in the northern states on account of its eating into the ears of growing corn. Besides corn and cotton this worm is often found in the garden feeding on tomatoes, green peas, peppers, and sweet corn, though the chief injury done is to the first named staples of the north and south.

The caterpillar is, when full grown, about an inch and a half long, and varies in color from pale green to dark brown, striped longitudinally with darker stripes of the same color, the green worms marked with darker stripes of green, and the brown with darker brown. On each segment are eight black piliferous spots, from which arise short brown hairs. The head and neck are brown. When full grown they leave the ears and transform to chrysalids beneath the surface of the ground, the first brood remaining in the chrysalis state from three to four weeks, but the second pass the winter in the ground to come out as moths the following spring. In the southern states there are three

broods, while in the northern limit of the species there is probably but one. The eggs from which the worms are produced are laid on the silk, upon which the young worms at first feed until they are about a third grown, feeding the rest of the time on the kernels inside of the husks. As a cotton insect it feeds, as its name indicates, upon the boll or pod, first upon the tender substances of the calyx, as it increases in size boring into and destroying the whole boll.

The moth is variable in depth of color and shading, but is usually of a pale clay yellow with a more or less distinct tint of olive green, and marked with olive and rufous, with a blackish spot near the center of the wing, and a dusky shade near the outer margin. The hind wings are a little paler, with a blackish outer border containing a light spot in the center.

*Remedies.*—The remedies for this insect must be chiefly preventive, especially in relation to their attack on corn, as their work is generally out of sight. Of these, early planting has been found advantageous, as late planted corn is usually the most injured. As they pass the winter in the chrysalis state, fall plowing infested fields, will break up the earthen cells containing them, and thus mingling them with the loose dirt the winter rains and frost will kill them.

*Spec. Char. Larva.*—Length 1.50 inches; color varying from pale green to dark brown; when full grown, some being pale brown striped with darker brown, others pale green striped with dark green. The stripes are a dorsal dark line bordered each side with light, then a subdorsal line darker than the dorsal, with the stripe along the stigmata light; lower part the general ground color. On each segment are eight shiny black piliferous spots, from which arise brown hairs. The four on the back of each segment are arranged in the form of a trapezoid, with the parallel sides transverse with the body, the shortest side towards the head. The two on each side are arranged about the stigmata, one above and a little anterior to the opening, and the other back and on a line with them. Head and legs brown; cervical shield dark brown. There are a few short hairs scattered over the body besides those from the piliferous spots.

*Chrysalis.*—Length, .80 of an inch. Color, light chesnut brown, the dorsal line, stigmata and divisions of the segments darker. Form rather slim, an indentation on the back where the abdominal segments begin, the last four segments movable, two thorns at the extremity. Riley, in his description of this says, four thorns at the extremity, but after carefully examining a number of bred specimens of the fall brood, as well as those taken from the cornfield, I fail to find more than two and no indications of any more.

*Moth.*—Expanse of wings, 1.50 inches. Ground color of fore wings a clayey yellow, tinged with light olive green, and marked with darker olive and dark brown or black. The usual marks faint; the subterminal line usually the most distinct. The basal, t. a. and t. p. lines, a slightly darker olive than the ground color, with a few black scales on the veins and costa, in rubbed specimens the position of these lines only indicated by the black scales. Orbicular of the same color as the wings, either bordered with olive and having a clear center, or bordered with black and green scales and a black point in the center. Reniform somewhat lunate, black with a violet tinge in the outer part. The subterminal space is usually a little darker than the rest

of the wing. Terminal dots black, fine. Fringe gray. Hind wings lighter, the outer border black, a white spot in the center of this border reaching almost or quite across it. Fringe white. Head and thorax the color of the front wings. The anterior rings of the abdomen and its tufts white, the rest of the abdomen dirty white. Eyes dark olive mottled with black. Antennæ ferruginous with slight pubescence. The underside of the wings are rather lighter than above, with the black spots showing, and a blackish outer border having a violaceous tinge. Sometimes a faded black spot each side of the head just back of the eyes.

HELIOTHIS (PYRRHIA) EXPRIMENS, Walker.

At Carbondale and in the northern part of Union county, were found the past season, by the writer, light gray worms a little more than half an inch long, eating into and disfiguring roses, making that which was intended as an object of beauty, only one of aversion. When found they had three narrow white lines between the dorsal line and the subdorsal, and a yellow line along the stigmata, and there were twelve black piliferous spots on each segment from which arise short bristles; head clear yellow, inclining to orange; tips of feet black. These were the larvæ of this species.

After moulting, the second segment contains two triangular black spots, the bases toward the head, light between them; the body a little darker, the anal segment whitish, but the segment preceding the anal with four black prominences.

In feeding, they eat more into the flower than on the outside, seeming to prefer the base of the petals. They were found the fore part of June, and by the 19th of the same month all had entered the ground to undergo their transformation. They began to hatch August 5th and continued to come out at intervals till the 31st of the month. The moth expands a little more than an inch and a quarter; has the fore wings and thorax reddish yellow, the usual lines reddish brown, dusky beyond the t. p. line; the subterminal line quite wavy, the stigmata the color of the wings, circled with reddish brown, a dark center to the reniform; hind wings whitish, the veins and the outer border reddish brown, the latter dusky through its middle, a light space in the middle portion along the margin.

DRASTERIA ERECHTEA, Hub.—The Clover Drasteria.

This is a grayish moth with two black dots near the apex, and broad diffuse line on the fore wing. The larva, when full grown, about an inch and a quarter long, has but two pairs of abdominal legs and loops the body in walking. The body is largest in the middle, tapering slightly to the head, but much more toward the anal extremity. The body above is reddish brown, with many longitudinal darker lines and stripes.

This caterpillar feeds on clover and is not usually regarded as injurious, though the perfect insect is one of our most common moths. I had supposed that clover formed the only plant upon which this fed, both from the writings of others as well as my own observations, but E. R. Boardman, M. D., of Elmira, Stark county, stated in a recent communication, that he had reared this moth from a chrysalis taken from a potato stalk. This opens up a new line of investigation for this insect.

*Spec. Char. Moth.*—Expanse of wings 1.50 to 1.75 inches. Body rather small, wings moderately broad, when at rest slightly roof-like, deltoid. Color of fore wings gray or brownish gray, two black antepical spots, and the wings crossed by two, more or less, distinct brown bands, the outer not reaching to the hind margin. Hind wings dull, more of a blackish gray, with two light bands along the outer margin.

### CATOCALA.

This genus, and one or two closely related, constitute a group of moths that are much sought by collectors, and as they are well represented in all parts of the state, as well as outside of it, they form an interesting part of every cabinet of insects. The larvæ are loopers like the clover worms, tapering from the middle, but they feed upon the leaves of trees and shrubs and are of similar colors as the substances upon which they feed. The perfect insects have rather large bodies, the abdomen tapering almost to a point, the hairs laying close to the body. The fore wings and thorax are some shade of gray, marked and shaded with brown or black. The hind wings vary considerably. In some they are a uniform black, in others black with white fringe or white with black bands parallel with the outer margin. Another group have the hind wings some shade of yellow with wavy black bands, another some shade of red with black bands; these bands and colors being repeated more or less distinctly on the under side. The wings are broad and the moths have a vigorous flight. In size they vary in expanse of wing of from an inch and a half to three and a half or four inches. Grote's check list of Noctuidæ contains 83 species as occurring in the United States. Of these 36 have been found, according to Mr. C. E. Worthington, of Chicago, in Cook county, and it is probable that enough more occur in other parts of the state to warrant us in saying that fully half the number indicated in the check list are to be found in Illinois. The following are a few of the more common species.

#### CATOCALA DESPERATA, Gue.

Expanse of wings three inches, head and thorax light gray with dark lines, abdomen blackish brown, fore wings light gray, the trans-



verse lines distinct, from the base a black shaded line extends to the outer margin parallel with the hind margin. Another similar black shaded line, somewhat curved, begins at the middle of the costa and reaches the outer margin a little above its middle. Each of these is met by a perpendicular black shading, the first along the t. a. line and the second between the t. p. and subterminal. Hind wings black with the fringe white, and a trace of an inclination to a light band through the center.

CATOCALA AMATRIX, Hub.

Expands from three to three and a half inches, color of fore wings brownish gray, the transverse line dark brown, not heavy, usually a longitudinal brown band running through the middle of the wing, interrupted in the middle; hind wings scarlet with two wide black bands and a whitish fringe, underside of fore wings have the outer edge gray, broadest at the apex, the rest of the space contains three black and three whitish bands; hind wings, the anal half scarlet, the rest grayish white with the bands of the upper side repeated.

CATOCALA CARA, Gue.

Expanse the same as the preceding; color of fore wings and body rich deep maroon or reddish brown, transverse lines black, narrow, and accompanied with scattered inconspicuous light scales; hind wings crimson with two black bands, the outer broad at the apex but gradually diminishing till it terminates in the anal angle; fringe dirty white.

CATOCALA ULTRONIA, Hub.

Expanse of wings from two to two and a half inches. Body above brown, gray beneath; fore wings with a stripe of pale ash color through the centre, beginning a little below the centre, elbowed in the middle, below thin, the wing is dark brown to the posterior margin, crossed near the hind angle by the zigzag subterminal line. Along the costa to the t. p. line then including the ante-apical and apical spaces, light brown; below the two spaces the same dark brown as in the posterior part of wing; hind wings deep red crossed by two black bands of which the outer is the widest, fringe white; underside of fore wings base black, between this and median band red, between median band and outer band yellowish white. Hind wings similar to upper surface.

## CATOCALA NEOGAMA, Gue.

Expanse of wings 3.25 inches. Thorax light gray; abdomen brown. Fore wings pale gray, with two oblique grayish white bands that extend from the costa to the middle of the wing, the first outside the t. a. line, the second inside the t. p. line, the latter with a tinge of brown in its lower part that extends across the t. p. line into the sub-terminal space. Transverse line dark brown. Hind wings yellow with two black bands, the outer wide, the median expanded in the middle, the yellow between them narrowest. Apical spot and emarginations yellow, fringe yellowish white. Under side light yellow with the black bands rather wide, darkest on the hind wings.

*Catocala neogama*, Abb. & Sm.

Expanse of wings three inches. Thorax gray, abdomen brownish yellow, color of fore wings gray, with brown shades, markings dark brown varying in distinctness in different specimens. The principal brown shadings are along the t. a. line, the reniform and the sub-terminal space. The sub-reniform is usually a lighter shade of brown. Hind wings dark yellow with two black bands that do not quite extend to the inner margin, the median line the narrowest. Fringe and apical spot yellow. Under-side yellow, the apex grayish, the fore wings crossed by three, and the hind wings by two irregular black bands.

## PHALÆNIDÆ.—Span or Measuring Worm Moths.

The Geometrids or Measuring Worm Moths may generally be known from others by the following characters: The body is slender, covered with fine and rather closely appressed scales; the wings are broad, thin, and when the insect is at rest are spread out horizontally, the fore wings but little overlapping the hind wings. In a few species the wings are abortive in the female. Antennæ usually pectinate; palpi short and slender; colors seldom strong, mostly delicate pale gray, green or yellowish. They often fly by day in shady places.

The larvæ have rarely more than ten legs, a few having twelve and some fourteen. Thus from the absence of legs in the middle of the body they loop up that part when walking, whence the common name, Geometrid or Measuring Worms. If disturbed they will generally let themselves down by a silken thread, for which reason they are often called Drop-worms. When at rest many attach themselves by means of their hind legs to a twig or leafstalk and hold the body out straight and motionless, mimicing a stem or twig which is of service in protecting them from their enemies. In pupating they are not uniform, some changing into chrysalids in the ground, some forming a loose cocoon in leaves loosely fastened together, and according to Harris, some are naked like the butterflies. The following species are likely to be met with as injurious in different parts of the state:

## PETROPHORA DIVERSILINEATA, Hub.

This commonly distributed species is to be found from June to August entering houses at night and settling on walls with its abdomen curved over its back. It varies in size in expanse of wings of a little more than an inch and a quarter to over two inches. The body and wings are light ochreous-yellow, often pale in the middle and basal portions. The fore wings are crossed by three rust brown curved lines, the outer strongly dentate in the middle. Beyond this is a sub-terminal faint line, not always distinct. The hind wings are paler than the fore wings, clear, usually without lines, except in the outer third near the anal angle, where there is a faint brown line edged on the outside with white. At the anal angle is a dark spot composed of two brown lines, with violet brown between them. The caterpillar varies from green to brown, spotted above, and the head larger than the first segment. It feeds on grape leaves.

## EUFITCHIA RIBEARIA, Fitch.—The Gooseberry Span-worm Moth.

This species has been known to writers generally as *Allopiia ribearia* or by some as *Abraxus ribearia*, until the creation of the new genus *Eufitchia*, by Packard, in his late monograph of this family. The caterpillar is, when full grown, about an inch long, of a bright yellow color, with lateral white lines and numerous black spots and round dots. The head is white, spotted with black. These worms may be seen on gooseberry and currant bushes soon after the leaves open, more or less of them being found every year. It occasionally occurs in such numbers as to strip the bushes of their leaves, as it did in the vicinity of Chicago in 1862, and a few succeeding years.

The moth is a pale ochreous yellow with a submarginal row of smoke colored spots on both wings, the middle of the wings being shaded with the same.

In the latitude of Southern Illinois, the worms attain their growth about the first of June, when they descend to the ground and transform to brown chrysalids, just beneath the surface. The pupa state lasts about fourteen days, when the moths emerge to lay their eggs on twigs, where they remain till the following spring.

*Remedies.*—Of the numerous remedies that have been recommended a dusting of the bushes with a white hellebore powder is probably the best. Of course, in dusting the bushes, the operator should stand on the windward side so as not to inhale the powder, as the irritating effect upon the nostrils would be unpleasant. If the bushes are trimmed up from the ground, the worms may be shaken off and killed.

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DYSPTERIS ABORTIVARIA, Herr. Sch.

I found the caterpillar of this species the fore part of August last, as a green worm, rolled up in a grape leaf, upon which it was feeding. In a few days it went into the dirt of its cage to undergo its transformations, and in due season the green moth appeared. This expands about seven-eighths of an inch, is of a pale green color, with an oblique light line running through both wings, but may be easily known from all similar colored geometrical moths, by the great difference in size of the fore and hind wings, the fore wing being rather large, while the hind wings are not more than half as large as might be expected when compared with other moths of the same genus.

SYNCHLORA RUBIVORARIA, Riley.—The Raspberry Geometer.

In his first annual report of the Entomology of Missouri, Professor Riley describes this species, stating that it had been numerous during the preceding season in parts of southern Illinois. The caterpillar is light yellowish gray, a little over three-quarters of an inch long when full grown, and lives upon the fruit and leaves. It has, as Riley says, "the peculiar faculty of thoroughly disguising itself with pieces of berry, seed, pollen, and other *debris* of the fruit, which it sticks to a series of prickles with which it is furnished. Add to this disguise the habit which it has of looping itself into a small ball and it almost defies detection. It is most numerous during the months of June and July."

The moth has an expanse of wings of half an inch, is pale green color, with two transverse light lines running parallel with the outer margin.

ANISOPTERYX AUTUMNATA, Pack.—The Fall Canker Worm Moth.

This species, called by some writers *A. pometaria*, is a little larger than the Spring Canker Worm, but has a similar habit, and like that species the larva not only strips apple trees of their foliage when they are abundant, but attacks elm, cherry, peach, etc.

The male moth is gray with an ochreous brown tinge, and usually is a little more glossy than the *vernata*. The fore wings have a distinct white spot on the costal edge and are crossed by two broad whitish bands, somewhat zig-zag and accompanied with a few blackish dots. The hind wings also have a faint light line. The female moth is wingless, so-called, or the wings reduced to two little ear-like appendages on each side of the body, back of the head. In color she is uniformly dark ash gray, paler beneath, the antennæ naked and the legs and abdomen smooth and glistening.



The moths issue from the ground late in the fall, or they may continue to come out during mild days through the winter. The females crawl up the trunks of trees, and after pairing with the males deposit their eggs in masses of from 100 to 200 each on the surface of the twigs or trunks of the trees. These remain through the winter to hatch in the spring with the opening of the leaves, upon which the young larvæ feed with such avidity that a tree may be stripped of its leaves before their presence is suspected. The larva is pale whitish green as a ground color, with a broad, brown, dorsal, median band and three lateral white lines, the middle of which is fainter than the other two. Below, there is a broad brown stigmatal line, and below that a broad white line. Body beneath, flesh colored; head brown. This species has twelve legs, six abdominal prolegs besides the six true thoracic legs. Of the prolegs, the anterior pair are much smaller than the others, there seeming to be a tendency in them to become abortive.

When full grown this forms a cocoon of tough silk beneath the surface of the ground, the outside somewhat interwoven with the surrounding dirt, from which the moth in due time issues.

*Remedies.*—The remedies that will apply to the Spring Canker worm will in a measure apply to this species, such as the traps of tar, printer's ink, the muslin on tin traps, etc., with the same force; but where fall plowing is recommended as a means of breaking up the cocoons and exposing the naked chrysalids to the action of rains and freezing temperature, or to expose them to the attack of birds, will not apply to this species, for the reason that the cocoons are of such tough material that plowing will not break them open, hence they would sustain no injury by such a process. The egg masses may be sought and destroyed before they hatch in the spring where their presence the preceding season would lead us to apprehend danger.

There is a little consolation to the orchardist in treating an orchard for this kind of an insect, and that is where the female is wingless the migrations of the species must be slow, confined to the distance the mother moth may crawl, and the accidental carrying of the egg masses, hence with the proper application of means that may be employed their spread may be stayed and the insects even destroyed.

#### ANISOPTERYX VERNATA, Harris—The Canker Worm Moth.

The character and habits of this species have been so well written up in Dr. LeBaron's second report that but little need be said here further than to give a brief general description of the species. The worm resembles the preceding in many particulars, but differs some in the stripes and has but ten legs instead of twelve. In length this is from .70 to .80 of an inch, while the Fall Canker worm is about .90. In this there are four pale longitudinal lines on each side of the body instead of three, there being no broad dark dorsal stripe, and the head is distinctly mottled.

This species pupates in the ground like the preceding, but the cocoon is not so strong and tough, and the moth does not issue till spring. The male of this is pale and colored, the fore wings are crossed by three interrupted black lines, consisting of black dots on the costa

and veins; the hind wings are clear without any mark except a discal dot. The female is pale gray, wingless, with a dark stripe along the back, sometimes consisting of two black lines with a white line between them or a row of white dots. Legs spotted and ringed with black. This is a more decided apple insect than the Fall Canker worm, as that seems to prefer elm when attainable, but while this will feed on other kinds the apple leaves are preferred. The eggs are deposited in March just as soon as the first mild days of spring warm insect life into activity, not on the twigs and smooth branches, but on the rough parts of the tree where the scales of bark may form a protection from the storms. This is because they are not covered with a thick coat of varnish that renders them impervious to water as is the case with some other kinds. These hatch about the time the leaves come out, or some time in April or the fore part of May, as Dr. Harris says "when the red currant is in bloom." They attain their growth in about a month, when they let themselves down from the tree by a thread and enter the ground to undergo their transformations.

*Remedies.*—Only a summary of these need be given here. Like most other caterpillar foes, birds and predacious ground beetles help man in keeping them in check. Of the artificial means that have been from time to time recommended, the following seems to be the most desirable as embracing simplicity with lightness of expense.

First—To prevent the females from ascending the trees to deposit their eggs, a band of coarse cloth, six inches or more wide, may be put round the tree and then smeared with tar or a mixture of tar and molasses.

Second—A hay rope may be put round the tree and over this a ring of tin wide enough so that there will be free tin below the rope, and the whole securely fastened, being careful that there are no crevices between the tin and the tree through which the insects may pass. The tin should be smeared on the inside with a mixture of castor oil and kerosene. In both these cases the moths will lay their eggs below the bands if prevented from going above them. To insure success, these should be sought and killed, as if allowed to hatch, it will be much more difficult to keep them from ascending the trees than it was the moths.

Third—When the worms are already in the tree, if the trees are not too large, a sudden jarring will cause them to be detached from the leaves or twigs, and hang suspended, when they may be swept down by passing a switch between them and their support, and they may be destroyed.

Fourth—Washes of Paris-green and other substances may be resorted to when they are in the tree, but it is probable that where the tree is small enough to make the application of washes practicable, a few times jarring will answer the same purpose.

Fifth—If the worms have entered the ground and changed to chrysalids, fall plowing will, if the ground be mellow, break up their slender cocoons, and expose them to the action of the weather which, with the birds, will destroy most of them.

## PHIGALIA STRIGATARIA, Minot.

The fore part of June of the past season, I found a larva of this specimen feeding on roses at Carbondale. It was then full grown, and soon entered the ground and transformed to a brown, slightly pubescent chrysalis. The worm was about an inch long, dark color with light dorsal and lateral lines; the dark being shaded somewhat by interrupted faint light lines. The dark color was brown or dusky reddish brown, while the light was dirty white or gray on the back, and dirty yellow on the sides. I am told by Mr. C. E. Worthington, of Chicago, that this caterpillar feeds on elm in that vicinity. The worms change to chrysalids in June, and the moths emerge the following March.

Like the Canker worms, the females of this species are wingless, but the wings are more developed here, reaching to the posterior edge of the second abdominal segment. The males are pale ash colored with dark brown specks and lines, these forming three blackish transverse lines across the fore wings, with a subterminal whitish line. Hind wings whitish, finely dusted with dark scales. Antennæ well pectinated. Expanse of wings in males from 1.35 to 1.60 inches.

The females are, according to Packard, light stone gray, with an indistinct double row of dorsal black spots. The species is rare and not likely to become injurious.

## PHIGALIA (?) CINCTARIA, French.

On the 28th of last May, I found a gray geometrid worm, about an inch long, banded transversely with a number of white bands, on an apple tree in an orchard belonging to Mr. G. W. St. John, of Irvington. June 6th the worm moulted, when all but one of the white bands were replaced by dark brown, the ground color remaining the same. It was now about an inch and a half long. By the middle of the month it ceased eating and entered into the ground and transformed into a robust, dark brown chrysalis, a little more than half an inch long, thickly covered with coarse punctures, with two short divergent bristles at the tip. This remained in the dirt through the winter, and produced a wingless female moth the 27th of March, 1878. This differed so much from the known females of this group that I sent it to Dr. Packard for identification, who replied that "it is entirely new to me and a good deal of a puzzle, as I do not know to what genus to refer it. It is allied to the female of *Phigalia* more than to *Anisopteryx* or *Hybernia*." As the males of all the other wingless species of the group are known, I will provisionally place this in the genus *Phigalia* until the male may be found and the generic characters of the species can be more fully determined. If, in the meantime, it should prove to be injurious to the apple trees, its habits being similar to the Canker worm, the remedies that are applicable to that species would be equally so with this.

*Spec. Char. Moth.*—Wingless female. Length .75 of an inch, the exserted oviduct .25 of an inch more. Color light gray with a very slight olive tint, and irregularly mottled all over with black, the spots large above, but fine below; the thorax nearly uniform black, the head grayish black, the clypeus black, antennæ black, annulated with the ground color of the body; divisions between the segments of the abdomen pea green. The hind wings reach to the back part of the first abdominal segment, the fore wings to the middle of the same segment. Feet and legs are grayish black, joints annulated with gray. The exserted oviduct consists of two joints, the last third of the last joint having the hairs perpendicular to the joint. Head short, scarcely to be seen from above, rather wide between the eyes; palpi very short.

*Chrysalis.*—Length .55 of an inch besides the bristles. Dark brown, coarsely punctured, the divisions between the abdominal segments finely punctured; ending in a conical segment which is smooth at the end and tipped with two short, stout, divergent bristles.

#### NEMATOCAMPA FILAMENTARIA, Gue.—The Strawberry Geometer.

In June, or earlier in the southern part of the state, a wood colored measuring worm with two long fleshy filaments arising from the middle of the body, may be found feeding on the strawberry and currant. The head is red with some spots of the same hue on the body. This curious worm produces a little pale ochre colored moth measuring about an inch across the wings with brown lines crossing the wings, and an outer border of dull brown that is continuous across both wings except the apical portion of the anterior pair. They are never sufficiently numerous as to cause much injury.

*Spec. Char. Moth.*—Pale ochre, with brown veins and transverse lines, a brown inner line, much curved, an outer sinuate line, with a supplementary line just inside, touching the outer line on the submedian vein and in the extradiscal space, and forming a large circle, one side of which touches the outer line. Beyond this line, the border of the wing is dull brown, with the apical region clear. Hind wings streaked transversely as on the fore wing, with the outer third brown, apex included. Expanse one inch.—Packard.

*Larva.*—Body cylindrical, head large, with two unequal pairs of long, slender, fleshy filaments, situated on the third and fifth abdominal rings, the posterior pair shorter than the others, curled at the end and finely tuberculated. Head pale rust red, marbled with a still paler hue. Head full on each side of the median line, flattened in front. Half way between the metathoracic legs and the first pair of filaments are two sub-acute tubercles, which are rust red. When the four filaments are uncurled they are as long as from the head to the tubercles. The anterior pair of filaments are pale rust red beneath at base, brown above, but tipped with white. A distinct dorsal line from the prothorax to the second pair of filaments; a pair of small tubercles next to the last segment, tipped with pale rust red. Body wood colored above and beneath; thoracic rings greenish above, suc-



ceeded by pale rust red between the tubercles and the first pair of filaments; behind these, variously marked with light and dark brown. An oval dark spot behind the last pair of tubercles and extending into the anal plate. Anal legs rusty, lined above with a whitish line. Length .70 of an inch.—Packard.

#### ANGERONA CROCATARIA, Fab.

This beautiful moth may be found from July to September, at twilight. It expands about an inch and a half, the wings and body are bright yellow, the first spotted with pale reddish brown, and crossed by a broad broken band of the same color a little beyond the middle. On the fore wings, midway between this band and the body is another band more broken than the outer one and the spots of which it is composed are smaller. It is one of the brightest colored of the geometrid moths.

The larva is, according to Packard, when full grown an inch and a half long, the body gradually increasing in size to the first pair of abdominal legs, the head flattened so as to be square above, whitish green with three longitudinally brown lines. The first segment of the same color with two of the brown lines extending across and uniting at the posterior part and forming an inverted V. The rest of the body is pale grass green with the sides swollen; four minute black dots, a whitish, indistinct subdorsal line and a lateral white line. It feeds on the currant and strawberry in May or June according to the latitude and season, but not generally injurious.

#### ENDROPIA BILINIARIA, Packard.

Further than the fact that the larva of this species has been found feeding on oak, little is known of it, though the moth is occasionally taken by collectors. It may be briefly described as follows.

*Spec. Char. Moth.*—Expanse from 1.30 to 1.65 of an inch. Color of wings and body clear fawn or yellowish brown, the costa of the fore wings paler and having more of a yellowish hue than the rest. There are two pale bands extending transversely across the fore wings parallel with the outer margin, the outer band edged on the outside and the inner on the inside with a fine brown line. The two bands are separated by a brown shade. Male antennæ heavily punctured. The hind wings are marked like the fore wings, except that the inner transverse band is wanting. The outer margins of both wings are dentate, the middle of the fore wings also somewhat angled.

#### EUGONIA SUBSIGNARIA, Hub.

This species is pure white, the wings entire in the male, but dentate in the female, expanding a little over an inch and a half. It may be known by the "snow white body, angulated fore wings and

notched hind wings," and the heavily pectinate antennæ of the males. In Packard's Monograph of this family it is stated that the caterpillar of this moth is very destructive to the elm in New York and Philadelphia. I have not noticed them feeding on that tree, but have twice found them feeding on the apple, upon the leaves of which I have reared them to the perfect insect. In neither case were they numerous.

The larva is grayish brown, about an inch and a half long, with head red and two darker brown transverse slightly elevated lines on the back, one a little before and the other a little past the middle, the under side of the feet green. When at rest it is stretched out full length with both ends attached. It pupates in June by loosely drawing together leaves of the tree upon which it feeds, in which it changes to a chrysalis in a loose web of silk, or it may attach its loose web to the side of any substance that will offer support. The moths issue in a little more than a month.

#### CABERODES CONFUSARIA, Hub.

This very common species expands an inch and a half, whitish ochreous, rather thickly specked with pale brown spots, and has quite a prominent brown line from near the apex of the fore wings to a little past the middle of the inner margin of the hind wings. The apical end of the line is usually obsolete, but when present it does not go to the apex, but the end bends to the costa at right angles. Inside this line there is a faint thread-like line on the fore wings half way to the body. The antennæ pectinate.

#### EUTRAPELA TRANSVERSATA, Drury.

This is a little larger and darker than the preceding, but has the dark brown line running across the wings in the same manner. The wings are acutely angled in the middle of the outer margin, the hind wings extending a quarter of their length beyond the tip of the abdomen. Wings and body fawn color, in fresh specimens rather dark, and sometimes frosted over and varying to ochreous, more or less striated with brown. Besides the prominent transverse brown line there is also a faint inner line generally present, on the fore wings, composed of two scallops meeting on the median vein. Outside the brown line there is a shaded band composed of diffused spots, parallel with the line in the hind wings, but in the fore wings running from the hind angle to the brown line which it meets a little in front of the middle of the wing. Antennæ not pectinate, only slightly ciliate in the males. The writer has reared this on Pepper Grass (*Lepidium Virginicum*) and Knot Grass (*Polygonum aviculare*).

## PYRALIDÆ.—Snout Moths.

The common name is given to this family on account of the long, slender, compressed palpi, and by this character they may usually be known. The wings vary somewhat, but in the most of them the fore wings are triangular, and when the moth is at rest, they form together a triangle resembling the Greek letter Delta, whence they are sometimes called Deltoids. The antennæ are sometimes simple, at others pectinate in the males, or hairy. The legs are rather long and slender, the front pair often tufted. The moths are to be found in moist grassy places; are readily disturbed by day; mostly fly in early twilight, while some are true day flyers. Only those few injurious species that may be met with in the State, will be mentioned here.

## HYPENA HUMULI, Harris.—The Hop-vine Moth.

I have not seen this species or its work for several years, hence will draw largely from the matter of others for my use here. Rev. C. J. S. Bethune, in the Report of the Ontario Entomological Society for 1872, says of this, "In the month of June, earlier or later, according to the season, the hop grower may frequently observe the leaves of many of his vines riddled with holes, or eaten down to the ribs. On inspection he finds a small caterpillar at work, pale green in color, with a dark, almost blackish longitudinal stripe on the back, and two narrow white lines on each side. Sometimes these lines are wanting. The body is long and slender, with its rings or segments very prominent; each segment is furnished with two transverse rows of black dots, from each of which proceeds a short hair. The head is rather deeply divided into two lobes, and is covered with similar dots and hairs. The mouth is yellowish, with the jaws tipped with black. Unlike the majority of caterpillars, this creature is furnished with only seven instead of eight pairs of legs, being destitute of the first pair of prolegs beneath the middle of the body. The result of this deficiency is that the caterpillar is obliged to loop itself up to a slight extent when crawling, though not to the same degree as the Geometer or measuring worms. When fully grown, it is over half an inch in length. It is a particularly active creature, and when disturbed jerks its body from side to side, and leaps from one spot to another; it is also able to let itself down from its leaf by a fine silken thread. After it has attained to maturity, it descends to the ground, and crawling into any crevice or other place of concealment, forms a slight silken cocoon and changes into the chrysalis state. In this condition it remains for a fortnight, or three weeks, and then comes forth at the end of June or early in July, as a dusky brown moth, measuring an inch and a quarter across its expanded wings. The fore wings are

marbled with gray behind the middle, and have a distinct gray spot on the tip; they are crossed by two wavy blackish lines, one near the middle and the other near the outer margin. These lines are formed by little elevated black tufts, and there are also two similar tufts on the middle of the wing. The hind wings are dusky brown or light brown, with a pale fringe, and are without bands or spots."

There are two broods of the caterpillars in a season, the first appearing as before stated in June, the second in July and August, the moths from the last issuing in September. If the insect should be found as far south as Southern Illinois, it is probable there would be three broods.

*Remedies.*—Drenching the vines with strong soap suds has been recommended for this insect. In this case cresylic or whale-oil soap would probably be more effective. Powdered white hellebore mixed with water—an ounce of the powder to a pailful of water—may be showered on the vines. By jarring the poles around which the vines twine many of the worms will fall to the ground when they may be killed. If this is done twice a day for a few days the worms may be destroyed without the use of any chemical.

#### PHILOMETRA SERRATICORNIS, Grote.

In the early part of the season when the grass has attained six or eight inches in height there may be found at its roots hiding among the preceding years dead blades, a small gray striped worm that feeds a few days longer and then changes to a light ochreous brown chrysalis in the merest semblance of a cocoon. This consists of a few threads of silk connecting bits of leaves or stalks or any other objects that may answer the purpose, in which the chrysalis is suspended, the object seeming to be to raise it a little from the ground instead of protection. In June these chrysalids produce brownish gray moths expanding about an inch when the wings are spread. The fore wings are crossed by three transverse brown lines and a central brown shade, the outer or subterminal line wavy, the others strongly bent outward. The hind wings are less brown and contain only two transverse lines. In the males the antennæ is pectinate and the front legs are tufted with long gray hairs. These moths provide for another brood of the worms in July, the moths coming out again the fore part of August.

Last summer when grapes were nearly full grown, they were, in various parts of Washington county, affected by rot that began in a little brown speck, that as it increased in size became flat, partially dry, and presented in the centre the appearance of having been stung. I gathered a handful of these and put them in a jar with sand in the bottom and waited the result, but was a little surprised to find after a time a number of the larvæ of this insect feeding on the grapes inside the jar. These passed through their transformations and produced the perfect insects the forepart of August, seeming to be very little discommoded by their confinement, and thriving as well upon the grapes as did those I had reared the forepart of the season upon the grass, grain and weeds I had fed them. Before leaving this subject I



might state that at Irvington all varieties of grapes were affected by this kind of rot, the Concords perhaps the most so, with the single exception of one vine that had made its way up into a maple tree. Even on this the clusters that were not more than ten feet from the ground were injured, but above that height the grapes were all sound. As to the cause of the rotting or what connection these worms had with it I have nothing to offer further than a simple statement of the facts, as the results of a single experiment are not sufficient to warrant conclusions to which they might seem to point.

*PYRALIS FARINALIS*, Harris.—The Meal Snout Moth.

The caterpillar of this species is dull whitish, with a reddish brown head, and with reddish prothoracic and anal plates. Dr. Harris says of this that it may be found in old flour barrels, but according to others it feeds on corn, straw and clover. The moth expands about three-fourths of an inch, is reddish gray at the base of the fore wings and the terminal space the same color, the last traversed by a light streak. The middle of the wing between these parts is ochreous, bounded by white transverse lines, the outer wavy. The hind wings are gray, crossed by three more or less distinct white lines, and with dark patches about the anal portion.

*ASOPIA COSTALIS*, Fab.—The Clover-hay Worm.

This insect is pretty widely distributed over the country, the larva being known as the Clover-hay Worm, on account of its attacking and spoiling clover hay while in the stack or mow, rendering it unfit for feeding to stock. In the Sixth Missouri Report Prof. Riley gives an extended account of its operations, from which a few of its habits may be gleaned. The worm interweaves the hay with masses of its silken web and black excrementitious powder, frequently making it so dense as to appear mouldy, while if taken up it will be found matted together. A number of instances are on record of hay in the bottom of stacks or mows, especially where the hay has been summered over, being completely destroyed, while the chaff and chopped-up stalks would be found alive with the worms.

There are probably two or more broods of the worms in a season. These are from five-eighths to three-quarters of an inch long when full grown, of different shades of olive brown, a little darker at the extremities than in the center, and taper a little from the middle. They generally dwell within a delicate cylinder of silk in a manner similar to other species of this family. The moth measures three-quarters of an inch across the spread wings, is a delicate lilaceous purple, with two spots on the front edge of the two fine lines on the hind wings, and the fringes a rich golden yellow.

*Remedies*—As the worms feed on dry clover they must be confined in their operations to such unfed hay as remains over from the pre-

vious year. For this reason new hay should not be stacked in contact with old, and in storing clover hay in barns the old should be examined, if any is left over, before any new is put in. In case they are found present in the old hay in great numbers, the old had better be taken out and the mow thoroughly cleaned out before any new is put in. Of course it need not be expected that where clover has been put into a barn only one season, and a little left over, that the worms should make their appearance in such numbers that much damage could be done; but where, from year to year, hay, either wholly or partly clover, has been stored in a barn and the bottom of the hay never cleaned out, it is obvious that they may so multiply in this undisturbed mass at the bottom as to ruin more or less of the new crop before it is used. Salting the hay as it is put in the stack or mow, as is often done, not only prevents mouldiness but may prove an antidote for the worms. There are experiences that seem to be against this, but the trials may not have been thorough.

*AGLOSSA PINGUINALIS*, Harris.—The Grease Moth.

I have not seen this, but Packard in his Guide says of it, "the palpi are rather long, the fore wings are grayish brown, clouded with a darker hue, and are crossed by two indented lines. The larva is of an uniform dark brown, with a darker head and prothoracic plate, and feeds on greasy horse cloths, etc."

*BOTYS FLAVIDALIS*, Gue.

There are several species of this large genus found in different parts of the state, but they are of little interest except to collectors. They are generally some shade of yellow, often brownish, and crossed by dark transverse lines, the palpi not longer than the head, and the tip of the abdomen extending back beyond the hind wings. The species here named is perhaps the most common.

Expanse of wings 1.15 inches. Color pale ochreous yellow, with a slightly brownish tinge on the front part of the fore wings. The fore wings are crossed by five somewhat wavy brown lines, the second, third and fourth continuous across the hind wings. Discal dot brown.

*DESMIA MACULALIS*, Westwood.—The Grape-leaf Folder.

This moth is shiny black with the fringes and patches in each wing white. The male and female differ from each other in the former, having the antennæ elbowed and thickened in the middle, with white patches on the wings, two in each fore wing and one in the hind wing, while the female has two white transverse bands on the abdomen, two patches to each wing, and the antennæ simple.

The larva is of a grass green color, very active, wriggling itself away very much like a tortrix caterpillar if touched. They feed on grape-vines, folding the ends or edges of leaves inward and fastening loosely with silk while the caterpillars remain within the enclosure. There are with us two broods of the moths in a season, the first in June, producing worms in July, and the second in August, the progeny of these passing the winter in the chrysalis state. These are formed within the folded leaf that was the habitation of the worm.

*Remedies.*—The chrysalids or worms within the folded leaf may be crushed between the two hands which will be, where there are but few vines, a good means of destroying them, but in a vineyard this would be tedious. By going over a vineyard in the fall before the leaves drop off and picking off and destroying all folded and crumpled leaves would destroy the June brood of moths and with that the next years worms. This however to be effectual should be done by all whose vines are affected, to accomplish the object sought for the moths may readily fly from one vineyard to another. There are several natural enemies that prey upon these worms.

PHYCITA (ACROBASIS) NEBULO, Walsh.—The Apple-leaf Crumpler.

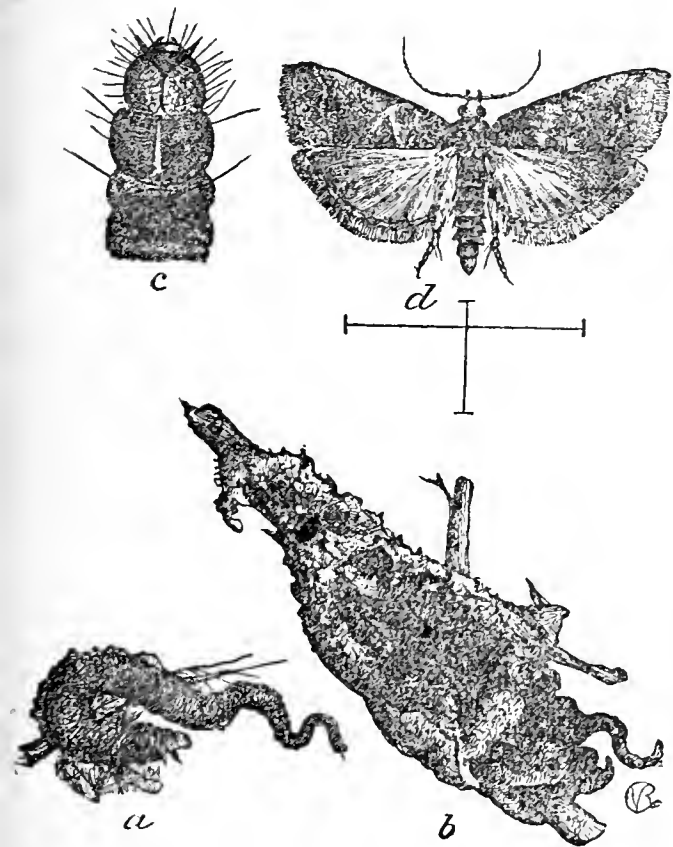


Figure 46.—Apple Leaf Crumpler.

More or less bunches of crumpled leaves are to be seen every winter remaining on apple trees after the leaves have fallen. An examination of these shows that several leaves are fastened together with a web and that they contain one or more twisted horn-like cases, enclosing small reddish brown worms, the whole securely attached to the twig by silken threads. These are the larvæ of this moth that thus hibernate in a half grown state to complete their growth by feeding on the young leaves as they open in the spring. They undergo their transformation in the case, and come out as moths in June, varying with the latitude. There is but one brood in a season, the worms from the eggs deposited by the

moths that come out in June becoming the partly grown worms that are found in the cases through the winter.

When full grown the caterpillar is often of a dull green color, the head and top of first segment a little darker than the rest of the body, and it tapers gradually from the first to the last segment. The moth has the fore wings pale ash gray, variegated with light and dark brown; the hind wings being more dusky. The male may be known from the female by a little tuft on the basal joint of the antennæ.

*Remedies.*—There are several species of insects that are parasite on the Apple-leaf Crumpler, and on account of these, orchards are not often seriously injured by them; but sometimes young orchards become so covered with them as to interfere with the growth of the trees. Then the crumpled leaves may be picked off in the winter or early in the spring before the leaves come out and the worms destroyed by crushing the cases or burning. A somewhat better plan has been recommended of taking the crumpled masses containing the cases to some distance from the trees, and leaving them in a pile where they can find no food. The worms will starve, but the parasites they might contain would be preserved to help destroy the future brood.

*Spec. Char. Moth.*—Expansion of wings .70 of an inch. Length of body .30 of an inch. General color light cinereous, varied with dusky. A row of about seven subsemilunar or linear dark spots on outer margin of fore wing. Then one-fourth of the distance to the body a waving light cinereous band parallel to the exterior margin, marked on each side with dusky black. Nearly at the center a much abbreviated black band. Beyond the center on the costal margin a subtriangular dusky black spot, the apex of which connects with the apex of a much larger subsoletole triangular brick red spot which extends to the interior margin, and is bounded on the outside by a wavy light cinereous band, which is again bounded by a wavy dusky black band proceeding from the apex of the costal triangle. Base of wing dusky black, enclosing a small round light cinereous spot. Hind wings and all beneath light cinereous, shaded with dusky, the fore wings darker. Tarsi dusky, with a narrow light cinereous fascia at the apex of each joint. Hind tibia fasciate, with dusky at the apex, sometimes obscurely bifasciate. Intermediate tibia fasciate with dusky at the center, the fascia generally extending to the base, but becoming lighter. Anterior tibia dusky, with a narrow apical light cinereous fascia. Palpi, both labial and maxillary dusky.—Walsh.

Besides the apple, this insect may be found on the cherry, quince, crab-apple and plumb.

PHYCITA (ACROBASIS) JUGLANDIS, LeBaron.—The Walnut-leaf Crumpler or Case Bearer.

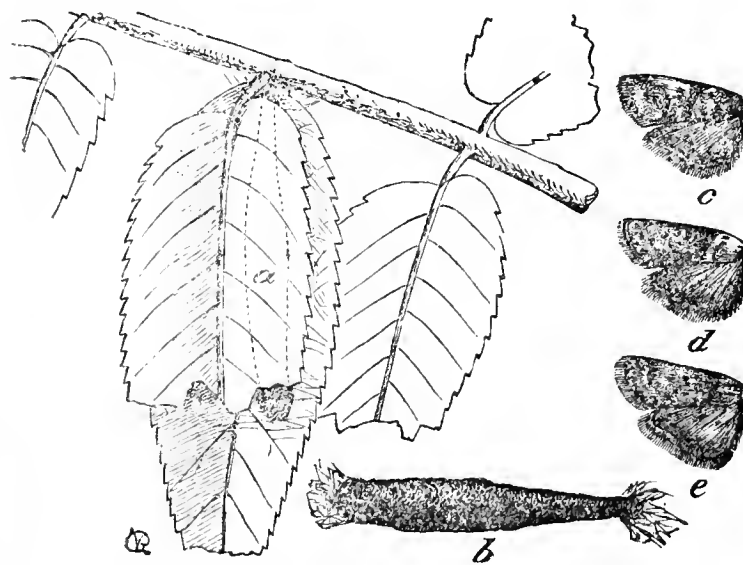


Fig. 47.—The Walnut-leaf Crumpler.

The leaves of black walnut and hickory are sometimes eaten by a case bearing insect very much resembling the preceding save that it is a more uniform dull green and its case is straight instead of horn shape. It attaches the small end of its case to the leaf stalk between two leaflets, usually about the middle of the leaf, and fastening the leaflets together with silk, feeds upon their tips while the remaining portion forms a protection and shelter. The



case, like that of the Apple-leaf Crumpler, is composed of excrementitious castings compactly woven together with silk, and the whole lined with the same material. Before winter sets in or the leaves fall, the worm partly grown removes its case from the leaf stalk and attaches it to the twig where it passes the winter to finish its growth in the spring.

The moth very closely resembles the one from the apple, so much so in some specimens that were it not for their different habits and food plants they might be regarded as different forms of the same species. In the annexed cut, *c* shows the characters of *P. nebulo*, a variety of the same bred from crab-apple, while *d* represents the wings of *P. juglandis*, the colors being the same. Dr. LeBaron in his description of these insects in his second report says of this, "The principal interest that attaches to it is its close relationship to the species just described involving the curious question of identity of species, under diversity not only of the coloration of the imago, but also of the food plants and habits of the larva." Without entering into the discussion of this question it is evident, whether we compare these two species or many other closely related ones that may be found in this and other orders that the perplexing question of the definite limits of species is not settled nor can it be settled without a more complete knowledge of their habits and forms in all their states than we now have.

#### MYELOIS CONVOLUTELLA, Zell.—The Gooseberry Worm.

This has been known as *Pempelia grossularia*, being first described under that name by Packard, but in his "Guide to the Study of Insects" he uses the name I have adopted here.

I have not at hand specimens of this and will give Packard's description of the insect with its habits from his Guide. He says: "The moth is pale gray with a dark, transverse, diffuse band on the inner third of the wing, enclosing a zigzag white line not reaching the costa. There is a discal discoloration, and beyond, a white zigzag line with a long, very acute angle on the internal margin, and a row of marginal black dots, while the apex is white, and the veins and their branches white; it expands nearly an inch. As soon as the gooseberries and currants are well formed, many turn prematurely red and dull whitish, which is due to the presence of a pale green, smooth worm, which after eating out the inside of one berry, leaving a hole for the passage of the excrement, enters another berry making a passage way of silk until it draws together a bunch of currants or two or three gooseberries. During the last of June it pupates, while the moth does not appear until the spring of the following year." I know of no remedy unless the affected fruit could be gathered and destroyed.

#### PHACELLURA NITIDALIS, Cramer.—The Pickle Worm.

The caterpillar of this beautiful moth, known as the Pickle Worm, bores cylindrical holes into cucumbers, melons or squashes, causing

them to decay. The worm, a pale greenish yellow caterpillar with a pale reddish head, begins its depredations in July, and continues until the fore part of October. They bore into the fruit and eat the fleshy part, growing rapidly and attaining their growth in from three to four weeks. When about to change they leave the fruit in which they have burrowed, and, drawing together a portion of some leaves near the ground, spin a slight cocoon of white silk, in which they change to slender brown chrysalids. The earlier insects change to moths in eight or ten days, but the late ones remain in the chrysalis state during the winter. The moth that issues from these chrysalids is yellowish brown with an iridescent reflection, the fore wings having an "irregular, semi-transparent dull golden yellow spot" from the hind margin to the middle, and the hind wings, all but the outer border, semi-transparent yellow.

*Remedies.*—Cucumbers, melons or squashes found to contain these worms may be picked with the worms in them and destroyed.

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NOTE.—This worm is often very injurious to nutmeg melons or cant leups, and during the present season has destroyed quite a number in some parts of southern Illinois. After the worm is once established in a melon there is no remedy, and all such melons should at once be fed to the hogs or otherwise destroyed. It is possible that gardeners by learning to know the moths may be able to destroy many and thus lessen the destruction.—C. Thomas.

#### PEMPELIA HAMMONDI, Riley—The Apple-leaf Skeletonizer.

In the Sept.-Oct. number of the second volume of the *American Entomologist*, 1869, this insect is mentioned in answer to a question by H. K. Vickroy, of Champaign, as a new species that had been very abundant about Warsaw and Quincy the preceding year, as well as having occurred in some other places. The name by which it was there designated was "Hammond's Leaf-tyer," to distinguish it from the Apple-leaf Crumpler, which it somewhat resembled in some of its particulars, as well as because the insects had been first brought to notice by Mr. A. C. Hammond, of Warsaw, Ill. An account of the insect, and its manner of work, may be had from the 4th Missouri Report, where Prof. Riley says:

"In the fall of the year the foliage of trees in young orchards, and especially in the nursery, often wears a blighted, corroded, rusty look, and upon carefully examining it such appearances will be found to result from the gnawings of this little skeletonizer. A badly infested orchard or nursery presents such a decidedly seared aspect that it attracts attention at a great distance. \* \* \* The rusty appearance is produced by the worm feeding solely on the green pulpy parts of the upper surface of the leaf, and thus leaving untouched the more fibrous framework. In some cases the pulpy portions are eaten very thoroughly, so that nothing remains but the semi-transparent epidermis below and the net-work of veins; but more usually a certain amount of the parenchyma is left, and this it is which acquires a bright rust-red appearance. The worm always covers the leaf with loose, tender, silken threads, with which it mixes numerous little black, gunpowder-like, excrementitious grains; and it is under this covering that it feeds. It is semi-gregarious, either living alone on the leaf, or in company within a bunch of leaves tied together.

"The worm is usually of a brown color, marked on the back, but it varies from brown to pale yellowish brown or greenish. The markings are pretty constant, however, and the distinguishing feature consists of four conspicuous black, shiny tubercles, with a pale basal annulation near the head.

"The chrysalis is of a light brown color, with no striking characters. It is generally formed among the leaves, in a very slight cocoon and often in the folds made by a Leaf-roller, which is generally found, in company with it. In confinement I have known the worms to go below ground, where they cemented their cocoons on the outside with grains of sand."

The moth has an expanse of wings of a little less than half an inch. The fore wings are glassy purplish gray, with two transverse pale bands, the first about a third of the length of the wing from the body extends across to the hind margin, but the outer, a third further, only reaches about half way across. It is probable there is but one brood in a season, the moths issuing irregularly from May to July.

*Remedies.*—Prof. Riley speaks of having bred two species of Ichneumon flies from this worm, and also states that the larva of the Lacewing fly (*Chrysopa*) eat the worms. It is probable that we are largely indebted to these little friends in preventing the wide spread and rapid multiplication of this insect. Where they are present in young orchards or nurseries, hand picking would do much to lessen them. Air slacked lime may be dusted on the leaves, or what would probably prove more efficacious, some poisonous powder as hellebore or Paris-green properly diluted, may be used.

#### GALLERIA CEREANA, Fabr.—The Bee Moth.

This is the well-known Bee Moth, the larva of which, the Wax-worm, is the worst enemy the bee-keeper has to contend with. The male moth is of a dusky gray; his fore wings are more or less glossed and streaked with purple-brown on the outer edge; have a few dark brown spots near the hind margin, and are notched or scalloped at the end; the hind wings are light yellowish gray. The female is generally larger than the male and darker colored, the wings longer, and the end not so deeply notched nor so much turned up when closed. There are two broods of the moths in a season, the first in May and June, and the second in August, but the time of appearing of different individuals of the two broods vary enough so that the moths may be seen most of the summer, after they first make their appearance. During the day time the moths remain quiet, hid in some crevice of the hive or elsewhere, but as night approaches they become active, the females seeking a favorable place to deposit her eggs. If she cannot gain access to the inside of the hive, she will deposit the eggs in some joint or crack, and the young worm, as soon as hatched, readily makes its way into the hive, spinning for itself a silken tube for its protection. It cuts its way through the comb, feeding on the wax and destroying the young bees as it goes. Caterpillar ash gray above, yellowish white beneath, and tapers somewhat from the middle to the

extremities. When full grown it creeps into a corner of the hive, or into some out of the way crack or crevice, where it makes a tough white cocoon, mingled with excrement, from which the moth in time issues to provide for another brood.

*R medies*.—Moth-proof hives will be of little service in keeping out the worms as it is not necessary that the eggs be deposited within the hive that the worms gain an entrance. With only moderately strong swarms of bees, vigilance with properly constructed movable frame hives is the only way to obtain immunity from their ravages. A strong swarm of bees will to a great extent resist the attacks of the worms; while a weaker swarm will need the more care and attention. Prof. Riley suggests that a good way to entrap the worms would be to raise the front of the hive on two small wooden blocks and put a piece of woolen rag between the bottom board and the back of the hive. The worms find a cozy place of retreat under the rag where they may be sought and killed from time to time.

#### TORTRICIDÆ.—The Leaf Rollers.

As the name indicates, the larvæ of many species of this family roll up the leaves of trees or shrubs or other plants upon which they feed while they feed within the enclosure. While this is the case with the larger and best known species, some devour the interior of fruit buds and seeds or live in various other ways.

The moths are small, seldom having an expanse of wing of more than an inch. The palpi are short, projecting beak-like in front of the head, rarely curved upward. The fore wings are oblong, the hind margin about the length of the costal, the costa much rounded, the wing variegated with bands and spots, often of brilliant metallic hues. When at rest they are folded roof-like over the body. The hind wings are dull colored and the inner edges fold fan-like against the body when the wings close. Antennæ simple; legs much shorter than those of the preceding family.

#### TORTRIX MALIVORANA, Le Baron.—The Lesser Apple-leaf Folder.

In his first report, Dr. Le Baron describes this insect as a "pretty little bright orange, round shouldered moth, the larva of which is a small, greenish, naked caterpillar, with a pale, amber brown head and whitish incisions. In some specimens the whole caterpillar is of a pale brownish tint. Usually, one caterpillar, sometimes two or three, eats off the upper cuticle of the leaf, curling the two sides upwards till the edges nearly or quite meet and tying them together with a web. In this inclosure the little caterpillar goes through its transformations." The worms from which Dr. Le Baron obtained his moths were found on the fruit farm of Mr. D. B. Wier, of Lacon, and seemed



to never have been sufficiently numerous before to attract attention. There are two broods in a season, the first brood of moths making their appearance and depositing their eggs in the folds of the young leaves just as they open; the second brood appearing the latter part of July, depositing their eggs upon such leaves as had not been injured.

*Remedies.*—The remedy suggested by Mr. Wier consists in looking over the trees for the rolled up leaves and destroying them before the first brood of worms change to moths, before the middle of July. As the insect had not been injurious previous to 1870, and as the second brood of the next year did very little damage in Mr. Wier's orchard, we may suppose that climatic changes and insect parasites will usually render other means of fighting them unnecessary.

*Spec. Char. Moth.*—Length .30 of an inch, average expanse of wings .50 of an inch. Antennæ brown, annulated with whitish on each joint, most distinctly on the under side, first joint densely clothed with orange scales. Palpi orange, horizontal; the scales project around and beyond the end of the penultimate joint so as to form a little cup in which the small ultimate joint is inserted. Maxillary palpi rudimental. Tegulæ well developed, more than half as long as the thorax; head, thorax and fore wings bright orange. The orange scales which cover the wings are observed when carefully examined, or seen through a lens, to be mixed with numerous whitish almost silvery scales, so arranged as to form about ten indistinct, transverse sinuous or wavy lines. Hind wings, abdomen and legs whitish with silken lustre. There is a little plume of divergent scales at the end of the abdomen.—LeBaron.

#### TORTRIX CINDERELLA, Riley.—The Green Apple-leaf Tyer.

The larva of this little gray moth may often be found, with several other species, in company with the Leaf Skeletonizer, aiding in denuding young apple trees of their foliage. The caterpillar is of a uniform yellowish green color with the head and neck horny, and of a slightly more tawny color. The head is marked with a crescent shaped black mark on which are the eyelets, and another dusky spot at the base on the sides. "Like the preceding species it lives and undergoes its transformations within a leaf folded and fastened with silk. It may be known from the Skeletonizer by its wriggling away and dropping to the ground when disturbed which the Skeletonizer does not do. The moth expands half an inch, has the front wing ash gray without spots, while the hind wings are paler. The same remedies that would apply to the Leaf Skeletonizer would apply here.

*Spec. Char. Moth.*—Expanse of wings .50 of an inch. Fore wings deep glossy, ash-gray, immaculate. Under a lens they have an irrorate appearance, while in certain lights some of the scales appear to form a series of darker, transverse, sinuous lines. Also scattered over the wing may be noticed a dozen or more reddish scales, which are not sufficient, however, to destroy the uniform immaculate appearance. Head, mouth parts, antennæ, legs and abdomen, of same color. Hind wings paler and semi-transparent. Fringes of all wings concolorous.—Riley.

## TORTRIX RILEYANA, Grote—The Walnut Tortrix.

Prof. Riley in his first report describes small yellow caterpillars, spotted with black piliferous spots, as tying together, during the month of May, large bunches of the leaves of black walnut and hickory, within the folds of which they feed. They may be known from the Walnut-leaf Crumpler, that may be found in similar places, by the lighter color and the dark spots on the segments, and by not living within cases. These worms change to honey-yellow chrysalids the latter part of the month, which, by the middle of June, work their way out of the leafy fold containing them, by means of minute teeth on the back. They hang here by the tips of the abdomen until the moths make their escape. These have an expanse of wings of about an inch. The color is deep ochreous, with a slightly golden tint, the hind wings being lighter and more golden in hue than the fore wings. On each fore wing there are four double darker spots, from the middle to the base, forming two interrupted, transverse lines, there being a third line of spots near the outer margin.

Similar nests may be found on the snowberry (*Symphoricarpos vulgaris*), containing caterpillars resembling the ones on the walnut and hickory. These go through their transformations in a similar manner, and produce moths marked like those, from the first named trees, but paler. They are regarded as a variety of this species.

## LOZOTÆNIA ROSACEANA, Harris.

The larvæ of this species, a pale yellowish green worm, binds together the leaves of the rose, apple and strawberry, feeding like the others on the leaves inclosing them. Though this is its normal mode of operating, it will, according to the editors of the American Entomologist, sometimes eat off patches of the rind of growing apples, thus causing it to have a rusty appearance when the place dries. The worm is, according to Packard, "pale livid, greenish above, and paler beneath, with a conspicuous black dot on each side of the prothorax. The head is very pale honey yellow, with two black spots, one near the insertion of the mandibles, and the other on the side near the base of the head. The posterior half of each segment is transversely wrinkled a few times. The body is scattered over with a few minute tubercles, each giving rise to a fine hair. It is .80 of an inch long." The fore wings of the moth are pale cinnamon brown, crossed by two oblique bands of darker brown, and a triangular spot of the same color near the tip. The hind wings are ochreous, with the inner margin blackish. It expands about an inch. There are two broods of the moths in a season, the first in June or July, and the second in August.

*Remedies.*—The withered clusters of leaves may be picked off and the worms crushed if they become sufficiently numerous to be troublesome. This may be done on a few young trees, but would be a tedious job on a larger scale. It is possible that air-slacked lime dusted over the trees may be of service.

ARGYROLEPIA QUERCIFOLIANA, Fitch.—The Oak Leaf Tortrix.

For a description of this insect and its work, see Miss Smith's article in another part of this report. From a letter received from Dr. Boardman, before this goes to press, I learn that the estimates made by him in regard to the damage done by this tortrix are fully confirmed. I learned recently that Prof. Fernald has identified this as Zeller's *Tortrix trifurculana*, being a redescription by Fitch.

PENTHINIA VITIVORANA, Packard.—The Grape-berry Moth.

When the grapes are nearly full grown they are sometimes attacked by a small white worm with a cinnamon colored head that eats a winding channel through the pulp. It continues to feed upon the pulp until full grown, or the inside of the grape has been consumed, eating out the interior of the seeds as it comes to them. If one grape does not furnish sufficient food for it the caterpillar will eat into the second, fastening the second berry to the one whose interior has already been eaten out by silken threads. When full grown it leaves the grape and forms its cocoon on a leaf in a manner that seems peculiar to this insect, the method being thus described in the first volume of the American Entomologist. After covering a given spot with silk, the worm cuts out a clean oval flap, leaving it hinged on one side, and rolling this flap over, fastens it to the leaf, and thus forms for itself a cozy little house. \* \* Sometimes, however, it cuts two crescent-shaped slits, and, rolling up the two pieces, fastens them in the middle. And frequently it rolls over a piece of the edge of the leaf, in the manner commonly adapted by leaf-rolling larvæ, while we have had them spin up in a silk handkerchief where they made no cut at all."

Within this retreat the worm changes to a chrysalis, from which the moths emerge about the first of August. When full grown the worms are darker than when young, being either olive green or dark brown with a honey yellow head. The moths have the front part of the body fulvous, the hind wings and abdomen dark slate color. The fore wings are "dark slate brown. From the middle of the costa proceeds a blackish band, which curves to the middle of the outer third of the wing; beyond is a linear curved costal band, succeeded by another broader but quite short costal line; the costa is tawny beyond, sending a tawny patch obliquely inwards. Near the margin is an irregular blackish patch and two darker spots on the costa, and a larger one at the apex. It expands .40 of an inch."—Packard.

*Remedies.*—It is probable that the second brood pass the winter in the cocoons, and by destroying the dry leaves in the fall, by burning, will destroy many of the cocoons and lessen the number of worms for the succeeding year. The bunches of grapes that are infected may be

gathered and destroyed, as they may be easily known by their appearance, unless the grapes have been attacked by grape rot. As the worm feeds inside the berry, appliances of poisons to the vines will be of but little service, as they would fail to reach the insect.

ANCHYLOPERA FRAGARIÆ, Riley.—The Strawberry Leaf-roller.

In the number for December 1, 1877, of the *Prairie Farmer*, appeared the following communication from Prof. Thomas in regard to this insect in answer to a correspondent who had sent the insects to this office for identification.

“The insects sent by Porter & Bro., Mackinaw, were received in good order, having been properly and very carefully packed. There were none of the specimens in the perfect or moth state, but the caterpillar and its work as shown by the leaves sent and the statement of Messrs. Porter & Bro., are amply sufficient to determine without doubt, it is the Strawberry Leaf-roller, first described in the *American Entomologist* for January 1869. It has been, as I learn, doing considerable injury to strawberry plants during this autumn in central and northern Illinois, but so far I have heard no complaint against it in the southern part of the state, in fact, it appears, from all the evidence I can obtain, to be a northern insect seldom extending further south than the southern border of the central section of the state.

“The letter accompanying the specimens makes the following statements in reference to its operations this season. ‘We know nothing of the habit of it. We first discovered them on our strawberry plants about six weeks ago, (date of letter Nov. 8.) About the same time we saw an article in the *Bloomington Pantagraph*, describing the same worm and stating that a good many plantations about Bloomington and Normal had been entirely destroyed by them, while some were saving theirs by hand picking, (which we think would be an endless job on matted rows.) We judge that it is not a new thing in the west as we find two or three inquiries about it in the *Fruit Record* in the last two or three years. We copy an extract from a correspondent at Waupun, Wis., in October number of the *Fruit Record* for 1874, signed W. Sperry.

“‘I with others have been troubled with white grubs in our strawberry beds for five years, but that is nothing compared to a very formidable foe in the shape of a small worm on the leaves, about one-third of an inch in length, of a yellowish green. They form a web on the upper side of the leaf, which causes the leaf to double up and shut them in. They do not eat the leaves, but the plant turns rusty and soon dies. They so completely destroy old beds of one or more years standing that not one green leaf is left. The pest is not confined to Waupun, but is equally bad in other parts of the State.’ The editor answers: ‘The worm spoken of is quite prevalent over the West,’ but suggests no remedy. Our experience corresponds with the above, and our plants had that rusty appearance, and were dying, until the rains set in about a month ago; since then they seemed to have



checked dying, and look some better. Have tried Paris green and also tobacco, but with no effect whatever.

"The following description of the worm is taken from living specimens of those sent by Messrs. Porter and Bro.: Length nearly half an inch, very narrow and slender, six true legs and eight abdominal legs; of a dull yellowish-green, or rather of a pale, dull, olive color; the head yellow, its hind portion slightly enveloped by the fold of the first segment; a quite distinct row of slightly paler tubercles on each side, with hairs arising from each. There are usually two tubercles of each row on each segment; some of the anterior segments appear to have additional tubercles on each side.

"The following description of the moth is that first given by the discoverer of the species: Head and thorax reddish brown. Palpi and legs paler. Antennæ dusky. Tarsal joints tipped with dusky. Front wings reddish brown, streaked and spotted with black and white as in the figures. Hind wings and abdomen dusky. Alar expanse .40 to .45, of an inch."

"It appears to be the general habit of this species to fold the leaves of the strawberry in such a manner as to bring the two halves of the upper surface together, fastening them with a slight web. That they also do feed to a certain extent upon the leaves must be admitted notwithstanding the above statement to the contrary. The leaves I have examined, which contained specimens, nearly all had a portion of the pulpy substance of the upper surface eaten, and in a few instances considerable notches were eaten. The species is two brooded, the first brood usually appearing in the larva state in June, the moths coming out early in July. The last brood appears in the latter part of September. These change into pupæ or chrysalids, in which state they pass the winter to appear again in the latter part of spring as moths.

*Remedies.*—Messrs. Walsh and Riley suggested only the following methods of contending with this pest of the strawberry beds: "The only modes of fighting this new and very destructive foe of the strawberry—which, however, seems to be confined to northerly regions, are, first, to plow up either in the spring or fall, such patches as are badly infested by it, by which means the pupæ will probably be destroyed; and second, not to procure any plants from an infested region, so as to run the risk of introducing the plague upon your own farm."

"The remedy here suggested implies the sacrifice of the plants, and it is very doubtful whether any one that is effectual can be found which does not involve this sacrifice in cases where the patches are badly infested. The extract from Porter and Bro.'s letter shows applications of tobacco and Paris green are ineffectual, but this we might suppose, as the worms are protected by the folds of the leaves.

"Hand picking or rather hand killing may be resorted to in cases where it is very desirable to save small patches, but the worms are very liable to escape and drop to the ground unless care is taken and their habits understood. Where it will not pay to adopt this method, and the patch is badly infested, I am inclined to the opinion that burning will be the most effectual remedy. Cover the plants with straw after the worms enter the pupa state in the fall, and burn over thoroughly. It is possible that rolling twice or thrice with a heavy roller may destroy most of them, but it is somewhat doubtful."

## CARPOCAPSA POMONELLA, Linn.—The Codling Moth.

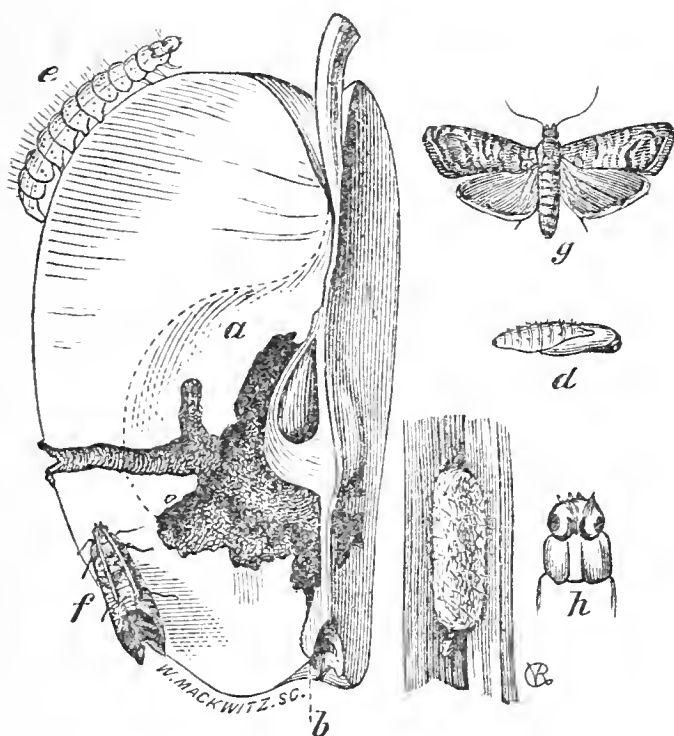


Figure 48.

when expanded. The fore wings are crossed in their inner two-thirds by numerous lines of gray and brown, while near the end of the wing is a spot of dark brown, the edges of which are burnished with coppery color. The hind wings are light yellowish brown with a shining lustre. These moths make their appearance from the middle of April to the fore part of June, varying with the season and the latitude, or about the time the young apples are about the size of hazlenuts. The females, after pairing, deposits a single egg on each apple, until her stock of from two to three hundred eggs is exhausted when, her mission ended, she dies. These eggs are usually placed in the blossom end of the fruit, but occasionally they may be placed in the hollow of the stem end, or simply glued to the side of the apple. These hatch in a few days from the time deposited, and the young worm at once burrows into the apple, making, as it increases in size, the core the center of its operations while it feeds upon the substance of the surrounding parts. In about thirty days from hatching, the larva reaches maturity and gnaws a passage to the outside, through which it escapes for the purpose of undergoing its transformations. Usually before this time the fruit has dropped to the ground. After leaving the apple, the caterpillar hunts some crevice or sheltered place, where it spins a cocoon and changes to a chrysalis. It more often crawls to the tree and finds such a nook under little pieces of bark on the side of the tree or in the crotches, but sometimes it pupates under boards lain flat on the ground, or weeds or other rubbish, if at hand and offering the requisite shelter. The cocoon is pure white, but is more or less disguised on the outside by being covered with minute fragments of whatever the worm attaches the cocoon to. The chrysalis is yellowish brown, and, like others of the family, has rows of minut

This insect is becoming so common and doing so much damage to apples and pears that to know its habits and how to circumvent it in its operations is one of the essential elements in apple and pear culture in order to ensure success. Though all who have eaten raw apples have seen the whitish worm that burrows at the core, the moth that is produced from this worm is not so generally known.

These little worms or caterpillars are produced from eggs laid by a beautiful little moth that measures about three-quarters of an inch across the wings

teeth on the back, by means of which it is enabled to partly push itself out of its cocoon, when the time arrives for the moth to emerge. In about two weeks from the time the worm has changed to a chrysalis, the moth comes out and is ready to provide for the same round of changes, there being two broods in a season. This brood of the moths appears the latter part of July or the first of August. The eggs are deposited as before and the worms when hatched burrow in the apples in the same manner as the fruit brood but the apples are larger and but few of them at this time fall off from the effects of the worms, the most of them remaining on the trees until they are harvested. Some of the worms however, reach their maturity before the apples are gathered and spin up in cracks and crevices, but many of them are still in the apples when harvested and come out and make their cocoons in cracks of boxes and bins in the cellars or barns where the apples are stowed, or in the crevices or under the hoops of barrels, where they pass the winter to make the first brood of moths of the following year. Unlike most larvæ, however, that come to their maturity in the fall these worms do not change to chrysalids in the fall but hibernate in the larva state in their cocoons, undergoing the transformation in the spring.

Pears and crab apples are subject to the attacks of the same worm but it is not known that they enter the peach or any other stone fruit.

*Remedies.*—The time to begin fighting these pests of the orchards is in early spring before the worms undergo their transformations in their cocoons and the moths emerge; and the place, where the apples have been stored. As a general thing the birds that remain through the winter will hunt out and destroy nearly all of the larvæ that left the apples before they were taken from the orchard, but those that were taken to barns and cellars in the apples will be found spun up in cracks and crevices of boxes and bins or about the barrels that had contained the apples and if these are not destroyed their progeny alone would destroy a large percentage of the fruit of the coming season. When it is remembered that the eggs from a single female will cause at least two hundred apples to prematurely fall to the ground the thoroughness with which this work should be done is evident. The cocoons in barrels may be destroyed by immersing them for a few minutes in hot water. Boxes and bins should be thoroughly examined and the cocoons crushed.

The second time is when the apples begin to fall to the ground, and the warfare should be continued from this time through the summer. This may be done in two ways: first, the apples that fall to the ground should be picked up, either by stock running in the orchard or gathered and fed to stock. By this means most of the worms will be destroyed before they leave the apples, but there will still be some that will escape. As these usually seek the body of the tree to pupate they may be entrapped here. The means usually adapted for this, is to put a band of twisted hay two or three times about the tree, under which the worms will be pretty sure to go to form their cocoons. These should be moved up or down as often as once in a week or ten days and the cocoons crushed. Instead of the hay band, old cloths hung in the crotches of the trees will serve as traps, especially if the tree is kept smooth and free from the rough bark so that they find no

other place of shelter. If all the eggs that form the first brood were deposited at the same time, the time for these operations need be only a week or ten days, some time in July, but the times vary so much that the mature and young larvæ may be found most of the summer from the time the wormy apples begin to fall till the apples are harvested, the broods somewhat overlapping each other, so that vigilance the summer through will be the price of sound fruit.

*Spec. Char. Moth.*—Expanse of wings three-fourths of an inch. General color of fore wings, head and thorax, purplish brown, with a shining metallic reflection; the basal two-thirds of the wing reaching along the costa to near the apex, and the thorax crossed by a number of irregular transverse gray lines somewhat running together, rather faint in the middle of the wing. On the outer third of the wing is a brown spot not quite reaching to the costa anteriorly, edged on its inner side by a dark brown line that is double below the middle of the wing, the spot crossed by two coppery lines that reach from the posterior margin of the wing two-thirds of the way to the costa, and a third short oblique line or dash half way from the end of the outer line to the apex. Hind wings and abdomen light yellowish brown, shining.

## TINEIDÆ.

Packard says in his *Guide to the Study of Insects*: "The Tineids are a family of great extent, and the species are very distinctive to vegetation, having innumerable modes of attack." They may be known from the Tortrix moths by their small size, by the narrow wings that are usually pointed, and the posterior inner margin edged with long delicate fringe. The wings, when at rest, are usually laid flat on the back, but in some species they are rolled round the body. The larvæ vary considerably in the number of legs, ranging from eighteen in the genus *Nepticula* to none in some of the smaller genera as *Tinagma*, etc., though the usual number is sixteen. They are generally called "Leaf Miners," as many of them feed beneath the epidermis upon the pulpy substances of various leaves, but some species feed within the kernels of various grains, some live upon the tissues of fabrics, etc. The latter kind constructs a case or sack of the fabrics within which they live, and which forms a protection to their tender bodies.

### TINEA DORSISTRIGELLA, Clem.—The Clothes Moth.

This is only one of several little moths, the larvæ of which are too well known to housekeepers by reason of their eating clothing, furs, carpets, etc., the name applying as appropriately to others. This insect is described in Packard's *Guide* as *T. flavifrontilla*, of Linnaeus, but Chambers' recent classification gives the name I have given.



The eggs from which these little pests are produced, are laid in May the moths not larger than a small fly flitting about our apartments with a noiseless stealthy flight. The eggs are generally deposited in woolen, though it is said they sometimes place them in bunches of cotton. The moths may be seen from this time through the summer. From these eggs are hatched very small pale caterpillars with sixteen legs that, when full grown, are not larger than a darning needle, and less than half an inch long. The body is tolerably plump, tapering slightly toward the tail; the head of a pale horn color. The rings of the body are thickened above, especially the thoracic ones, by transverse thickened folds. As soon as hatched, these worms cut in pieces bits of the wool or other substance in which they find themselves, and laying them in successive layers, fasten them together with silk, and thus construct for themselves cases within which they live. As these cases are of the same color as the material upon which they feed, they furnish the insects a double protection, hiding them from observation and protecting their tender bodies from injury. This case or tube is not quite cylindrical, but is flattened a little in the middle, and is open at both ends. As the worm increases in size, the case is made larger by adding to it at the end, and by cutting the sides open with its jaws and inserting more material. As the worm travels, he eats himself a path through the fabric, taking his case with him and the greater his inclination is to travel, the more mischief he does. When full grown, the larva changes to a chrysalis within its case. This is curved, the head smooth and rounded, with the long antennæ and leg case reaching to the tip of the abdomen. On the upper side of each segment there is a transverse row of minute spines with which the chrysalis is enabled to move towards the mouth of its case just before the moth emerges. The moth that issues from this chrysalis is of a reniform light buff color, with a silky iridescent lustre, the hind wings and abdomen being a little paler. The head is thickly tufted with hairs, and is a little tawny, and the upper side of the densely hirsute feelers (*palpi*) is dusky. The wings are long and narrow, with the most beautiful and delicate long silken fringe, which increases in length towards the base of the wing."—Packard.

Several broods of these moths appear during the summer, the last brood of caterpillars passing the winter within their cases to assume the chrysalis state early in spring, making the first brood of the perfect insects.

*Remedies.*—The remedies that may be adapted for this and other species of moths infesting furs and fabrics, may all be given here. All writers on this insect agree that vigilance is the first essential to prevent injury by this pest. Early in June closets, wardrobes and other receptacles for clothing should be emptied of their contents, and the latter thoroughly brushed and shaken before being replaced. Furs or woolens that are to be laid away during the summer may be kept from these insects by putting them into tight paper sacks that are kept securely fastened, if they be taken before the moths appear to deposit their eggs. To guard against any worms from eggs that may have been deposited, camphor or tobacco should be placed among the articles when put away. A better way, especially if a large quantity is to be guarded, will be to put them in boxes, pasteboard or wooden, and after putting on the cover pasting paper over every crack or

crevice, using camphor or tobacco as before. Sometimes it is desirable to take up a carpet in the spring and not put it down again till fall. In this case it may be kept from these pests during the summer by thoroughly dusting after taking up and rolling into a bundle, around which a sheet is securely fastened, being careful that no place is left at the ends of the bundle for the little moths to gain an entrance to deposit their eggs. Camphor or tobacco should be used as in the first mentioned cases. Carpets that remain on the floor during the summer will not be troubled if they are regularly and thoroughly swept, especially if tobacco is placed round the edges when the carpet is put down.

Dr. Harris' work on "Insects Injurious to Vegetation," contains the following additional suggestions: "In old houses that are much infested by moths, the cracks in the floors, in the wainscot, around the walls and shelves of closets, and even in the furniture used for holding clothes, should be brushed over with spirits of turpentine. Powdered black pepper strewed under the edge of carpets is said to repel moths. Sheets of paper sprinkled with spirits of turpentine, camphor in coarse powder, leaves of tobacco, or shavings of Russia leather, should be placed among the clothes when they are laid aside for the summer."

"The cloth linings of carriages can be secured forever from the attacks of moths by being washed or sponged on both sides with a solution of the corrosive sublimate of mercury in alcohol, made just strong enough not to leave a white stain on the black leather. Moths can be killed by fumigating the article containing them with tobacco smoke or with sulphur, or by shutting it in a tight vessel and then plunging the latter into boiling water, or exposing it to steam for the space of fifteen minutes, or by putting it into an oven heated to about one hundred and fifty degrees of Fahrenheit's thermometer." A weak solution of carbolic acid has also been recommended.

#### TINEA TAPETZELLA, Linn.—The Carpet Moth.

This insect as its common name implies, works mostly in carpets, constructing its case and having a habit similar to the preceding species. The perfect insect is "blackish at the base of the fore wings the remainder being yellowish white, while the hind wings are dark gray, and the head white. The larva feeds on carpets, etc."

*Remedies.*—Given under the Clothes Moth.

#### TINEA RUSTICELLA, Hub.

This, sometimes called *T. vestianella*, is another Clothes Moth that has habits similar to the one already described. The perfect insect is dark brown, tinged with violet, with a very pale yellow costa, discal patch and one above the interior angle. Fringe of the fore wings dark colored, dotted on the hind margin with pale yellow. Hind wings gray, with a bronzy hue.

*Remedies.*—The same as the first mentioned.

## TINEA PELLIONELLA, Linn.—The Fur Moth.

The larva of this species is destructive to furs, and may also occasionally be found in cases of insects in the entomologists cabinet. It is of a dirty white color, with head and cervical shield black. The perfect insect has the fore wings pale yellowish brown, dusted over with fuscous, especially at the costal portion of the base. It has a conspicuous dark brown spot on the end of the discal cell and two smaller spots of the same between this and the base of the wing, one about the middle of the disc and the other beneath it. Fringe the same as the ground color, or a little paler. Hind wings pale bluish gray, fringe a little darker.

*Remedies.*—See Clothes Moth.

## TINAE BISELIELLA, Hum.—The Hair Moth.

Dr. Clemens says of this species, that the young larvæ appear about two weeks after the eggs are deposited, and that they do not immediately make a case. The mature larva is white, with a dark brown head and a cervical shield of the same hue. They reach their maturity about the middle of March, and climb the sides of the walls to the ceiling of the room in which they feed, and suspend or attach their cases. Besides working in material composed of hair these caterpillars feed upon woollen substances, carpets, cloths, etc. The first brood of moths or perfect insects appear in May and another in August and September.

The moth has the thorax and abdomen pale yellow; the fore wings pale yellowish brown or pale yellow, with a silky lustre and without spots; sometimes slightly dusted with fuscous on the costa at the base of the wing, and with a brownish spot on the end of the discal cell. Hind wings pale shining yellow.

*Remedies.*—Besides the remedies mentioned for the insects in the larva state under "Clothes Moth" these may be swept the ceiling of rooms containing them in April or July and August. By thus destroying the chrysalids the future deposit of eggs may be prevented.

## TINEA GRANELLA, Linn.—The Wolf or Grain Moth.

The larva of this species, as described in "Packards Guide" and in the Agricultural Reports, feeds on grain after it is stored in the granary. It usually fastens together several kernels with silk, and feeds within its inclosure upon the contiguous parts of the grains, eating out the interior of several kernels before reaching maturity. The eggs from which these are produced are laid one or two on each kernel

until the female has exhausted her stock of thirty or more. The larvæ which hatch in a few days, are white. When these are full grown they change to chrysalids in little oval cocoons about the size of a kernel of wheat. These are formed among the grain, or in crevices of walls or floors of the bin. The moth that emerges in due time is creamy white, with six brown spots on the costa of the fore wings, and with brown fringe.

*Remedies.*—It is evident that to prevent destruction of grain by this pest, granaries should be thoroughly cleaned before grain is put in. Whitewashing the walls and the roof, or washing them with coal oil, is also recommended; scattering salt over the grain is also advised. If the larvæ are at work in the grain, it should be shoveled over frequently to disturb them. Probably as good a way to destroy them, if they are already at work, will be by burning sulphur in the granary, keeping it closed long enough for the fumes to destroy the worms and moths, and then airing the grain by shoveling it. It has been recommended to place a bright light in the granary in April or May, that the moths may be attracted to it and killed, and thus prevent the deposit of eggs, but unless the light were kept burning all the time, this would be only a partial protection.

#### GELECHIA CEREALELLA, Linn.—The Angoumois Grain Moth.

This insect, some time since introduced into the southern portion of the United States from France, is one of the most destructive insects known to wheat, barley, oats and Indian corn; but its ravages seem to be more confined to the warmer portion of our country.

The larva is a smooth white worm, and each individual attacks a single kernel, consuming the inside without injuring the external shell, the one kernel being sufficient to feed it from the time it hatches till it reaches maturity. When full grown it pupates in the grain, and comes out as a moth in May and November. This has the head dull ochre, the fore wings pale shining ochre, with a grayish or brownish gray streak in the fold towards the base, and a few scales of the same towards the tip of the wing on the margin. Hind wings and fringes grayish ochre.

*Remedies.*—The most effective remedy for this insect is to subject the grain to the heat of an oven or very warm dry room. In France "insect mills" for this purpose have been invented. They consist of a hollow iron cylinder, resembling an ordinary coffee roaster, into which the infested grain is put, and then the instrument is placed over a fire and revolved, heating the grain up to a certain point. In this way all the insects in the grain are killed in a short time, and with little expense. The preceding species might be treated in the same way.

#### PLUTELLA CRUCIFERARUM, Zell.—The European Cabbage Web Moth.

Under the name *P. xylostella*, a name that has been extensively used for this species of insect, in the last report of the State Horti-



cultural Society, is included among those injurious to garden vegetables. It is an importation from the old world, that like many others, has followed in the wake of civilization to prey upon the food plants man has taken with him in his migrations. It has been reported as doing great damage to the cabbage crop in various parts of the northern states. Dr. Packard speaks of it as occurring in Massachusetts, a similar report comes from Michigan, and there are evidences of its occasionally being found in Illinois, though I have met with very few of them.

The larva is a little green worm about a quarter of an inch long, that feeds on the under side of the outer leaves. When ready to transform, they spin web-like cocoons in the folds and depressions of the leaves. The moth, not more than half an inch across the expanded wings, has the fore wings pale gray with a white hind margin. Packard describes these as "Gray, with a conspicuous broad, longitudinal, white band along the inner edge, and extending to the outer third of the wings. This band sends out three teeth towards the middle of the wing, the third tooth being at the end of the band. There is a row of dark dots along the outer edge of the stripe; a row of blackish dots along a pale shade just outside of the front edge of the wing, and two diverging rows of blackish dots diverging from the tip or apex of the wing. The fringe is marked with a few dark spots. The middle of the wing, next the white band, is darker than the front edge, while a faint yellowish shade runs along the middle of the outer half of the wings towards the tip, inclosing a few black dots."

There are two broods of the worms in a season, one in the middle of the summer, and the other late in autumn, when the cabbages are heading, and when sufficiently numerous, they riddle the leaves full of holes. The first brood feeding on the young cabbages in early summer may do more mischief than the second brood in autumn, when the heads are fully formed.

*Remedies*—Plentiful showering with soapsuds or brine has been recommended as the best remedy. In addition to this, the cocoons may be picked off, or if the fall brood be somewhat confined to single leaves, these may be broken off and the worms and cocoons destroyed.

#### PTEROPHORIDÆ.—Plume Moths.

This family represents a small group of moths of medium or small size called Plume Moths, which may be readily known by the fore wings being more or less deeply notched or cleft at the end, and the hind wings being divided into two or more separate pieces or plumes. When at rest these are folded together under the narrow fore wings and the whole stand out from the body nearly at right angles, raised a little from the horizontal. The larvæ have sixteen legs and are rather hairy. They form no cocoon but fastening themselves by the tail to a leaf or stem, shed their larva skins and appear in the pupa state. Some of the pupæ are nearly as hairy as the larvæ, while others are quite naked. Most of them feed in the early summer months,

the perfect insect appearing later, but a few may be seen in the spring. Among the species that have been described the following is the most important.

*PTEROPHORUS PERISCELIDACTYLUS*, Fitch.—The Grape Vine Plume.

This species, described by Dr. Fitch, in his first report, may sometimes be seen injuring grape vines the latter part of May or the fore part of June. It occasionally appears in such numbers as to do serious injury to vines as may be seen from the report already referred to, and from an article in Prof. Riley's first report on Missouri Entomology.

It is a very pale green caterpillar about half an inch long when full grown, with four elevated white spots and two still smaller dots on each segment, from which spring stiff white hairs of different lengths that stand in all directions. The worm draws together the edges of one or more leaves by means of silken threads, thus making a large roomy cavity, within which it stays, apparently in repose during the day time. The larva changes to a chrysalis the fore part of June, and the perfect insect emerges in about eight days after. The chrysalis is angular and cut off slantingly and bluntly at the head, but the principal characteristic is two sharp and angulated projections from the middle of the back. Besides these it is ridged with the remnants of the tubercles of the caterpillar.

The moth has an expanse of wings of a little more than three-fourths of an inch; is of a tawny yellow color; the fore wings bifid, the cleft reaching almost to the middle, with two oblique white bands crossing both their forks; the space between these bands often rusty brown; a transverse white spot at the commencement of the cleft, edged on its inner side with rusty brown; two white spots inside of this, the first towards the outer, the second upon the inner margin. Hind wings trifold, the anterior cleft reaching their middle, the posterior one extending to the base, tawny yellow at base. There are probably two broods in a season.

*Remedy.*—The only remedy that seems applicable is hand picking.

# ANALYTICAL TABLES OF THE FAMILIES AND GENERA OF LEPIDOPTERA, REPRESENTED IN THE PRECEDING PAPER.

## SYNOPSIS OF FAMILIES.

- I. Antennæ filiform, terminating in a knob or club.....RHOPALOCERES, or Butterflies
  - A. Having six feet adapted for walking.
    - a. Wings closed back to back and erect in repose.
      - b. Colors black, white or yellow; size from medium to large.....*Fam. 1, PAPILIONIDÆ.*
      - bb. General color blue or coppery.....*Fam. 2, LYCENIDÆ.*
    - aa. Wings spread in repose, or closed and thrown far back .....*Fam. 4, HESPERIDÆ.*
  - AA. Having four feet adapted for walking, the first pair aborted .....*Fam. 3, NYMPHALIDÆ*
- II. Antennæ variable, never knobbed or clubbed at the tip.....HETERO CERES, or Moths.
  - A. Body stout, spindle-shaped; wings narrow; hind wings about half as long as the fore wings; antennæ prismatic .....*Fam. 1, SPHINGIDÆ.*
  - B. Size small, wings completely or partly transparent; day flyers.....*Fam. 2, ÆGERIDÆ.*
  - C. Size medium; head large, free; antennæ simple or pectinate, partly swollen in the middle or partly clavate.....*Fam. 3, ZYGENIDÆ.*
  - D. Body usually large, thick; head small and apparently sunken into the thorax; mouth parts usually obsolete or very small; antennæ pectinate, placed higher on the head than usual .....*Fam. 4, BOMBYCIDÆ.*
  - E. Body thick; thorax and abdomen often with dorsal tufts; antennæ simple or only slightly pectinate; wings folded like a flat roof over the body in repose.....*Fam. 5, NOCTUIDÆ.*
  - F. Body slender; scales fine; wings broad, thin, spread out in repose; antennæ usually pectinate; palpi small.....*Fam. 6, PHALENIDÆ.*
  - G. Palpi in most species very long and compressed; wings deltoid in repose, or, in some, folded round the body.....*Fam. 7, PYRALIDÆ.*
  - H. Size below the medium; palpi very short, beak-like; fore wings oblong, crossed by bands that are often metallic.....*Fam. 8, TORTRICIDÆ.*
  - I. Size small, many minute; antennæ long, filiform; wings pointed, heavily fringed on posterior margin.....*Fam. 9, TINEIDÆ.*
  - J. Fore wings narrow, bifid (or trifid in a genus not represented here); hind wings trifid.....*Fam. 10, PTEROPHORIDÆ.*

## SYNOPSIS OF GENERA.

### RHOPALOCERES—Butterflies.

#### Family 1—PAPILIONIDÆ.

- A. Hind wings tailed.....*Papilio.*
- AA. Hind wings not tailed.
  - a. Ground color white or yellowish white.....*Pieris.*
  - aa. Ground color yellow or orange.
    - b. Border pale yellow, with dark spots in the fringe of the females. ....*Callidryas.*
    - bb. Border black.
      - c. Antennæ straight, club obconic, round.....*Colias.*
      - cc. Antennæ slightly bent, club obconic, compressed.....*Terias.*

#### Family 2—NYMPHALIDÆ.

- A. Club of antennæ not flattened, bent outward; hind wings of males with a black spot in the middle, on a vein.....*Danaüs.*

- AA. Club of antennæ flattened.
- a. Silver spots on under side of wings ..... *Argynnis*.
- aa. No silver spots.
- b. Fore wings sinuous..... *Euptoieta*.
- bb. Fore wings not sinuous ..... *Melitæa*.
- AAA. Club of antennæ not flattened.
- a. Eyes hairy.
- b. Golden or silvery spots on under side of hind wings..... *Grapta*.
- bb. No golden or silvery spots on under side of hind wings.
- c. Palpi very hairy ; apex of fore wings truncate..... *Vanessa*.
- cc. Palpi slightly hairy ; apex of fore wings scarcely angular..... *Pyrameis*.
- aa. Eyes naked.
- b. Apex of fore wings rounded , hind wings slightly dentate.
- c. Antennæ terminating abruptly in large obconic club..... *Junonia*.
- cc. Antennæ terminating insensibly in a club.
- d. Wings without eye spots..... *Limenitis*.
- dd. Wings with eye spots.
- e. Color not uniform, fore wings slightly dentate..... *Apatura*.
- ee. Color uniform, wings entire..... *Neonympha*.
- eee. Color nearly uniform, hind wings dentate, marbled beneath... *Satyrus*.
- bb. Apex of fore wings strongly angular ; palpi very long..... *Libythea*.

## Family 3—LYCÆNIDÆ.

- A. Color brown or blue, two tails to the hind wings, under side marked with wavy stripes.. *Thecla*.
- B. Color fulvous ..... *Chrysophanus*.
- C. Color blue or blackish, gray beneath ; hind wings often with one tail..... *Lycæna*.

## Family 4—HESPERIDÆ.

- A. Knob of antennæ thick ovoid or elongate ovoid.
- a. Hook much contracted, pointed, nearly half as long as the knob..... *Pamphila*.
- aa. Hook slender conical..... *Amblyscirtes*.
- aaa. Knob rounded at tip, straight, or a little semilunar..... *Pyrgus*.
- AA. Knob of antennæ spindle-shaped.
- a. Palpi surpassing the front by more than the length of the eyes ; gray below..... *Thanaos*.
- aa. Palpi surpassing the front by about the length of the eyes ; white below ..... *Pholisora*.
- aaa. Palpi surpassing the front by less than the length of the eyes ; gray below..... *Eudamus*.

## HETEROCERES—Moths.

## Family 1—SPHINGIDÆ.

- A. Fore wings entire.
- a. Abdomen tufted at tip, wings transparent..... *Sesia*.
- aa. Abdomen not tufted at tip.
- b. Ground color olivaceous.
- c. Tongue as long as body.
- d. Fore wings with longitudinal white stripe ..... *Deilephila*.
- dd. Fore wings without longitudinal stripe..... *Philampelus*.
- cc. Tongue half as long as body ..... *Darapsa*.
- bb. Ground color brown..... *Ceratomia*.
- bbb. Ground color gray..... *Macrosila*.
- AA. Fore wings not entire.
- a. Fore wings excavated near the apex and posterior angle; hind wings yellow..... *Thyreus*.
- aa. Fore wings dentate; tongue about as long as palpi..... *Smerinthus*.

## Family 2—ÆGERIDÆ.

- Antennæ gradually thickening nearly to the end..... *Ægeria*.

## Family 3—ZYGÆNIDÆ.

- A. Antennæ not pectinate.
- a. Antennæ thicker in the middle than at apex..... *Alypia*.
- aa. Antennæ slender, setaceous ; fore legs densely tufted..... *Eudryas*.



- AA. Antennæ pectinate.  
 a. Wings moderately broad, containing large lunate spots ..... *Psycomorpha*.  
 aa. Wings narrow.  
 b. Hind wings ovate, opaque..... *Acoloitus*.  
 bb. Hind wings partly transparent ..... *Ctenucha*.

## Family 4—BOMBYCIDÆ.

- A. Body rather slender.  
 a. Antennæ simple in both sexes; pilose below in the males..... *Utethesia*.  
 aa. Antennæ simple, two strong ætæ at each joint..... *Callimorpha*.  
 AA. Body robust.  
 a. Size medium, body not pilose.  
 b. Male antennæ, and sometimes the female, pectinate.  
 1. Wings rounded, marked with angular black patches..... *Arctia*.  
 2. Fore wings pointed, deep ochre..... *Pyrrharctia*.  
 3. Fore wings pointed, female white ..... *Leucarctia*.  
 4. Wings rounded, white, with a few spots; abdomen ochre ..... *Spiloroma*.  
 5. Fore wings long, leopard spotted..... *Ecpantheria*.  
 6. Small, white, without spots..... *Hyphantria*.  
 7. Pale ochre, fore wings banded, shoulder tufts tipped with green..... *Halesidota*.  
 8. Antennæ heavily pectinate, female wingless ..... *Orgyia*.  
 bb. Male antennæ simple.  
 c. Fore wings with subcostal vein trifold beyond discal cell..... *Empretia*.  
 cc. Fore wings with subcostal vein bifid beyond discal cell ..... *Iimacodes*.  
 bbb. Male antennæ pectinate.  
 c. Female wingless, wings of male transparent..... *Thyridopteryx*.  
 cc. Female winged.  
 d. Male antennæ minutely pectinate, female minutely serrate ..... *Datana*.  
 dd. Female antennæ serrate..... *Notodonta*.  
 ddd. Male antennæ not pectinate to apex..... *Edema*.  
 aa. Size large.  
 b. Eye spots in both wings, antennæ strongly pectinate.  
 c. Eye spots transparent.  
 d. Color brownish or ashy ochre..... *Telea*.  
 dd. Color green, hind wings tailed ..... *Actias*.  
 ddd. Color reddish brown or ferruginous ..... *Callosamia*.  
 cc. Eye spots opaque.  
 d. Color grayish brown ..... *Platysamia*.  
 dd. Color grayish olive..... *Samia*.  
 bb. Eye spots in hind wings only, or wanting.  
 c. Eye spots in hind wings..... *Hyperchiria*.  
 cc. No eye spots in wings.  
 d. Antennæ pectinate in the males, serrate in the females ..... *Eucronia*.  
 dd. Antennæ of males serrate about one-third their length, females simple..... *Eacles*.  
 ddd. Antennæ of males pectinate more than half the length, females simple. *Dryocampa*.  
 aaa. Size medium, body pilose.  
 b. End of wings denticulate, antennæ very short ..... *Gastropacha*.  
 bb. End of wings not denticulate.  
 c. Color russet brown ..... *Clisiocampa*.  
 cc. Color hoary, wings crossed by black reticulations..... *Xyleutes*.

## Family 5—NOCTUIDÆ.

- A. Thorax and abdomen without dorsal tufts; eyes naked.  
 a. Fore wings with psi mark near hind angle..... *Acronycta*.  
 aa. Fore wings without psi mark..... *Agrotis*.  
 B. Thorax and abdomen with dorsal tufts.  
 a. Tibæ without spurs.  
 b. Eyes naked ..... *Hadena*.  
 bb. Eyes hairy ..... *Mamestra*.  
 aa. Middle and hind tibæ spurred.  
 b. Fore wings narrow; apex obtuse or acute.  
 c. Eyes hairy..... *Ceramica*.

- cc. Eyes naked.....*Prodenia*.  
 bb. Fore wings broad, truncate at apex.  
 c. Eyes hairy, male antennæ pectinate.....*Nephelodes*.  
 cc. Eyes naked.  
 d. Apex of fore wings acute .....*Gortyna*.  
 dd. Apex of fore wings round.....*Achatodes*.  
 C. Thorax and abdomen not tufted ; palpi ascending.  
 a. Eyes hairy ; fore wings moderate width ; usual marks not prominent.....*Leucania*.  
 aa. Eyes naked, hind wings coppery.....*Pyraphila*.  
 D. Thorax crested in front ; eyes naked ; head crested ; abdomen without dorsal tufts.]  
 a. Male antennæ pectinate, fore wings deeply notched.....*Scoliopteryx*.  
 aa. Male antennæ simple.  
 b. Palpi straight ; fore wings oblong, truncate, obtuse.....*Xylina*.  
 bb. Palpi ascending ; fore wings triangular : apex acute .....*Anomis*.  
 E. Thorax with broad posterior crest ; abdomen slightly tufted ; eyes naked ; fore wings with metallic spots .....*Plusia*.  
 F. Thorax and abdomen without tufts ; eyes naked ; antennæ simple.  
 a. Palpi short ; fore wings elongate triangular.....*Heliothis*.  
 aa. Palpi moderately long ; wings broad, deltoid.....*Drasteria*.  
 G. Thorax slightly crested ; eyes naked ; antennæ simple ; body robust ; hind wings usually banded with two colors .....*Catocala*.

Family 6—*PHALÆNIDÆ*.

- A. Antennæ usually ciliate ; palpi large, third joint long and pointed ; head free from thorax ; color ochreous.....*Petrophora*.  
 B. Antennæ well pectinate ; palpi slender, pointed, passing beyond the head ; head square ; color dull ochreous .....*Eufitchia*.  
 C. Antennæ pectinate on basal fourth ; palpi unequal in the sexes ; color green.  
 a. Hind wings very small .....*Dyspteris*.  
 aa. Hind wings of usual size, rounded ; head broad in front ; female palpi very long.....*Synchlora*.  
 D. Antennæ various ; color gray ; female wingless, or nearly so.  
 a. Female wings shorter than the head.....*Anisopteryx*.  
 aa. Female wings as long as head .....*Phigalia*.  
 E. Male antennæ usually heavily pectinate ; palpi large, straight or ascending, third joint distinct.  
 a. Color yellow ; wings angular ; male antennæ simple.....*Nematocampa*.  
 b. Color deep yellow ; wings not angled ; hind wings notched.....*Angerona*.  
 c. Color ochreous brown ; wings dentate .....*Endropla*.  
 d. Color white ; wings deeply scalloped.....*Eugonia*.  
 e. Color ochreous ; fore wings broad ; apex rectangular, slightly angled .....*Caberocles*.  
 f. Color ochreous brown ; hind wings with prominent angle .....*Eutrapela*.

Family 7—*PYRALIDÆ*.

- A. Wings deltoid in repose.  
 a. Palpi much longer than head.  
 b. Male antennæ ciliate .....*Philometra*.  
 bb. Antennæ simple .....*Hypena*.  
 aa. Palpi shorter or scarcely longer than the head.  
 b. Palpi ascending.  
 c. Wings rather narrow, not pointed .....*Pyralis*.  
 cc. Fore wings sublanceolate triangular, glossy.....*Asopia*.  
 bb. Palpi straight.  
 c. Wings opaque.  
 d. Male antennæ bipectinate .....*Aglossa*.  
 dd. Antennæ simple .....*Botis*.  
 cc. Wings partly transparent.....*Phacellura*.  
 bbb. Palpi recurved against the eyes, feathery ; male antennæ elbowed .....*Desmia*.  
 AA. Wings folded against the body in repose.  
 a. Male antennæ more or less ciliate, curved at base ; fore wings fasciate.  
 b. Fore wings elongate triangular, ends rounded .....*Phycita*.  
 bb. Fore wings narrow.  
 c. Color gray .....*Myelois*.

- cc. Colors black and white..... *Pempelia*.  
 aa. Antennæ simple ; fore wings emarginate at the apex in males, truncate in females .....  
*Galleria*.

## Family 8—TORTRICIDÆ.

- A. Fore wings broad, rounded at shoulder..... *Tortrix*.  
 AA. Fore wings elongate triangular.  
 a. End repanded, marks oblique..... *Lozotænia*.  
 b. Subconvolute, ocellated near hind angle..... *Carpocapsa*.  
 c. End subtruncate or rounded ; disc with silvery marks..... *Argyrolepis*.  
 AAA. Fore wings narrow.  
 a. Sides almost straight, end rounded, colors black and white..... *Penthina*.  
 aa. Lanceolate, costa slightly emarginate..... *Anchylopera*.

## Family 9—TINEIDÆ.

- A. Palpi slender, short, straight ; head strongly crested in front ; fore wings glossy ; incumbent, elongate, rounded behind..... *Tinea*.  
 B. Palpi long or moderately long, reflexed ; head smooth ; fore wings elongate, pointed or obscurely pointed ; hind wings trapezoid, slightly or deeply emarginate below the apex....  
*Galechia*.  
 C. Palpi rather long, curved upward, thickly squamose, last joint setiform ; antennæ simple ; fore wings elongate, rounded at ends..... *Plutella*.

## Family 10—PTEROPHORIDÆ.

- A. Fore wings two lobed, hind three..... *Pterophorus*.  
 AA. All wings six lobed ; (not represented.)..... *Alucita*.

REMARK.—As this table is not intended to be a *synoptical* table, in the true sense of the term, but rather an aid in finding the genera represented in the preceding paper, such characters are often used as would not in all cases apply to the genera, when taken in their widest sense. In this I have in a measure followed the plan adopted in making up the table for Coleoptera in the preceding report.

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## ERRATA AND CORRIGENDA.

- Page 33, under the figure for LACHNNOSTERNA read LACHNOSTERNA.  
Page 41, number of Figure should be "9" instead of "10."  
Page 60, line 21, for "carniverous" read "carnivorous."  
Page 78, line 9, where I speak of Syrphus-flies feeding on Plant-lice, it is understood that I allude to the larvæ, or worms, and not the perfect insects.  
Page 91, line 5, for *tassellata* read *tessellata*.  
Page 96, line 28, for *Headena* read *Hadena*.  
Page 114, line 45, for *guercifoliana* read *quercifoliana*.  
Page 128, under Fig. 29, for "bivalnerus" read "bivulnerus."  
Page 130, under the figure, for "Chalcia" read "Chalcis."  
Page 133, in title of second part, for LARVA read LARVÆ.  
Page 136, lines 14 and 17, for *Aristolchia* read *Aristolochia*.  
Page 147, line 1, for EBULE, read EUBULE.  
Page 152, line 19, for "precedin" read "preceding."  
Page 160, line 33, for "MANATAQUA" read "MANATAAQUA."  
Page 163, for HETEROCERES read HETEROCERA.  
Page 172, for "Black Currant-borer" read "Black-currant Borer."  
Page 183, for SPILOSOMCA read SPILOSOMA.  
Page 209, number of figure is omitted, should be 39.  
Page 218, number of figure is omitted, should be 42.  
Page 227, line 13, for HYLINA read XYLINA.  
Page 228, line 6, for *ylina* read *xylina*.

# LIST OF ILLUSTRATIONS.

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Some of the cuts are from electrotypes purchased from Prof. C. V. Riley; another portion from the electrotypes used by Dr. LeBaron, whose reports will show whence they were obtained; a few are original, some drawn by J. H. Emerton and some by Th. Pergande.

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# INDEX

## TO THE PLANTS AND OTHER SUBSTANCES INJURED BY INSECTS MENTIONED IN THIS REPORT.

The following index or list embraces the various plants and other substances injured by the insects described in this report, with the names of the insects causing the injury placed opposite, in alphabetical order. This is intended to facilitate in the search for the name of an insect found injuring some plant or other substance, of whose habits the reader is anxious to gain some information. It may be used thus: If the reader finds an insect injuring his cucumbers, let him refer to "Cucumber" in this list or index. Opposite this name he finds two species named, *Ageria cucurbitæ* and *Phacellura nitidalis*, which injure this vegetable, which are mentioned in this report. By referring to the "General Index" to these names (*Ageria* and *Phacellura*) and the species here mentioned, he will find the page where they are described.

It has been thought unnecessary to repeat the common names of the insects here, as the scientific names are sufficient to refer the reader to the General Index, although he may know nothing whatever of scientific names. From these he can refer to the page where the species is described in plain language, and the common name, if it has one, is given.

In a few cases—two or three—substances are included in the list which are not mentioned in the report as injured by the species of insect whose name is placed opposite. These have been added because they were overlooked at the time the text was written, or because the fact has come to my knowledge subsequent to that time.

Acacia.....	Eudamus tityrus.
Ailanthus .....	Samia cynthia .
Apple .....	Anisopteryx autumnata.
	"    pometaria.
	"    vernata.
	Aspidiotus Harrissii.
	Carpocapsa pomonella.
	Clisiocampa americana.
	"    sylvatica.
	Deilephila lineata.
	Eugonia subsignaria.
	Gastropacha valleda.
	Hylina cinerea (See Xylina.)
	Hyphantria textor.
	Lithophane cinerea.
	Lozotaenia rosaceana.
	Orgyia leucostigma.
	Papilio Turnus.
	Pempelia Hammondi.
	Phigalia cinctaria.
	Phycita nebulo.
	Samia cecropia.
	Smerinthus excæcatus.
	Tortrix cinderella.
	"    malivorana.
Arbor-vitæ.....	Callosamia promethea.
Aristolochia.....	Papilo philenor.
Ash .....	(See Prickly Ash.)
Aster.....	Phyciodes tharos.
Balm of Gilcad.....	Xyleutes robinia.
Bass-wood.....	Grapta interrigationis.
Bean .....	Eudamus bathyllus.
	Spilosoma virginica.
	Thecla humuli.
Bees.....	Galleria cereana.

- Birch..... Hyphantria textor.  
 Box-elder..... [See Horse-chestnut.]  
 Buckeye..... Lecanium acericola.  
 Burdock..... Pyrameis cardui.  
                   "          huntera.  
  
 Butternut..... Citheronia regalis.  
 Cabbage..... Pieris oleracea.  
                   "          protodice.  
                   "          rapæ.  
                   Plusia brassicæ.  
                   Plutella cruciferarum.  
                   Spilosoma virginica.  
  
 Cantaleup..... Phacellura nitidalis.  
 Carpets..... Tinea tapetzella.  
 Cassia ..... Terias nicippe.  
 Cherry ..... Anisopteryx autumnata.  
                   "          vernata.  
  
 Chestnut ..... Acronycta americana.  
*Cimicifuga racemosa*..... Lycæna comyntas.  
 Clothes..... Tinea biseliella (T. flavifrontella.)  
                   "          rusticella (T. vestianella.)  
                   "          tapetzella.  
  
 Clover..... Asopia costalis.  
                   Callydrias eubule.  
                   Colias eurytheme.  
                   "          philodice.  
                   Drasteria erichtea.  
                   Hyphantria textor.  
                   Lycæna comyntas.  
                   Pyrallis farinalis.  
                   Pyrrhætia isabella.  
                   Terias nicippe.  
  
 Clover-hay ..... Asopia costalis.  
   orn..... Achatodes zeæ.  
                   Agrotis clandestina.  
                   "          C-nigrum.  
                   "          herilis.  
                   "          messoria.  
                   "          saucia.  
                   "          subgothica.  
                   "          tessellata.  
                   "          epsilon.  
                   Aphidæ (Plant-lice.)  
                   Aphis maidis.  
                   Arctia arge.  
                   "          phalerata.  
                   Army-worm.  
                   Blissus leucopterus.  
                   Chinch-bug.  
                   Cutworms.  
                   Elateridæ (Wire-worms.)  
                   Empretia stimulea.  
                   Gortyna nitela.  
                   Grasshoppers or Locusts.  
                   Hadena arctica.  
                   "          devastatrix.  
                   Heliophila unipuncta.  
                   Heliiothis armigera.  
                   Hyperchiria io.  
                   Laphygma frugiperda.  
                   Leucania unipuncta.  
                   Leucarctia acree.  
                   Locusts or Grasshoppers.  
                   Macroductylus subspinosus.  
                   May Beetles (white Grubs.)  
                   Nephelodes violans.  
                   Plant-lice.  
                   Phyllophaga (white Grubs.)  
                   Pyrallis farinalis.  
                   Sphenophorus zeæ.  
                   Spilosoma virginica.  
                   White Grubs (Phyllophaga.)  
                   Wire-worms (Elateridæ.)  
  
*Cornus actinomeus*..... Lycæna comyntas.



- Cotton..... Aletia argillacea.  
Anomis argillacea.  
Heliothis armigera.
- Crab-apple ..... Xyleutes robiniaë.
- Cottonwood ..... Acronycta lepusculina.  
" populi.
- Croton capitatum* ..... Paphia andria.
- Cucumber..... Egeria cucurbitæ.  
Phacellura nitidalis.
- Currant ..... Egeria caudata.  
" tipuliformis.  
Angerona crocataria.  
Myelois convolutella.  
Nematocampa filamentaria.
- Dandelion..... Pyrrhætia isabella.
- Desmodium marilandicum* ..... Lycæna emyntas.
- Dyctamnus fraxinella*..... Papilo cresphontes.
- Elder... Hyphantria textor.
- Elm ..... Acronycta americana.  
Anisopteryx autumnata.  
Ceratomia amyntor.  
Eugonia subsignaria.  
Grapta comma.  
" interrigationis.  
Hyphantria textor.  
Orgyia leucostigma.  
Vanessa antiopa.
- Epilobium coloratum*..... Eudryas unis.
- Forest trees..... Acronycta americana.  
" lepusculina.  
" oblinita.  
" populi.  
Apatura celtis.  
Anisopteryx autumnata.  
" pometaria.  
" venata.  
Argyrolepis quercifoliana.  
Callosamia promethea.  
Catocala amatrux.  
" cara.  
" desperata.  
" neogama.  
" ultronia.  
Ceratomia amyntor.  
Chrysophanus thoe.  
Citheronia regalis.  
Clisiocampa americana.  
" sylvatica.  
Dryocampa rubicunda.  
" senatoria.  
Ecpantheria scribonia.  
Endropia bilinearia.  
Eucronia maia.  
Eugonia subsignaria.  
Grapta comma.  
" interrigationis.  
Halesidota tessellaris.  
Hylina cinerea, (misprint for *Xylina*.)  
Hyperchiria io.  
Hyphantria textor.  
Limenitis ursula.  
Lithophane cinerea.  
Orgyia leucostigma.  
Papilio ajax.  
" cresphontes.  
" troilus.  
" turnus.  
Phycita nebulo.  
Pyrophila pyramidoides.  
Samia cecropia.  
Smerinthus juglandis.  
Thecla humuli.  
" strigosa.  
Tortrix rileyana.  
Vanessa antiopa.  
Xylina cinerea.  
Xyleutes robiniaë.
- Fur..... Tinca pellionella.

- Garden vegetables ..... *Egeria cucurbitæ*.  
*Ceramica picta*.  
*Deilephila lineata*.  
*Doryphora 10-lineata*.  
*Dyspteris abortivaria*.  
*Eudamus bathyllus*.  
*Eutropela transversata*.  
*Gortyna nitela*.  
*Hypena humuli*.  
*Leucartia acraea*.  
*Macrosila carolina*.  
" *5-maculata*.  
*Mamestra picta*.  
*Papilio asterias*.  
*Phacellura nitidalis*.  
*Pieris oleracea*.  
" *protodice*.  
" *rapæ*.  
*Plusia balluca*.  
*Plutella cruciferarum*.  
*Pterophora diversilineata*.  
*Pyrophila pyramidoides*.  
*Pyrrhætia isabella*.  
*Spilosoma virginica*.  
*Thecla humuli*.
- Goat-weed..... *Paphia andria*.
- Gooseberry..... *Eufitchia ribearia*.  
*Grapta faunus*.  
*Limenitis ursula*.  
*Myelois convolutella*.
- Grain..... *Tinea granella*.  
*Gelechia cerealella*.
- Grape-vine..... *Acoloithus americana*.  
*Egeria polisiformis*.  
*Alyphia octomaculata*.  
*Darapsa myron*.  
*Deilephila lineata*.  
*Desmia maculalis*.  
*Eudryas grata*.  
" *unio*.  
*Hyphantria textor*.  
*Penthina vitivorana*.  
*Philampelus achemon*.  
" *pandorus*.  
*Philometra serraticornis*.  
*Psychomorpha epimenis*.  
*Pterophorus periscellidactylus*.  
*Spilosoma virginica*.  
*Thyreus abbotii*.
- Grass ..... *Arctia phalerata*.  
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*Heliophila unipuncta*.  
*Leucania unipuncta*.  
*Leucartia acraea*.  
May-beetles.  
*Neonympha eurytis*.  
*Pamphila sassacus*.  
*Philometra serraticornis*.  
*Phyllophaga*.  
*Satyrus nephele*.  
White grubs.
- Grease ..... *Aglossa pinquinalis*.
- Hackberry ..... *Apatura celtis*.
- Hair..... *Tinea biseliella*.
- Hibiscus* ..... *Eudryas unio*.
- Hickory..... *Citheronia regalis*.  
*Hyphantria textor*.  
*Phycita juglandis*.  
*Smerinthus juglandis*.  
*Tortrix rileyana*.  
*Xylina cinerea*.
- Holly..... *Thecla strigosa*.
- Holyhock ..... *Pyrameis huntera*.
- Hop ..... *Grapta interriginis*.  
*Hypena humuli*.  
*Plusia balluca*.  
*Thecla humuli*.

- Hop tree.....*Papilio cressphontes*.  
Horse-chestnut.....*Orgyia leucostigma*.  
Jimpson.....*Macrosila carolina*.  
" 5-maculata.  
Knot-grass .....(See Knot-weed.)  
Knot-weed'.....*Eutrapela transversata*.  
Larch .....*Orgyia leucostigma*.  
*Lespedeza*.....(See Red-root.)  
Lilac .....*Ægeria syringæ*.  
Linden .....*Acronycta americana*.  
*Liptilium virginicum*.....(See Pepper-grass.)  
Locust .....*Epantheria scribonia*.  
*Eudamus tityrus*.  
*Samia cecropia*.  
*Xyleutes robinia*.  
Lupine.....*Colias eurytheme*.  
" *philodice*.  
Maple .....*Acronycta americana*.  
*Ægeria acerni*.  
*Dryocampa rubicunda*.  
*Lecanium acericola*.  
" *acericorticis*.  
*Orgyia leucostigma*.  
*Samia cecropia*.  
Melons .....*Dcilephila lineata*.  
*Phacellura nitidalis*.  
Milkweed .....*Danais archippus*.  
*Monarda* .....*Pholisora catullus*.  
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Nettles .....*Grapta comma*.  
*Pyrameis atalanta*.  
" *huntera*.  
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*Clisiocampa sylvatica*.  
*Dryocampa senatoria*.  
*Eudropia belinaria*.  
*Eucronia maia*.  
*Hyphantria textor*.  
*Limenitis ursula*.  
*Thecla strigosa*.  
*Xyleutes robinia*.  
Orange .....*Papilio cressphontes*.  
Osage orange.....*Hyphantria textor*.  
*Lecanium macluræ*.  
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Paw-paw.....*Papilio ajax*.  
Peach .....*Ægeria exitiosa*.  
*Anisopteryx autumnata*.  
" *pometaria*.  
*Pyrophila pyramidoides*.  
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*Pyrophila pyramidoides*.  
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Persimmon .....*Citheronia regalis*.  
Phlox .....*Heliothis phloxiphaga*.  
Pine.....*Callosamia promethea*.  
Plantain.....*Arctia arge*.  
*Pyrrhætia isabella*.  
Plum.....*Ægeria exitiosa*.  
*Orgyia leucostigma*.  
*Pyrophila pyramidoides*.

<i>Poligonum aviculare</i> .....	Eutrapela transversata.
Poplar.....	Pyrophila pyramidoides. Vanessa antiopa. Xylina cinerea.
Potato .....	Doryphora 10-lineata.
Prickly Ash.....	Chrysophanus thœ. Papilio cresphontes.
<i>Ptelea trifoliata</i> .....	Papilio cresphontes.
Purslain .....	Deilephila lineata.
Radish.....	Pieris oleracea.
Raspberry .....	Ægeria rubi. Pyrophila pyramidoides. Selandria rubi. Synchlora rubivoraria.
Red-bud .....	Pyrophila pyramidoides.
Red-root .....	Lycæna comyntas.
<i>Ribis floridum</i> ,.....	Ægeria caudata.
Rose.....	Emprertia stimulea. Heliothis exprimens. Hyphantria textor. Lozotænia rosaceana. Orgyia leucostigma. Phigalia strigataria. Pyrhia exprimens. Smerinthus excæcatus.
Sassafras .....	Papilio troilus. Hyperchiria io.
Scrub-grass.....	Pamphila sassacus.
Smart-weed .....	Acronycta oblinita.
Silk-weed.....	(See Milk-weed.)
Snow-berry.....	Sesia thysbe. Tortrix rileyana.
Sorrel.....	Chrysophanus americana.
Spruce .....	Orgyia leucostigma.
Squash .....	Phacellura nitidalis.
Straw.....	Pyralis farinalis.
Strawberry.....	Anchylopera fragariæ. Emphyrtus maculatus.
Sunflower . .....	Pyrameis cardui " huntera. Epantheria scribonia.
Sumach .....	Citheronia regalis.
Sycamore .....	Hyphantria textor.
<i>Symphoricarpus vulgare</i> .....	(See Snowberry.)
Thistles .....	Plusia precautionis. Pyrameis cardui.
Thorn .....	Papilio turnus Pyraphila pyramidoides. Thecla humuli. " strigosa.
Tobacco .....	Macrosila carolina. " 5-maculata.
Tomato .....	Macrosila carolina. " 5-maculata.
Turnip .....	Ceramica picta. Deilephila lineata. Mamestra picta. Pieris oleracea. Plutella cruciferarum.
Violet .....	Argynnis diana. " idalia.



Virginia creeper.....	Acoloithus americana. Citheronia regalis. Eudryas grata. Philampelus achemon. " pandorus. Thyreus abbottii.
Walnut.....	Orgyia leucostigma. Phycita juglandis. Smerinthus juglandis. Tortrix rileyana.
Watermelon.....	Deilephila lineata.
Wax.....	Galleria cereana.
Wheat.....	Army-worm. Blissus leucopterus. Chinch-bug. Gelechia cerealella. Gortyna nitella. Grasshoppers. Heliophila unipuncta. Leucania unipuncta. Micropus leucopterus. Tinea granella.
Wild bean.....	Eudamus bathyllus.
Willow.....	Ecpantheria scribonia. Hyphantria textor. Limenitis ursula. Vanessa antiopa.

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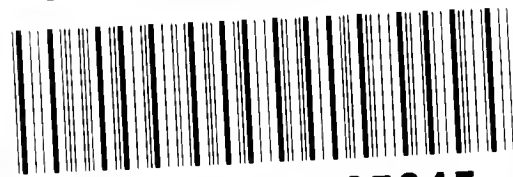








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