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TENTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

FOR THE YEAR 1894

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

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

ALBANY
UNIVERSITY OF THE STATE OF NEW YORK
1895

Some Entomological Publications of J. A. Lintner.

Entomological Contributions. Albany: Weed, Parsons and Company, Printers, 1872. Pages 90, plates (lithographic) 2. Also in the Twenty-third Annual Report on the New York State Cabinet of Natural History [for the year 1869]. 1873. Pages 137-222.

Entomological Contributions — No. II. Albany: The Argus Company, Printers, 1872. Pages 76. Also in the Twenty-fourth Annual Report on the New York State Museum of Natural History [for the year 1870]. 1872. Pages 109-170.

Entomological Contributions — No. III. Albany: The Argus Company, Printers. May, 1874. Pages 80 (112-192), figures 17. Also in the Twenty-sixth Annual Report of the New York State Museum of Natural History [for the year 1872]. 1874. Pages 117-192.

Entomological Contributions — No. IV. Albany: Weed, Parsons & Company, Printers, June, 1878. Pages 144. Also in the Thirtieth Annual Report of the New York State Museum of Natural History [for the year 1876]. 1878. Pages 117-254.

Report on the Insects and other Animal Forms of Caledonia Creek, New York. Albany: 1878. Pages 26, plates (lithographic) 3. Also in the Tenth Annual Report of the New York Fishery Commissioners, for the year 1877. Albany: 1878. Pages 12-36, plates 1-3. (For summary of contents, see the Seventh Report on the Insects of New York, 1891, page 373.)

Lepidoptera of the Adirondack Region. Albany: 1880. Pages 28. Also in the Seventh Annual Report of the Topographical Survey of the Adirondack Region of New York, by Verplanck Colvin Albany: 1880. Pages 375-400. (See Sixth Report on the Insects of New York, 1890, page [82] 178.)

The Insects of the Clover Plant. Albany: 1881. Pages 17, figures 6. Also in the Transactions of the New York State Agricultural Society for the years 1877-1882, xxxiii, 1884. Pages 187-207. (See Sixth Report on the Insects of New York, 1890, page [88] 184.)

The White Grub of the May Beetle. Bulletin of the New York State Museum of Natural History, No. 5. Albany: November 1888. Pages 31, figures 5. Also in the Transactions of the New York State Agricultural Society, xxxiv, for 1883-1886, pages 5-33.

Cut-worms. Bulletin of the New York State Museum of Natural History, No. 6. Albany: November, 1888. Pages 36, figures 28. Also in the Transactions of the New York State Agricultural Society, xxxiv, for 1883-1886, pages 66-100.

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No. 68.

IN SENATE,

JANUARY, 1895.

TENTH REPORT

OF THE

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

OFFICE OF THE STATE ENTOMOLOGIST, {
ALBANY, *January*, 1895. }

To the Legislature of the State of New York :

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

Very respectfully,

J. A. LINTNER.

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REPORT.

OFFICE OF THE STATE ENTOMOLOGIST, }
ALBANY, *November 30, 1894.* }

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

GENTLEMEN.—The Entomologist, in accordance with the provision of chapter 355 of the Laws of 1883, presents herewith to your honorable board the following report:

Owing to an unusual pressure of official work — principally in an increased correspondence and several special insect investigations which have not been completed — there has not been the opportunity for preparing the usual report embracing the observations and studies made during the year. It is, therefore, thought better to present the following partial report, and postpone a more extended one until the material in hand can be suitably prepared for presentation hereafter.

In former reports reference has been made to the steadily increasing correspondence of the office, but in no preceding year had it attained to such magnitude as to engross almost the entire time of the Entomologist. The simple statement of the number of letters received and answered could give no adequate idea of the time occupied in the correspondence. Inquiries for information of the names of insects — whether they are injurious or not — of their habits and means of control, when received from remote parts of the United States to which they are peculiar, may require an entire day, or more, in their study and in examination of their scattered literature before they can be satisfactorily

answered and record made of such portion of the study as may be desirable to record for publication. Although such inquiries might more appropriately be made elsewhere — either to the Agricultural Experiment Station of the State or to the Entomological Division of the United States Department of Agriculture at Washington — than of the New York State Entomologist, still it has been thought proper to give them all the attention they merit, in consideration of the value of the study (when required) to your Entomologist and to entomological science at large. Many of these replies have been communicated to agricultural journals, while those of general interest may hereafter be given in following numbers of my annual reports.

During the year correspondence has been had with residents in each one of the States and Territories except two. The number of letters pertaining to the work of the office, sent out during the year, so far as they have been listed, is 1,583. Of the more important ones, or those which might be useful for reference, copies have been retained; of the others their subjects have been noted. The number of letters received and filed during the same time is 1,310.

Although the year has not been remarkable for widespread insect attacks of unusual severity, still there have been many which deserved and have received careful study, which will be reported hereafter. Some of these are of special interest, as being new to the State, and others, from extending their range into, and occupying portions of, the State, which had been previously exempt from their presence.

The one event that has made the year a notable one in the annals of entomological science is the appearance of the periodical Cicada or "the 17-year locust" in the Hudson River Valley, and the opportunity afforded for studying in many localities the remarkable above-ground structures made by the pupæ

for a purpose unknown. Much interesting information relating to the insect was secured during its brief stay, from personal observation, correspondence, and the public press, and it is a matter of regret that the more pressing duties of the office have not left the time for the preparation of the material for presentation in this report.

The publications of the Entomologist during the year in agricultural, scientific, and other journals, and society proceedings, are 38 in number. A list of them with brief summary of contents is given in the Appendix, together with that for the preceding year (62 in number), which was not included in the printed report for that year, and also a list of some earlier entomological publications (1862-1869).

Three reports of the Entomologist have been published during the present year, viz., for the years 1891 and 1892 (long delayed by the State printer), and 1893, and are contained in the forty-fifth, forty-sixth, and forty-seventh reports on the New York State Museum. Separate editions on heavy paper of 700 copies each, of the first two of these, have been printed for the use of the Entomologist. These are entitled "Eighth Report on the Injurious and Other Insects of the State of New York for the Year 1891" (223 pages and 53 figures, issued in February, 1894), and "Ninth Report on the Injurious and Other Insects of the State of New York for the Year 1892," (211 pages and 34 figures, issued in March, 1894). The "Report of the State Entomologist to the Regents of the University of the State of New York for the Year 1893" (of 24 pages, and issued in November, 1894), is contained in the Forty-seventh State Museum Report, and a small edition on ordinary paper, under the same title, has also been printed separately.*

* A few pages of this report have been reprinted in the present one.

The additions to the collection by the Entomologist have been — of mounted and labeled specimens, about 1,800 examples (a complete record was not kept), and of alcoholic and unmounted, exceeding 700 specimens. Among the more important of the additions are a number of slides prepared for the microscope, exhibiting minute insects or insect stages; species of Lepidoptera, Diptera, etc.—reared from the egg or larva, permitting notes of their life-history to be made; and Lepidopterous and other larvæ beautifully prepared by inflation by my assistant, Miss Davis.

Contributions to the collection have been made by 54 persons, aggregating about 500 examples. The list of donors, with their contributions, may be found in the appendix.

The collection, in part, is arranged in small folding boxes, the size of which, 11 by 14½ inches, has been found convenient for arrangement of the contained material and for holding in the hand while being studied. The remainder is in drawers, 15 by 18 inches inside, patterned after those used in many of the continental museums of Europe and in the entomological department of the Museum of Comparative Zoölogy at Cambridge, Mass. They were made under personal inspection of Dr. Hagen while director of the museum, and are believed to be almost, if not entirely, proof against the entrance of museum pests. Naphthaline, in the convenient form of pin-pointed cones, is employed for insuring additional protection from insect depredations. The entire collection is given inspection from time to time, and is believed to be at the present wholly free from insect attack.

Considerable progress has been made in the arrangement, classification, and labeling of the collection. The alcoholic portion has been put in better condition for its preservation through the application of paraffine to the corks where rubber ones of proper size were not available. It is proposed to replace these

with rubber as soon as it can conveniently be done. In the Hymenoptera, the *Andrenidæ*, which have been gradually accumulating for a number of preceding years, but left unstudied from the difficulty attendant upon their close resemblances, have been carefully studied and all — so far as it could be done — determined and labeled. The *Apidæ* have been partly gone over in the same manner. In the Diptera special study has been given to the interesting family of *Bombylidæ*, and most of them have been named. In the Orthoptera all of the *Acrididæ* have been studied and their determinations made. Work of this character is necessarily slow, but it will be carried on as rapidly as the time that can be devoted to it will permit, with the view of putting the entire collection in such shape that the duplicates that are accumulating may be named and labeled, and ready for distribution to the educational institutions of the State whenever it shall be feasible to enter upon so desirable a work. With the increasing attention that is being given to the study of natural history in our schools, a series of cases representing typical insects in each of the seven older orders, and another series to illustrate the more injurious species, with their transformations and their injuries — all authoritatively labeled, could not but prove a valuable contribution toward the educational material of the schools.

It is specially desirable that such collections, and still more extended, should be placed in each of the Normal schools. Some of them are already provided with them, and are giving valuable instruction in entomology. The study of injurious insects, the nature of their injuries, and methods for preventing their ravages has, during recent years, become so indispensably connected with successful agriculture that the demand will soon be imperative for instruction in economic entomology in our principal schools. Teachers, therefore, should be in training that may be prepared to respond to such demand.

As illustrating both the importance of entomological investigation to the agricultural interest, and the recognition that these studies, in their utilitarian aspect particularly, have — after years of indifferent regard — finally obtained and secured, the following remarks are quoted. Their source lends them additional weight. They are from an address made by Governor Flower, in August last, at Jamestown, N. Y., to a concourse of the farmers and others of Chautauqua county, estimated at 8,000 persons. The subject of the address, as announced, was “Scientific Farming.”

Premising that the State was doing much for the promotion of scientific agriculture — the admirable work that was being done in this direction at the agricultural experiment station at Geneva, and at Cornell University and the experiment station connected therewith — was detailed at considerable length, and the great benefits that were accruing to the State from these institutions in various directions were pointed out.

The Governor, in continuation of his remarks, said :

“Another important field of State effort in the application of science to agriculture is that of entomology. Not only is this a subject of study at the experiment stations, but there is a special State officer to pursue investigations in entomology and furnish information based on his researches to the farmers. Prof. Lintner is a thoroughly trained entomologist, and his work has been of great benefit to the agricultural interests of the State. Few of us appreciate what an important bearing on agriculture insect life has. You farmers, who have lost whole crops of grapes, or wheat, or potatoes, or hops, by the wicked ravages of these little animals, do appreciate their power and do appreciate the value of some sure means of preventing their inroads. They are mysterious creations — these mischievous destroyers of crops. They come suddenly at times, they work quietly and assiduously, they

breed so rapidly that it seems impossible to exterminate them. No State function is more useful or necessary than that which employs the best ability of science to exterminate these pests. Why, the entire grape culture of France was threatened with destruction by the grapevine phylloxera — which you in this country know something about, I dare say — and the French government has not only spent nearly \$200,000 for investigations, but has also offered a reward of \$60,000 for the discovery of an effectual remedy. The successful ravages of this little animal (which is not nearly as big as the head of a pin) in this State would mean a loss of over \$5,000,000 a year. Surely a State would be remiss which was unwilling to appropriate a few thousand dollars for experiments to prevent such a catastrophe. When it is considered how many farm plants, grains and fruits are endangered by injurious insects of one kind or another — wheat, hops, potatoes, peaches, currants, cabbages, cherries, plums — indeed nearly all varieties of plant life — it would seem of the highest importance that the State relax no effort to overcome these public enemies. Prof. Lintner estimates that with our present scientific knowledge and with the means now at our command, we can, if we will, lessen insect depredations to the extent of at least one-half of their present magnitude. That, indeed, would be a remarkable triumph, but it is only an assurance of greater results in the future. Scientists are learning to depend not alone on poisons to destroy these insect enemies, but they are enlisting in their efforts the aid of other insects — parasites which prey upon the injurious species and drive them from the field. I read the other day in the Albany *Argus* that Postmaster-General Bissell had issued an order allowing the importation of lady-bugs through the mails from Australia, because they were of such value in destroying insect enemies. Scientists give

us reason to hope that perhaps in the near future, when we find the hop-louse on our hops, or phylloxera on our grapevines, we can turn loose some other insect which will help us exterminate them. So let us encourage our entomologists in their good work that our farmers may get the greatest possible benefit from their valuable discoveries.”

The additional office-room which the Regents have kindly provided for the use of the Entomologist, through the inclosure and fitting up of a portion of the adjoining corridor, has proved of the greatest possible convenience, relieving, as it does, the discomforts of an overcrowded apartment and affording all needed room, for the present, for the arrangement of the collection and the growing library.

Provision having been made for an assistant to the Entomologist, Miss R. L. Davis, who had had three years' experience in the work of the Insectary connected with the Hatch Agricultural Experiment Station, at Amherst, Mass., under direction of Prof. C. H. Fernald, was selected for the position; and having been duly appointed, entered upon her duties in November, 1893. Her services have been of material aid in extending the work of the department.

The entomological collection continues to be an interesting feature in visits made to the Capitol. Although a very limited public display can be made of its material, owing to its liability to injury from exposure to light, yet the drawers of the more attractive insects and cases, illustrating the manner of mounting, preparation, classification, and labeling, are always gladly shown and explained to those who give evidence of appreciation of the study and interest in its progress. The pupils connected with our schools are especially welcomed at all times, and every pains is taken to enlist their interest in the insect world and to encour-

age them in its study, by pointing out to them the fascination that it presents, the ease with which it may be pursued, its almost ever-at-hand source of enjoyment, and its growing importance in its practical applications.

In the preceding nine reports of the entomologist, aggregating 1,950 pages, hundreds of species of insects have been noticed at greater or less extent. The same species has also, in several instances, been treated of in different reports, in additions to former histories, or in correction of the earlier statements. To facilitate reference by those who have occasion to refer to or study these reports, a general index, which will include the present report, has been prepared and will be found at the end of this volume. It has not been made as full as the separate ones that have been presented, but it will contain the scientific names of insects by their generic and specific designation, family and ordinal names, the common or popular names, the insects infesting the more important food-plants, the principal remedies and preventives, and reference to figures used in illustration. So far as possible from the literature at hand, the more important synonymy has been brought down to the present time, omitting, however, many of the changes that have been lately proposed (especially in the Lepidoptera) but are still purely tentative, and in which there is an almost entire absence of accord among our recent writers, both in nomenclature and classification.

With grateful acknowledgment of the interest taken by your Board in the work of the department during the year, and the aid extended to it,

Respectfully submitted,

J. A. LINTNER.

INJURIOUS INSECTS, ETC.

Ants on Fruit-Trees.

(Ord. HYMENOPTERA: Fam. FORMICIDÆ and MYRMICIDÆ)

From a not uncommon belief that all insects are injurious, fruit-growers are often unnecessarily alarmed by the appearance, in large numbers, of ants in fruit-trees, especially when found in association with apparent insect injury; and inquiries are made of the precise nature of the damage caused by them and how they may best be destroyed. The following is one of many similar letters received:

Do the small ants that nest in ant-hills in the ground, especially about the drives and walks, injure fruit-trees? I have noticed them running about young apple, pear, and peach-trees, some of which have leaves curled and otherwise showing the ill effects of something. There are also some green lice on the leaves. What will destroy both ants and lice, and how can ants be kept off the trees if they are detrimental? Trees have been sprayed with solution of London purple, but I do not see that it stops the ants or kills the lice.

E M.

An Ant Frequenting Apple-Trees.

The ants that are so often to be seen running up and down the trunks and main branches of fruit-trees, are not known to be injurious to the tree or its fruit. A large black ant with a deep chestnut-red thorax is quite common on apple-trees. It was described by Dr. Fitch in his *First Report on the Insects of New York*, as *Formica Novaboracensis*, but has since been identified with an European species bearing the name of *Camponotus herculeanus* (Linn.). It is also, according to Cresson, the *Formica Pennsylvanica* of many writers. Its occurrence on apple-trees is always associated with the presence of plant-lice or aphides. It feeds on the "honey-dew" secreted by the aphides and given out from the pair of honey-tubes projecting from their abdomen, and in return the ant gives them protection from their insect enemies in consideration of the grateful food they supply.

The Cherry-Tree Ant.

Another smaller ant is, according to Dr. Fitch, a constant attendant of the cherry-tree plant-louse, *Myzus cerasi*. The worker is only 0.14 of an inch long, of a dark-brown color, with a shining, black, pointed

abdomen. Its scientific name is *Cremastogaster cerasi* (Fitch). Sometimes a half-dozen or more of these ants may be seen upon a single aphid-infested cherry leaf, touching or rubbing the aphides with their antennæ to induce them to yield their honey-dew. They are more faithful nurses of the aphides than the preceding species, and despite their smaller size they are abundantly able, by means of their sting, to defend themselves against the powerful *C. herculeanus*, to conquer it, and even to rob it of its flock of aphides. Dr. Fitch gives an interesting detailed recital of the manner in which this is accomplished, through the use of its sting when seized by the larger species, and then marking each plant-louse with the pungent venom thrown out from its sting which apparently makes them repulsive to their former guardians.

The Little Yellow Ant, Common in Walks.

If our correspondent is correct in his identification of the ants frequenting his fruit-trees with those that make the little ant-hills in and about the drives and walks, then the species must be the "little yellow ant," *Monomorium molestum* (Say). The worker measures 0.06 of an inch in length, "is of a honey-yellow color with the head and abdomen tinged with brown, the abdomen being broadly oval and almost globular." I do not recall any record of this species ascending fruit-trees for its food, but it is undoubtedly injurious at times to succulent vegetation, for Dr. Fitch has stated (First Report, p. 129) of it, that it sometimes does much injury in corn-fields by gnawing the blades of corn when they are but a few inches high, for the purpose of drinking the sweet juice which flows from the wounds.*

Ants Injurious to Orange-Trees.

Two species of ants are injurious to orange-trees in the South, as we learn from the studies of Mr. H. G. Hubbard, contained in his volume, entitled *Insects Affecting the Orange*, 1885. Of these, *Monomorium carbonarium* Smith, eats holes into the leaves when they are young and tender, but seldom causes any material damage. The other, *Solenopsis xyloni* McCook,† "frequently and seriously injures the orange by gnawing away the bark and causing an exudation of the gum. The ants make their attack in force, and either girdle or kill the shoots or cut so deeply in their bases that they bend over or break off by their own weight. Sometimes, but rarely, the ants attack the old bark of the trunk and larger branches and gnaw holes therein,

* See an interesting account in the *Transactions of the New York Agricultural Society*, xxv, for the year 1865, p. 133, of attacks made by this species upon cut-worms.

† Subsequently referred to *Solenopsis geminata* (Fabr.).

eating away the cambium layer without waiting for the gum to exude" (*loc. cit.*, pp. 129, 130).

Ants Usually Harmless to Fruit-Trees.

It will appear from the above that, as a rule, it is not necessary to destroy the ants that frequent our fruit-trees, although it is thought by some — Dr. Fitch among the number — that from the protection that they give the aphides, these serious pests become more numerous than they possibly could without such fostering care. The aphides may be killed when they first make their appearance and before they are sheltered in the cavities of the curled leaves, by spraying them with tobacco water, soapsuds or kerosene emulsion. The London purple spraying mentioned in the inquiry could have had no effect upon them, as it is only serviceable upon biting insects, and not upon the suctorial class, which draw their food through a needle-pointed proboscis, unaffected by the external poisoning of the foliage.

Should careful observation show, in any instance, that the ants are really detrimental, for any reason, when frequenting fruit-trees, they may be driven away by a free application of tobacco in the form of dust or factory waste spread around the base of the tree. Where tobacco is grown, the following method, recommended by Rev. W. P. Smith, of Fayetteville, Texas, might be employed :

"I was raising some tobacco, and operated with the green leaves in the following manner: I removed the earth from around the tree as much as I could without injuring the roots; then I put a handful of tobacco leaves around the tree where the ants worked, covered them nicely with the earth and pressed it well. In a few cases I had to repeat the dose, but I have tried it often with uniform success in driving away the ants and saving the tree." (*Rept. Commis. Agricul. for 1868*, p. 433-434.)

To Prevent Ants from Ascending Trees.

Different methods have been proposed for this. A band of fur with the hairs pointing downward and tied closely to the trunk, is said to form an almost impassable barrier. The skin of a rabbit has been found effective, but probably that of almost any stiff, closely-set, long-haired animal would do as well. A broad band of chalk eight or ten inches wide, completely covering the bark and encircling the trunk, is also efficient in the absence of rain or excessive dews, if occasionally renewed. Insect-lime, when it can be obtained, applied in a broad band, will serve for weeks for preventing the ascent of ants, as well as a number of other insect pests of fruit-trees.

Ants Regarded as Valuable in Orchards.

A correspondent of the *Country Gentleman* (vol. lvii, 1892, p. 689), writing from London, presents the following plea for the introduction and protection of ants in orchards:

The *Horticultural Times* (London) has recently published a statement that many of the leading orchardists of southern Germany and northern Italy hold the black ant [*Formica nigra* L.] in high esteem, and take measures to promote their increase. They establish ant-hills in their orchards, and leave the police service of their fruit-trees entirely to their tiny colonists, which pass all their time in climbing up the trunks of the trees, cleaning the boughs and leaves of malefactors, matured as well as embryonic, and descend laden with spoils to the ground, where they comfortably consume or prudently store away their booty. They never meddle with sound fruit, but only invade such apples, pears, and plums as have already been penetrated by the insects, in pursuit of which they get to the very heart of the fruit. Nowhere else in the orchards are the apple and pear trees so free from insect ravages and blight as in the immediate neighborhood of a large ant-hill five or six years old. In China, ever since the sixteenth century, and probably earlier, ants have been used to protect the fruit-trees from the ravages of insect pests. In the province of Canton the orange-trees are injured by certain worms, and the orchardists rid themselves of the pests by importing ants from the hill country.

Ants on Peonies.

A correspondent has written: "The peony bushes in my garden are thickly populated with black ants, which I find on no other plant. Few of the blossoms reach handsome perfection, but show the effects of insect attack. Are the ants to blame for the mischief, or are they really friends, visiting the peonies only to destroy small aphides or other minute creatures which do the harm? In either case, is there a better remedy than hellebore? How would pyrethrum answer?"

Ants are not known to be injurious to peonies. They are often drawn to them in numbers, either to feed on the minute insects that are attracted to the plant, or on the sweet and sticky secretion which it gives out so abundantly. I am not sure that any of the aphides occur on the peony, and I have not the means of ascertaining at the present writing whether they do or not. I find, however, no species recorded in our lists as infesting that plant; still, it may sustain one peculiar to it, as many of our species are still undescribed. I am under the impression that several years ago, when my attention was called to the presence of ants on peonies, and to injuries which it was supposed they were inflicting on the flower as it was about opening, I found that the injury was caused by some small plant-bugs (Hemiptera) that

were puncturing and deforming the leaves of the calyx and the corolla; and furthermore, that the ants were actively engaged in capturing and carrying off for their food some of the smaller insects.

Derostenus sp. ?

(Ord. HYMENOPTERA: Fam. CHALCIDIDÆ.)

Parings of apple-tree bark received from Mr. F. A. Fitch, of Randolph, Cattaraugus county, N. Y., in April, 1893, bearing numerous crushed or broken cocoons of the apple-tree *Bucculatrix*, *Bucculatrix pomifoliella* Clemens, contained within the cocoons and on the bark around them, a large number of small, shining black pupa-cases, from which the insects had escaped. Ten of them were counted packed against, and partly underneath, one of the cocoons near to three round holes made in the cocoon from which doubtless the parasites had emerged.

The pupa-cases were identified by Dr. C. V. Riley as those of a species of *Derostenus*, probably undescribed.

The genus belongs to the subfamily of *Entedoninæ* of the *Chalcididæ*. No American species of this genus have been described. One appears in Cresson's *Hymenoptera of North America*, 1887, under the name of *D. primus* Howard MS., which had been bred by Dr. Riley from a leaf-mining Coleopter, *Odontota suturalis*. Mr. Howard remarks: "A number of the brilliant little species of this genus have been bred in this country from the leaf-mines of both lepidopterous and coleopterous larvæ. None have ever been described; they are very difficult of separation and approach very closely to the European species. * * * The fact that a species of this genus has been bred from the pupa of an *Eulophus* [a Chalcid] would seem to indicate that *Derostenus* may consist of secondary parasites" (*Entomologica Americana*, i, 1885, p. 117-18).

This same *Derostenus* parasite has been reared (March 3, 1887) from the larvæ of *Bucculatrix Canadensisella* Chamb., occurring in New York (*Insect Life*, v, 1892, p. 16).

Operations against the Gypsy-Moth in Massachusetts.

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

In preceding reports I have written of the accidental introduction into the State of Massachusetts, in the year 1869, of the destructive

European Bombycid, "the gypsy moth," *Ocneria dispar*—of the probability of its entering New York and spreading over adjoining States—and of the efforts being made, under the direction of the Massachusetts State Board of Agriculture, for its extermination while within the limited locality of the northeastern part of the State, where it is at present confined.

This is the fourth year of active operations against this insect under annual appropriations by the State Legislature, which have now amounted in the aggregate to \$275,000.*

In June last an invitation was extended to me by the committee of the State Board of Agriculture to visit the infested district in company with the State Entomologists of adjoining States, for the purpose of inspecting the work of the committee, and to offer such suggestions or criticisms as it might be thought proper to make.

Every facility was afforded for thorough examination, such as witnessing the field operations for spraying, kerosening and burning rocky and waste places; banding and liming trees for preventing the ascent of the caterpillars; personal inspection of the present condition in most of the twenty towns in which the insect has occurred; the experimental work being conducted at the Insectary at Amherst, in testing the susceptibility of the larvæ to various insecticides, and the study of the life-history of the insect and its habits; the method of recording by the office staff the field observations made by the force of nearly two hundred employees; the various instruments and appliances used in the field-work, with the manner of their use, etc., etc.

The inspection was very satisfactory and gratifying and at the same time instructive, as showing what may be done in arresting insect depredations, when the task would seem almost a hopeless one. I had not expected to find that such progress had been made toward the extermination of the myriads of the notorious gypsy-moth. It was a surprise to me that in the brief space of three years, the fearful ravages of the insect, as described to me and as pictured in photographs, could have been reduced to such a degree of comparative harmlessness, that to the ordinary observer no indication of its presence was visible; and in a ride of an entire day through several of "the worst infested towns," including a visit to localities which had been frightfully scourged, not a single example of the larva could be found by me, although diligent search for it was made.

How a work of such magnitude—extending over two hundred square miles, with the insect so abundant that in one locality the entire

* Including the two following years, 1894 and 1895, the appropriations have reached \$525,000.

side of a house was so closely covered with the caterpillars that the point of a pencil could not be thrust among them without touching them — could have been accomplished, was an enigma to me, until the means by which it was done had been shown and explained.

The only suggestions that occurred to me to offer to the committee in response to their request, were these two: Now that the mechanical details of field-work were rapidly diminishing with the steady reduction of the insect, there was both the greater need and the opportunity of such scientific work as might serve to complete the labors of the committee and present the result in form that would render it available for future use whenever the necessity might arise for a resort to similar methods in other insect invasions hereafter. A volume or two, which should treat exhaustively of the gypsy-moth and the methods employed for its extermination, might be another contribution to natural science, which would rank with those which Massachusetts had already made.

It was also recommended that at this stage of the committee's work, the cultivation of the parasites of the gypsy-moth (of which about a score of native ones are already known) be entered upon and conducted with all the knowledge and skill that could be brought to bear upon it.

A plan for the artificial rearing proposed was suggested, embracing in brief these points: The entire collection of the pupæ for this year, which might amount to twenty thousand, should be preserved, placed in suitable cases, and kept, through cold storage, from giving out their parasites until caterpillars of suitable age and reared from eggs gathered for the purpose, could be inclosed with them to receive the entire parasitic oviposition. The parasitized caterpillars should be properly guarded until their pupation, when the parasites that they would disclose within the cases should have a caterpillar supply in readiness for them. This round could be repeated as long as there seemed to be the necessity for it and the parasites could be obtained.

By the above method, or by some modification of it, it would seem that an actual extermination of the insect can be effected, and possibly in no other way.

In view of what has already been accomplished, there is abundant reason for a continuance of the appropriations by the Legislature of Massachusetts until the desired extermination is secured, or until the insect shall have been reduced to entire harmlessness and in position never again to develop in injurious numbers or to invade other States. Knowing as we do, the frightful ravages of the gypsy-moth in the past, and the certainty that, if left to itself, its natural multiplication

would soon carry it over the entire State, it would unquestionably be a wise economy if its extermination could be attained through the expenditure of a million of dollars. It may be recalled in this connection that the wheat-midge inflicted upon the wheat crop of the State of New York in one year — 1854 — an estimated loss of fifteen millions of dollars. (*Report of the Entomologist to the Regents of the University S. N. Y. for the Year 1893.*)

Gortyna immanis (Guenée).

The Hopvine Grub.

(Ord. LEPIDOPTERA : Fam. NOCTUIDÆ.)

A correspondent, Mr. A. B. Ryder, writing from Barnersville, in Schoharie county — one of the principal hop-growing counties in the State of New York — makes complaint of the ravages of “the grub,” and asks for an effective remedy for it. He writes:

Operations of the Grub.

The hop grub is the greatest enemy that the hop-growers of this county have to contend with. It makes its appearance in the spring about the time that we are making our first tying. We notice that the tops of the vines are stung by some insect, and on examination we find a tiny worm in them, which in a few days falls to the ground. Here it eats into the hop roots so that the hill winter-kills the following winter. The grub gets to be about an inch long. I suppose that it is a fly or some other insect that deposits an egg in the head of the hopvine and develops into the grub. If so, where does the fly come from, and how can we prevent having so many grubs? Any information that you can give me will be thankfully received, and a remedy for the prevention or destruction of the grubs would be worth thousands of dollars to our hop-growers.

A copy of the *Second Report on the Insects of New York*, containing the life-history of the insect as worked out by Prof. J. B. Smith, was sent to Mr. Ryder, which would tell him what the insect was, of its habits, nature of its injuries, its transformations, etc. For the remedies and preventives to be used, he was referred to the excellent and full study of the insect by Professor Smith, published in Bulletin 4 of the Division of Entomology — U. S. Department of Agriculture, Washington, 1884. As this bulletin is now virtually out of print, the following summary of its [provisions is here given for the benefit of hop-growers.

Remedies for the Grub.

First. Cultivate skunks, which are invaluable as hunters and destroyers of the grubs and their pupæ. Where they are left alone and protected and given convenient hiding and breeding places they will visit and clear every infested hill in a hop-yard.

Second. Search for and destroy the pupæ in early spring, which will involve but little labor when grubbing and cleaning the roots. A little experience will render them readily recognizable. They are formed in a rude earthen cell lying close to the roots. The pupa is an inch or more in length, stout, of a cylindro-conical shape, and of a deep-brown or blackish color. [By examining it, as in others of the same group of moths, the position of the future wings and legs will be found upon it, held firmly together, while the several rings of the abdomen can be made to move slightly upon one another.]

Third. Destroy the young grubs while tip-worms and in the "muffle-heads" when the vines commence to climb and the growers are beginning to tie. Do this by picking off the "muffle-heads" and by pinching between the fingers the contained larva. As the larvæ only remain in the head for about a week, by going through the field every second day and picking the muffle-heads as they appear, a yard of considerable extent can be cleared with little trouble.

Fourth. If the above have failed, then expose the roots for a few days in early June, after the larvæ have come to the ground, by drawing away enough earth to expose the junction of the growing vine with the old root. This will force the grubs to enter the ground to feed on the old roots where they will do little harm. After five or six days' exposure apply a handful of a mixture of coal and wood ashes or ammoniated phosphate, and hill high. This will cause the vine to throw out rootlets above the main root to sustain the vine while the grub may be working below.

Nothing that seems to promise better than the above has been proposed by later writers, if, indeed, anything in addition has been given.

Gortyna cataphracta Grote.

As a Raspberry-cane Borer.

(Ord. LEPIDOPTERA: Fam. NOCTUIDE.)

A raspberry cane was brought by State Botanist Peck on June 19 from his garden at Menands which had been bored upward for five inches, with the six inches of the tip beyond bending over. The larva

found in the burrow was in all probability that of *Gortyna cataphracta* Grote, described and figured in *Proc. Ent. Soc. Phila.*, iii, 1864. The following brief notes were made of it: It was six-tenths of an inch long, the head and collar pale red, head and first segment with a black stripe laterally; body with a dorsal and lateral stripe of white, which are widened over segments 8 to 10; beneath black on segments 3 to 6, elsewhere white. Caudal plate pale red, with a broad black lateral line. Legs black, stout. Spiracles in the black stripe oval, black, annulated with white. Prolegs on 8 and 9 white, with the two spots above them brown; prolegs on 7 and the terminal pair also white. The caterpillar, not maturing, was placed in alcohol in the State collection.

Not Frequent in the Raspberry.

This attack of *G. cataphracta* is either rare, or its operations, when noticed, are referred to the work of some other of the well-known and common raspberry-cane borers. It is not mentioned in Saunders' *Insects Injurious to Fruits*, nor in Professor Webster's *Insects Affecting the Blackberry and Raspberry*, published in December, 1892, wherein 87 species are noted. (*G. nitela*, the "stalk-borer," is recorded without particulars as boring in the stems of the raspberry.) No mention of it is made by Dr. J. B. Smith in his several notices of insects affecting the raspberry in New Jersey.

Bred from Various Plants.

The caterpillar, as might be suspected from the known habits of that of *Gortyna nitela*, by no means confines itself to raspberry canes, and its occurrence therein may be exceptional.

In the *Sixteenth Annual Report of the Entomological Society of Ontario* (1886), Mr. Fletcher reports his having bred for the first time (in 1885) *Gortyna cataphracta*, which had been very destructive during the last three seasons by boring into the stems of various kinds of plants, more especially lilies and raspberries.

Later, in 1893, Mr. Fletcher wrote me, in reply to inquiry made, that he had several times bred *G. cataphracta* from raspberry stems; also from the stems of lilies, burdock, *Amarantus* and, in fact, from almost any kind of large, juicy-stemmed plant, even including grasses. He has kindly sent me, with permission for its use, the following careful and detailed description of the caterpillar, found by him on July 14, boring into the fruit of a gooseberry:

Description of the Caterpillar.

Larva slender, 35 mm. long, dark purplish-brown, with three white, conspicuous, unbroken lines, one dorsal extending from segment 3 to

posterior margin of 12; two lateral on same segments. On segments 2 and 3 at the base of the thoracic feet, which are black, is a short line showing only on those two segments and very pale on 8, 9, and 10, at the base of the prolegs. Head yellow at the top, with a black line on each side running from the ocelli to the posterior margin of segment 2, where it passes along the lower edge of the large cervical shield and joins the dark brown color of the body beneath the white lateral line. Cervical shield yellow, conspicuous, almost covering the second segment, lined at the bottom by the black line that runs from and surrounds the ocelli. Spiracles dark, with pale-edged orifice, conspicuous on segment 2, where they lie in the short white line at the base of the thoracic feet. Anal shield yellow and conspicuous like the cervical shield, with two dark lines in continuation of the lower edges of the white lateral lines. Tubercles conspicuous, dark brown, shining, piliferous. Dorsal tubercles in two series, the anterior touching the edge of dorsal line and larger than those of the posterior series, which just touch the lateral line. Below the lateral lines are five series of tubercles, one suprastigmatal (No. 3 counting from the dorsum) just beneath lateral line anterior to spiracles. Another series (No. 4) on stigmatal line, immediately beneath series No. 3, the tubercle half the size. Another series (No. 5) posterior to spiracles and equidistant with series No. 4 from spiracles, composed of large tubercles, twice the size of those in No. 3. Immediately beneath spiracles and stigmatal folds is series No. 6 of tubercles, not quite as large as those in No. 5. Posterior to this there is a supraventral series (No. 7) of spots slightly larger than those of No. 3.

On segment 3 are three tubercles in the subdorsal area, a large anterior blotch, and a median row of two spots on each side of the dorsal line. Beneath lateral line are, 1st, two small spots in continuation of the median row, and beneath these two tubercles above ventral fold, the posterior of which is much the larger. The tubercles of the supra-ventral series is on the base of thoracic foot. On segment 4 the tubercles are arranged in the same pattern, but the anterior dorsal spot is very small. Segment 12 has but 6 tubercles in a transverse row, two dorsal very large, and the two of series 6 and 7.

Pupated August 4. Moth emerged Sept. 4, *Gortyna cataphracta*, male.

Of several specimens which I have bred from the stems of raspberries and lilies, I found about half pupated (in the breeding jars) in the stems, while others burrowed into the ground.

Some of the Literature of the Species.

A brief description of the full-grown larva has also been published by Mr. Wm. Beutenmuller, in the *Bulletin of the American Museum of Natural History*, vol. v, 1893, p. 94.

Mr. H. G. Dyar has also described in the *Canadian Entomologist*, xxiii, 1891, p. 157, the mature larva and pupa of *Gortyna cataphracta* — the larva "boring in the leaf-stems of rhubarb, and pupating in its burrow after biting a hole, across which it spins a few threads." The larval description differs in several particulars from the others given,

and it may be questioned if some error has not occurred in the identification of the moth.

The above is all of the literature of the species, except list references, known to me, while that of its congener, *G. nitela*, is voluminous.

Distribution.

Mr. Grote gives as the habitat of this species, "Canada in September; Massachusetts; Northern New York in October; Colorado." I have received the moth from Wisconsin: it has not been taken in my New York collections.

Collections in the Adirondack Mountains in 1893.

The additions made to the State collection have been mainly, as in preceding years, in the Adirondack region of the State. The collections made in Keene valley, Essex county, this season, during portions of the months of July and August, were larger than usual. Lepidoptera attracted to light were unusually abundant. Over six hundred examples, mostly belonging to the *Noctuidæ*, were taken by this means. Two species of *Plusia*, a genus containing perhaps the most beautiful of our Noctuids — *P. u-aureum* and *P. mortuorum* which in former years have been comparatively rare in the Adirondacks, although belonging to high altitudes, were this year really common — more common, indeed, than any other species. The first *Plusia purpurigera* ever taken by me was captured on August 6th. As the *Plusias* have place among the rarer of our Noctuidæ, and are always regarded as desirable additions to collections, the several species taken at Keene valley this season, with the number of each, is herewith given:

<i>Plusia</i> (Deva) <i>purpurigera</i> Walker, 1	<i>Plusia</i> <i>precatonis</i> Guenée, 10
<i>P.</i> <i>area</i> Hübner, 1	<i>P.</i> <i>u-aureum</i> Grote, 84
<i>P.</i> <i>aeroides</i> Grote, 9	<i>P.</i> <i>mortuorum</i> Guenée, 58
<i>P.</i> <i>balluca</i> Geyer, 8	<i>P.</i> <i>simplex</i> Guenée, 8
<i>P.</i> <i>bimaculata</i> Stephens, 4	

The total number of *Plusias* — all taken within doors — was 183, not including many worn and rejected examples appearing in August.

Comparing the above with the collections reported by Mr. W. W. Hill, in the western portion of the Adirondacks (Lewis county) during the four years, 1875–1879,* we find that nearly twice as many

* In *Seventh Report on the Survey of the Adirondack Region of New York*, 1880, p. 387.

examples of *P. u-aureum* and *P. mortuorum* were taken this year as in the four years cited -- or 142 as against 82. Of species contained in the Hill List, and not seen at Keene valley this season, are the following: *Plusia Putnami* Grote, *P. thyatiroides* Guenée, *P. formosa* Grote, *P. mappa* Gr.-Rob., *P. viridisignata* Grote, *P. epigea* Grote, and *P. ampla* Walker. These, however, are among the rarer species, and only thirteen examples are reported in the List.

The following of the *Noctuidæ* were among the most common that came to light, and of each from ten to thirty examples were obtained:

Adelphagrotis prasina (Fabr.)	Agrotis redimicula Morr.
Noctua baja Fabr.	Mamestra purpurissata Grote
Noctua Normaniana (Grote)	Mamestra meditata Grote
Noctua bicarnea Guenée	Mamestra olivacea Morrison
Agrotis (Feltia) subgothica Steph.	Xylophasia dubitans (Walker)
Agrotis (Feltia) tricosa Lintn.	Tricholita signata Walker

In contrast with the abundance of *Noctuidæ*, there was almost an entire absence of some other insects which in other seasons have been observed in large numbers. Thus, of the attractive and conspicuous family of the "hover-flies" or *Syrphidæ*, scarcely any were seen except the small form of *Sphaerophoria cylindrica*, which seems almost inseparably associated with the golden-rods of August. The *Bombylidæ* were much less abundant on the damp spots in roadways than usual. Scarcely any of the "Dragon flies" or Odonata, were seen; and indeed but few Neuroptera, except three species of *Phryganidæ*, which shared with the moths in attraction in the evening to lighted rooms. Coleoptera were not common. In a locality -- a dried roadway ditch -- where in 1892 hundreds of *Cicindela repanda* could be taken by simply swinging the net from side to side as one walked rapidly along, hardly any were met with. (*Report of the Entomologist to the Regents of the University for the year 1893.*)

Sitotroga cerealella (Oliv.)*

The Grain-Moth.

(Ord. LEPIDOPTERA : Fam. TINEIDÆ.)

Additional Bibliography to that contained in the 2d Rept. Insects New York, 1885.

PACKARD: Guide Study Ins., 1869, p. 350, figs. 265, 266 (larval food); Entomol. for Begin., 1888, p. 151 (figure of moth and larva).

LADD: in Psyche, iv, 1885, p. 337 (life-habits at Geneva, N. Y.).

* Mr. Meyrick refers the species to *Sitotroga*; the other writers cited, with one or two exceptions, to *Gelechia*.

- LINTNER: 2d Rept. Ins. N. Y., 1885, pp. 102-110, figs. 18-21 (general account); 6th Rept. do., 1890, p. 190 (mite associated with it); in *Count. Gent.*, lviii, 1893, pp. 188, 189 (general notice).
- WEBSTER: *Ins. Affect. Corn* (in *Ind. Agr. Rept.* for 1885), 1886, p. 24, pl. 5, f. 3, pl. 6, fig. 2, (brief general notice); in *Insect Life*, i, 1889, p. 354 (injurious in Australia to stored grain).
- HUNT: in *Miss. Ess. Econom. Entomol.*, 1886, pp. 89, 90 (bibliography).
- RILEY-HOWARD: in *Insect Life*, iii, 1891, p. 339 (reply to inquiry from Va.); id., iv, 1892, p. 207 (remedy for, in granary), p. 283 (in Florida), p. 293 (in Miss., reference), p. 296 (in India, reference).
- WEED: *Bull. 17 Miss. Agr. Exp. St.*, 1891, pp. 3-6, figs. 1-3 (general notice).
- SMITH: in *Ann. Rept. N. Jer. Agr. Exp. St.*, 1891, pp. 347, 405-408, f. 22 (general account with remedies); *List Lepidop. Bor. Amer.*, 1891, p. 100, no. 5335.
- BECKWITH: *Bull. 12 Del. Agr. Exp. St.*, 1891, p. 14 (brief notice); *Bull. 21 do.*, 1893, pp. 10, 11, figs. 6, 7 (brief notice).
- DORAN: *Bull. 16 Md. Agr. Exp. St.*, 1892, pp. 437-441 (general account).
- KELLOGG: in *Insect Life*, v, 1892, p. 116 (in two years' stored grain in Kansas); *Com. Inj. Ins. Kans.*, 1892, pp. 50-52, f. 24 (description and remedies).
- HOWARD: in *Insect Life*, v, 1893, pp. 325-328 (history, preventives, remedies, etc.).
- SLINGERLAND: in *Rur. N. York.*, lii, 1893, p. 493 (remedies); in do., liii, 1894, p. 425 (at World's Fair).
- BRUNER: in *Ann. Rept. Nebr. Agr. Exp. St.* for 1893, pp. 408-410, f. 53 (habits, etc., from Riley).
- RILEY: in *Insect Life*, vi, 1894, pp. 216, 222 (at World's Fair).
- FLETCHER: in *Prairie Farmer* for July 7, 1894, lxvi, p. 9 (not abundant or destructive in Canada).
- CHITTENDEN: in *Yearbook U. S. Dept. Agricul.* for 1894, 1895, pp. 281-283, figs. 44, 45 (history, injury to grain, life-history, remedies).
- COMSTOCKS: *Manual Stud. Ins.*, 1895, p. 258 (brief notice).
- MEYRICK: *Handbook British Lepidop.*, 1895, p. 571 (description and distribution).

The letter given below, received from one of the southern counties of Pennsylvania, illustrates forcibly the great injury that may be caused to wheat between its reaping and November threshing— at least one-half of its flour product— by the larva of the Angoumois moth, or the "fly weevil" of the southern wheat belt, during the larval growth of a single brood.

EDS. COUNTRY GENTLEMAN.— I have just returned from Montgomery county, Pa., where I learned of a new (at least to me) enemy to wheat. It is a small worm that eats the grain after harvest, just as the bean-weevil develops in the bean, and then feeds upon it. During harvest and when seed wheat was threshed in September, the wheat has apparently all right. But in November, while threshing, as the weaves were handed out of the mow, thousands of small white millers were seen coming out of the sheaves and flying confusedly about in

the barn. Bushels of light wheat were blown out with the chaff, being nothing but hulls of bran; the rest of the grain had been eaten by the worms. After threshing some time the man feeding the thresher found that the cylinder did not draw the sheaves into the machine as usual, and some time later not at all. Upon examination the concave was found clogged with dust and mashed worms, which adhered to the concave teeth, until the spaces between them were closed, excepting passage ways kept open by each cylinder tooth.

The wheat was put in sacks from the machine as threshed, and would heat over night in the bags. I was told that a farmer took 100 measured bushels of wheat to a mill, and when weighed he had only 59 bushels, which was then kept separate and ground, and it made five barrels of flour.

These worms first appeared in 1890, and have now spread about ten miles from their starting point. I enclose a sample of wheat damaged by these worms. Is it a new enemy to wheat, or is it an old one just appearing in a new territory, and how can it be successfully destroyed? Can it be carried and introduced by sowing infected wheat from where it is now?

The insect, so destructive to wheat in Montgomery county, Pa., is an old grain pest, which has been known in Europe for over a century and a half, although it was first given a scientific name by Olivier in 1789. Réaumur wrote extensively of its ravages in France in 1736. In 1760 it had increased to so alarming an extent that the attention of the government was enlisted, and commissioners of the Academy of Science of Paris were appointed to visit the province of Angoumois and investigate and report on the insect. As stated in their report: "The insect was found to swarm in all the wheat fields and granaries in Angoumois and of the neighboring provinces, and the afflicted inhabitants were thereby deprived not only of their principal staple wherewith they were wont to pay their annual rents, taxes, and tithes, but were threatened with famine and pestilence from the want of wholesome bread." It is shown in its several stages in Fig. 1.

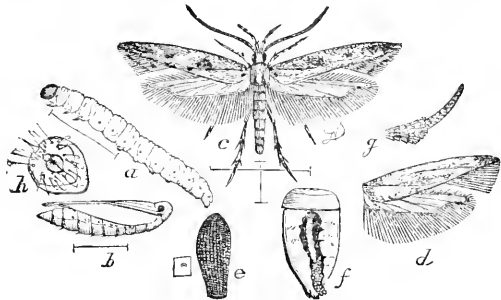


FIG 1—*SITOTROGA CEREALELLA*: *a*, the larva; *b*, the pupa; *c*, the moth; *d*, the wings of a pale variety; *e*, the egg; *f*, kernel of corn showing the work of the larva; *g*, labial palpus of the male moth; *h*, anal segment of the pupa—all enlarged except *f*. (From Riley.)

History in the United States.

As early as in 1730, it was operating in North Carolina. In 1768, a communication upon it was sent to the American Philosophical Society

of Philadelphia, entitled "Observations Concerning the Fly-Weevil that Destroys Wheat." Before the middle of the present century, it had become largely distributed over the "wheat belt" from the Atlantic westward to the Mississippi river, but, fortunately, it seems to be less destructive as it extends northward, not being able, apparently, to endure the cold of severe winters.

Rare in New York State.

It has never been particularly injurious in New York -- indeed, it is rather a rare insect therein, having only come under my notice on three or four occasions. Dr. Fitch, writing of the insect in 1861, states that it had made its appearance in the museum of the State Agricultural Society ten years before, in wheat preserved in closely-corked bottles, and had so multiplied in them that the contents were entirely ruined. (Reports 6-9, p. 127.)

Operations at the New York Experiment Station.

In the autumn of 1884, corn infested with it was received by me from the State Agricultural Experiment Station at Geneva. It had been working within the corn in the museum for the preceding two years. At my suggestion, careful examination was made for its operations in the field. Answer was returned that no indications of its presence there were found, and it was believed that it was entirely confined to the dried corn contained in the museum. The following observations upon it in the museum, were made by Mr. E. F. Ladd, at that time the horticulturist of the station:

Hundreds of moths emerged daily, and it became necessary to burn much of the collection, while the remainder was packed in boxes and treated to bisulphide of carbon. An examination seems to show that the larvæ feed only upon the deposit of starchy matter in the kernel. Larvæ were not found in the varieties of sweet corn in which the starch is distributed throughout the kernel, but they were found, frequently, two and occasionally three, in a kernel of the flint corn, in which the starch is deposited in a mass. In pairing, the moths remained together twenty-five minutes. One moth laid thirty-six eggs, in two patches of seventeen and nineteen, which hatched in seven days, from 2d to 9th of November. The eggs were at first milky white, showing an orange tint at the end of twenty-four hours, and gradually becoming deep orange at the end of thirty-six hours. They were laid on the bottom of a dish, in threes, touching at the ends.

It is probable that in each of the above instances the insect was brought into New York in infested grain or corn, and it is doubtful if it ever attacks growing crops, or newly grown, within our State.

A Parasitic Attack.

About the middle of February, 1893, ears of "eight-rowed Shaker" corn, from South Dakota, of the crop of 1891, were brought to me from a commission house in Albany, which contained the larvæ of the insect and numerous holes from which the moth had emerged. Some small ears of the pointed kernels, known as "Egyptian Rice," and used for popping, grown in this State in 1891, were quite badly infested; nearly every kernel had been burrowed.

Three weeks thereafter, several examples of a chalcid parasite emerged, which, being submitted to Dr. Riley at Washington, were found to belong to the genus *Catolaccus*, and was probably an undescribed species.

It was subsequently learned from the firm that not long before the infested corn had been sent to me, thousands of a minute and delicate-winged insect had been noticed flying in the room where the corn was stored, when aroused by a light brought into it. In the belief that their presence was connected with the injury to the corn, sulphur was burned to destroy them. It accomplished its work so effectually that when I visited the room to see the condition of the attack, no living examples could be found, but the identity of the reported myriads with the *Catolaccus* parasite bred by me was established by dead specimens that were lying upon the beams and in folds of paper in the room.

Number of Broods.

Under natural conditions, abroad, there are, except in the South, two annual broods of the insect. According to Réaumur, the moths emerge in June from the stored grain and deposit their eggs upon the growing grain as it is beginning to head. The second brood of moths appears in August, and from these the larvæ are produced which operate within the grain throughout the winter. European writers record two broods of the moth, which appear in May and June, and in November. It seems, however, that the number of broods depends on the latitude, for while Dr. Harris records but two in Massachusetts, five are claimed in Southern Virginia, between June and October; and Prof. H. E. Weed, of the Mississippi Agricultural Experiment Station, states *loc. cit.*, that "there are, at least, eight annual generations" in that State, and that "in warm weather it takes but a month to pass from the egg to the moth, and the various stages of the insect can be found in infested grain at all times in the year."

Writers do not agree in their statements of when the eggs of the first brood are laid. In Europe the moths are said, as above, to appear

in May or June, and oviposit on "growing grain." According to Mr. L. O. Howard, "it lays its eggs only on hard grain. After the time of harvest, the moth flies out from the granaries to the wheat fields and lays its eggs upon grains of wheat in the shocks."

The "thousands of small white millers seen coming out of the wheat-sheaves in the barn" at the time of threshing during November, in Montgomery county, Pa. (in the extreme southeastern portion of the State, latitude about 40°), were probably of the third brood. Their larvæ were undoubtedly operating within the wheat at the September threshing, but had not sufficiently advanced to have injured the kernels perceptibly. A portion of this brood would, perhaps, hibernate in the larval stage, to appear the following spring. That it could not have been the pupæ alone which clogged the teeth of the cylinder of the thresher is evident from the statement made in regard to the subsequent heating of the grain.

The Heated Grain.

The statement in regard to the heat observed in the grain after it had been threshed and put into sacks is an interesting one. The heat was evidently the result of the friction attending the gnawing of the interior of the hard-dried grain by the larvæ contained within. This phenomenon, so far as I remember, has not been recorded before in connection with the Angoumois moth, but has been several times mentioned in notices of our bean-weevils. It has been observed where the common bean-weevil, *Bruchus obtectus* Say, was operating in dried stored beans, and is not at all uncommon with a southern species of bean-weevil, *Bruchus Chinensis* Linn. (formerly known as *B. scutellaris* Fabr.), which so often infests the "cow-pea" of the Southern States. Mr. Howard has recorded an instance where the surrounding temperature of a paper bag containing about a quart of these beans being 71° Fahr., a thermometer thrust within the beans rose 25° (to 96° Fahr.) in a few minutes (*Insect Life*, i, 1888, p. 59).

Results of the Attack.

Not only is the yield of the flour very greatly diminished by the operations of this insect, but the flour produced from infested grain is decidedly unwholesome. A distinguished French savant has written of it: "The bread made from wheat attacked by it, and especially when the flour has not been suitably bolted, contains the debris of the bodies and excrement of the insects. It has a disagreeable and loathsome taste, which is very lasting. It is even said that a very danger-

ous throat disease results from the use of this unhealthy food — a disease which has been epidemic for some years in regions infested by the *Alucita* [Sitotroga]. It manifests itself by gangrenous ulcerations which form in the back of the mouth; the sick succumb in a few hours and cannot be aided." (*Report Dept. Agricul. for 1889*, p. 317.)

In reply to the inquiry regarding the introduction of the insect into Montgomery county — the insect can easily be carried from one locality to another in seed wheat, and introduced in places where it was before unknown.

Distribution of the Insect.

In the United States the Angoumois moth is distributed more or less over the Eastern, Middle, and Southern States where wheat is grown, but it is especially a southern insect. It is occasionally seen in Canada, but, according to Mr. Fletcher, it has not occurred there in destructive numbers. It infests middle and southern Europe and also occurs in England. Prof. Webster found it causing serious damage to stored grain in Australia. Its origin is unknown. Mr. Meyrick does not believe it to be a true native of Europe.

Remedies and Preventives.

Various methods have been used for the destruction of this insect, as violent agitation, or frequent stirring of the grain to destroy the eggs and possibly the contained larvæ; application of heat at about 165° Fahr. for an hour; spraying with kerosene; subjecting to the fumes of sulphur, etc., etc. But beyond question the cheapest and the best is the use of bisulphide of carbon — purchasable at drug stores at about 25 cents per pound. As soon as the corn or grain is found to be infested, it should be put into a bin tightly closed at the sides, but not necessarily so at the top, where a heavy close cloth covering would suffice, and the bisulphide of carbon placed in open vessels on the top of the grain. The heavy vapor given off from the volatile liquid descends and permeates the grain and destroys all the animal life contained therein. A day or two of exposure to the vapor is sufficient. One pound, or a pound and a half, may be used for each ton of grain.

For use in a reasonably tight room, Mr. Howard has made the following computation: One pound to be evaporated for every one thousand cubic feet of space, or in a space 10x10x10, one-third of a pound in each of three shallow vessels. For a room 10x10x20, use two pounds divided among six vessels; for a room 10x20x20, use four pounds in twelve vessels and in like proportion for larger apartments.

Some writers have recommended the simple sprinkling of the liquid over the surface of the grain.

For use in large quantity it might be desirable to order the carbon bisulphide of Edward R. Taylor, Cleveland, Ohio, manufacturer of "fuma" carbon bisulphide, at the following advertised prices: In 10-pound cans, 12 cents per pound; in 30-pound cans, 11 cents per pound; in 50-pound cans, 10 cents per pound. So long as any of the vapor remains, no light or fire of any kind should be brought near it, as the vapor is very explosive. It has been known to ignite even from the heat of a hot-air register.

As the insect is often local in its occurrence,—in consideration of the fact that it passes the winter in granaries in a continued succession of broods, where the temperature is moderate, it would not be difficult to destroy the insect and arrest the continuation of the broods, through concert of action in any one locality. If all the grain holders would unite in disinfecting their granaries and storehouses by the use of the carbon bisulphide in the early summer, there would be no moths to leave them for the deposit of eggs upon the ripe grain in the fields, and consequently future attacks would be prevented until the insect could again be introduced from some other locality.

It is stated that corn can be kept for years *nearly* exempt from injury by this insect and the grain-weevils, by being housed in the shuck or husk: it has been thus kept through the third year. Mr. Ruffin has also stated: "If wheat be threshed and well-fanned early in July [in the South] there will be no weevils worthy of notice. The eggs previously laid do not exist on the grains, but on the chaff or shuck, in which they are inclosed, and upon hatching, the maggots must perish for want of food. As in the case of corn, the wheat is not exposed to subsequent layings except on the grain at the surface of the bulk."

But evidently the best reliance is to be placed upon the destruction of the egg-bearing moths in the granaries in the early summer before harvest.

The Angoumois Moth Destroyed by a Mite.

Several years ago (October 1, 1889) a sample of infested wheat was sent to me by a correspondent at Charlottesville, Va. Statement of the nature of the attack may be of interest in connection with its unusual termination. The gentleman wrote:

Wheat harvest in our section was followed by continuous rains which resulted in serious sprouting in the shuck. As soon as possible I hauled up and threshed, storing the wheat in a large barn, spreading

as thin as possible, say 12 to 15 inches deep, ventilating all we could, and turning it over frequently with shovels. In from three to four weeks after storing I noticed a small fly crawling and flying on and over the wheat, followed in three or four weeks thereafter by what seems to be an egg-deposit. These latter appeared mainly in depressions on the surface [of the bed], such as foot-tracks, etc. I inclose a sample of the wheat-fly and eggs (or are they embryo flies)? * * * * My crop is probably from 1,500 to 1,600 bushels, and I fear serious loss if some remedy is not promptly applied. In an experience of over twenty years at the business I have never seen such an insect before. I should add that the wheat was fanned after coming from the separator, which took out the sprouted grain. It is now almost entirely dry and seemingly in good condition, barring the insect attack.

The insect was readily identified as the Angoumois moth. With the wheat sent was a large quantity of the exuviae or the dried remains, or both, of the mite, *Heteropus ventricosus* Newport, first brought to notice in this country by Prof. F. M. Webster, in the *Twelfth Report on the Insects of Illinois*, as having been found in the autumn of 1882 in a sack of wheat received from Southern Illinois. For two or three months thereafter, the mites were observed, as opportunity offered, to be feeding voraciously on the larvae of the grain-moth. Reference to the above has been made in my *Second Report on the Insects of New York*, and the illustration of the mite therein given, after Newport, and reduced from the figure in Murray's *Economic Entomology—Aptera*, is reproduced in this.

The gentleman was informed of the nature of the attack—usually serious and calling for active measures for its arrest. In this instance, however, it was highly probable, that he need give himself no further trouble in the matter, for from the large number of the remains of the carnivorous mite that he had sent me with the wheat, and from what was known of its habits, assurance was felt that the attack of the moth was already arrested, or speedily would be.

On October 29th, the gentleman wrote as follows, after thanking me for the information given :

I am pleased to be able to report to you that your predictions have been verified, and that the insect attack upon the wheat has resulted in no injury. I, therefore, conclude that your diagnosis of the case was the correct one, and that the mites preyed upon and destroyed the insect. I am yet holding the wheat, and with perfect confidence that it is now entirely safe. As evidence that there was absolutely no

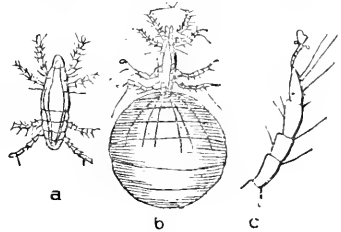


Fig 2—*HETEROPUS VENTRICOSUS*. a mite preying upon the Angoumois moth: a, a mature individual; b, female distended with eggs;—both enlarged; c, leg greatly enlarged. (After Newport.)

injury to the germ, I have delayed reply to your letter until I seeded from the pile, and have the pleasure of reporting that it is coming up beautifully.

Professor Webster's notice of this mite is the only one that I can recall in our economic literature. Dr. Packard has figured it on plate 10 of his "Guide." It was "discovered by Newport on the body of a larva of a wild bee," *Anthophora retusa*, in England (see Newport, "Trans. Linn. Soc., 1850"). Professors Osborn and Underwood, for some reason, have not included it in their "Preliminary List of the Species of Acarina of North America," given in the *Canadian Entomologist*, xviii, 1886.

Diplosis pyrivora Riley.

The Pear-Midge.

(Ord. DIPTERA: Fam. CECIDOMYIDÆ.)

The eggs of this insect are known to be deposited within the unopened blossom buds of the pear as soon as a petal shows itself between the segments of the calyx (see Ninth Report, p. 149). The larvæ

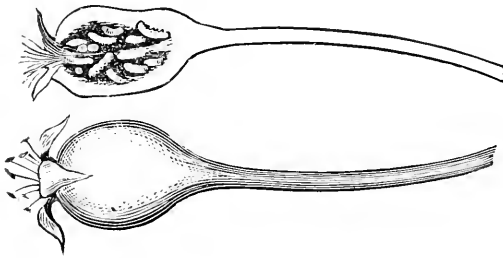


FIG. 3.—Section of a pear containing the larvæ, and an uninfested one for comparison of forms.

produced therefrom have usually been seen when they have grown sufficiently to deform and discolor the fruit, by which time they nearly fill a large irregular central cavity therein, as represented in figure 3 (from the Eighth Report).

Upon opening pears that gave the first indication of an abnormal form, I have found the larvæ imbedded within the upper half of the fruit.

Early Observation of the Larvæ.

In some young pears of the Beurre Bosc variety, less than one-fourth of an inch in diameter, received on May 22d from Theo. A. Cole, of Catskill, N. Y., the larvæ were seen at an earlier stage of development than in any record of their observation. The pears were just out of blossom and had some of the petals still attached. Numerous larvæ were found quite near the calyx end imbedded in the broken down structure of the fruit, and not yet imparting the slightest discoloration to either the interior or exterior, or perceptible distortion.

The Lawrence pears of Mr. Cole are, as usual, badly infested this year, also, the Beurre Bosc, while the Bartlett is but slightly attacked.

Mr. S. B. Husted, of Blauvelt, Rockland county, N. Y., writing under date of June 18th, states that the pear-midge has been discovered in that vicinity this year for the first time.

Spread of the Insect.

At the time of notice of this insect in my Eighth Report, in 1891, it was not known to have been extensively distributed in the Hudson River valley, or, indeed, was there knowledge of its occurrence outside of Greene and Columbia counties. It is undoubtedly steadily spreading, for it has been heard from in several localities in Dutchess, Orange, Ulster, and Rockland counties, and it is presumably present in all of the river counties south of Saratoga and Washington counties. Its introduction into New Jersey must have been direct from Connecticut and not through New York, for Dr. Smith records its occurrence there in 1891, and is of the opinion that it had then been in the State for some years: it has already reached to nearly the central portion of the State.

A correspondent writing from Mountainville, Orange county, N. Y., reports that the attack was first seen by him on a single tree two years ago, and this year every pear upon it has been destroyed by the larvæ. In the other localities where it has been lately heard from, it is said to be a new insect pest. Its spread is evidently a slow one, from which it may be inferred that much good may be expected from the prompt destruction of the infested fruit — easily to be recognized when looked for — when first observed. The figures given on page 145 of the Report, above cited, of the deformed and infested fruit may be referred to.

At Menands, three miles north of Albany, the most northern locality known for the midge, the pear-trees which have been infested with it for the preceding two years have, this year, from some unknown reason, been entirely free from the attack.

For illustrations and the history of this insect in its several stages, its literature, etc., see pp. 140-151 of the Report above-named.

Notes on Sciara.

(Ord. DIPTERA: Fam. MYCETOPHILIDÆ.)

Some Literature of Sciara.

MEIGEN: in Illiger's Magazin, ii, 1803, p. 263 (genus established).

MACQUART: Hist. Nat. Ins.—Dipt., i, 1834, pp. 147-150 (characters of 15 species occurring in France).

FITCH: 2d Report (of 1st and 2d), 1856, pp. 252-255 (*Molobrus mali*, *vulgaris*, *fuliginosa*, *inconstans*).

- CURTIS: Farm Insects, 1860, pp. 460-462 (habits and description of *S. fucata*, *quinquelineata*, *pulicaria?*, *punctata*).
- LOEW: Mon. Dipt. N. Amer., Pt. I, 1862, p. 13 (differs greatly from the rest of the family).
- OSTEN SACKEN: in Proc. Ent. Soc. Phil., i, 1863, pp. 153-157, pl. ii, figs. 3, 16, 18, 20 (larval characters), p. 158 (pupal characters), pp. 163-165 (larval habits), p. 165 (descr. of *S. toxoncura*), pp. 169-171 (literature); Cat. Dipt. N. A., 1878, pp. 12, 13 (list of 24 species); Char. Larv. Mycetoph., 1885, as in Pr. Ent. Soc. Ph., with pp. 27, 28 of additional literature.
- WINNERTZ: Beit. Monog. des Sciarinen, in Verh. Zoöl. Bot. Gesellsch., 1867.
- WALSH: 1st Rept. Ins. Ill., 1868, pp. 18, 19 (of *S. mali*); in Pract. Entomol., ii, 1867, pp. 71, 72 (in potatoes? causing scab).
- WALSH-RILEY: in Amer. Entomol., i, 1869, p. 186 (in rooms of dwelling).
- PACKARD: Guide Study Insects, 1869, p. 386 (habits of larvæ).
- GLOVER: in Rept. Commis. Agricul. for 1872, pp. 115, 116, f. 5 (snake-worm and other species); MS. Notes Journ.—Dipt., 1874 (habits, etc., of several species).
- RILEY: in Cole. Rur. World, 1876, p. 220 (habits in congregating); in N. Y. Tribune, Dec. 4, 1878, p. 237 (habits); in Amer. Nat., xv, 1881, p. 150 (food habits, yellow-fever fly).
- SCUDDER: in Rept. Prog. Geolog. Surv. Can. (1876-1877) 1878, p. 457 (*S. depedita*, fossil); the same in Rept. U. S. Geolog. Surv. Terr., xiii, 1890, p. 586, and on p. 588. *S. scopuli*, fossil.
- HAGEN: in Psyche, iii, 1880, p. 111 (yellow-fever fly).
- COMSTOCK: in Rept. Commis. Agricul. for 1881, pp. 202-204, pl. xvii, (*Sciara ocellaris*).
- SAY: Compl. Writ. Lec. Ed., i, 1883, pp. 249, 250, 308 (description of 5 species); ii, pp. 70, 351, 352 (description of 3 species).
- SAUNDERS: Ins. Inj. Fruits. 1883, p. 136 (account of apple-midge).
- WILLISTON: in Kingsley's Stand. Nat. Hist., ii, 1884, p. 408 (mention of *S. mali* and the snake-worm *Sciara*).
- FORBES: 13th Rept. Ins. Ill., 1874, pp. 57-59, pl. 4, figs. 5-9 (larvæ); 18th Rept. do., 1894, pp. 19-21, pl. 3, figs. 3-7 (describes "black-headed corn-maggot" in corn and hot-houses, in all stages).
- LINTNER: 5th Rept. Ins. N. Y., 1889, pp. 264, 265 (*Sciara* in wheat, *S. mali*, and the "army-worm" *Sciara*, European species, etc.); in Gardening for June 15, 1893, p. 313 (infesting a greenhouse, and of other species).
- RILEY-HOWARD: in Insect Life, iii, 1890, p. 126 (larvæ under pear-tree bark), iv, 1891, p. 115 (snake-worm), vi, p. 273 (yellow-fever fly).
- THEOBALD: British Flies, 1892, pp. 107-112 (description and habits of 10 British species, synoptic table of 25 species).
- SCUDDER: in Psyche, vi, 1892, p. 262 (larvæ on snow in midwinter).
- SMITH: in Insect Life, vii, 1894, pp. 151, 152 (injurious to mushrooms).
- HOPKINS: in Insect Life, vii, 1894, p. 147 (*Sciara* sp. and *Epidapus* causing potato scab); the same extended in Sp. Bull. 2 W. Va. Agr. Expt. Station, 1895, pp. 100-114, and in Proc. Wash. Ent. Soc., iii, 1895, pp. 149-161 (detailed figures of *Epidapus*).

SOUTHWICK: in *Insect Life*, vii, 1894, p. 136 (the injurious sap-fly, probably a species of *Sciara*).

COQUILLET: in *Insect Life*, vii, 1894, pp. 406-408, fig. 48 (habits, description of *S. tritici* n. sp., all stages illustrated).

COMSTOCKS: *Man. Stud. Ins.*, 1895, p. 443 (*S. mali* and army-worm).

The genus *Sciara* is a member of the family of *Mycetophilidæ* or "fungus gnats," and is closely allied to the well-known *Cecidomyidæ* in appearance and in habits. Indeed the two families can not be separated by any clear lines of demarcation, and the true position to be held by the genus *Zygoneura* is still in question among dipterologists. Of the eight sub-families into which the *Mycetophilidæ* have been divided by late writers, the *Sciarinæ* are numerous in species, both in this country and in Europe,—175 species having been described by Winnertz in his "Monograph of the Sciarinæ."

The Limited Study Given to *Sciara* in America.

From the resemblance that they bear to one another—the species having often been separated by little beyond their wing or antennal coloration—so little critical study has been given them by our entomologists that published descriptions will hardly permit positive identification of any of the number. For this reason, the little that has been observed of the habits and life-histories of our North American forms can not be positively referred to any one named species. It is doubtful if, of the twenty-six species of *Sciara* listed in the Osten Sacken *Catalogue of the Diptera of North America* a half dozen could be positively identified—their descriptions being so brief and general,—their types possibly all lost, and only two of the number (Loew's species—possible types) having representation in the Museum of Comparative Zoölogy at Cambridge. In marked contrast with this apparent lack of study of *Sciara* stands the fact that of the closely allied genus of *Mycetophila*—of the eighteen N. A. species listed, all but three (Say's species) have place in the Cambridge Collection, where comparison for identification can be made.

Larval habits of *Sciara*.

The habitat of *Sciara* is quite varied. Several of them are known to live in their larval stage in decaying vegetable matter of various kinds and in fungus growths. They have been reared in vegetable mold; beneath the bark of trees; in decayed wood and in the roots of decaying trees; in putrid potatoes, turnips and other vegetables; in excavations in potatoes and in connection with "the scab" thereon; in flower-pots in rooms; in manure beds; as guest flies in apples and grapes in

association with other insect attack; some species are met with in cowdung (Theobald).

A Notable Species of *Sciara*.

A species (perhaps more than one) is noted in Europe, for its gregarious and migratory habits. It is there known as the army-worm or *Heermourm* from its collecting at certain seasons in companies — sometimes consisting of millions — and traveling along in a body of often from twelve to fifteen feet in length and two or three inches broad and perhaps a half inch thick. “M. Guérin Méneville observed columns as many as thirty yards in length.” The species has not been positively determined, but it is accepted as either *Sciara Thoms* (Linn.) or *S. militaris* Now. — but probably the latter, according to the statement of Baron Osten Sacken. Similar gatherings have been observed in this country, one of which is narrated in *Insect Life*, iv, 1891, page 214; two others recorded by Glover in the *Report of the Commissioner of Agriculture for 1872*, p. 115, as observed in Virginia (figures of the larva and fly are given); and two others by Prof. F. M. Webster, in *Science* for Feb. 23, 1894, p. 109. With us they bear the name of “snake-worms,” from the snake like appearance and movements of some of the processions.

Those who have access to Figuiet's *Insect World* may find therein (pages 46, 47) some interesting details, taken from the writings of M. Guérin-Méneville, respecting migrations of these larvæ observed on the borders of forests in Norway and Hanover, and their conduct upon meeting obstacles, when their ranks are broken, and when the two ends have been brought together; also, some strange superstitions respecting them, entertained by the peasants of Norway and Siberia. No satisfactory explanation has yet been given for the assemblage of such myriads of these footless larvæ and their marches in the brightest sunlight.

The Yellow-Fever Fly.

Another species of *Sciara* has been named in its winged state, “the yellow-fever fly,” from its appearance in immense number (in swarms) on different occasions in some of the Southern States, during the prevalence of the epidemic from which it has drawn its name. As appears from an article by Dr. Hagen, in *Psyche*, iii, 1880, p. 111, entitled “The Yellow-fever Fly,” no literature relating to these appearances could be found. They rested only on report. From a specimen collected in New Orleans in 1848, and marked as “the yellow-fever fly,” which came to the Cambridge Museum, Dr. Hagen

identified it as a *Sciara*, but could not refer it to any of the species listed in the Osten Sacken Catalogue of Diptera, and, therefore, accepted it as undescribed.

Prof. Riley, in a notice of the above paper in the *American Naturalist*, xv, 1881, p. 150, quotes the occurrence of another undescribed species of *Sciara*, where the flies came out in millions from the joinings of the floor boards in an upper room of a new addition to a seminary building in Bethlehem, Pa.

The Apple-Midge.

Still another species possessing particular interest from the habitat of its larva differing so greatly from that of most of those of its congeners, is *Sciara mali*, originally described by Dr. Fitch in his *Second Report on the Insects of New York*, as *Molobrus mali*, found by him in its pupal and winged stages in the center of an apple that had been eaten and perforated by the "apple-worm" of the codling-moth. Dr. Fitch was of the opinion that the eggs of this midge are deposited on apples that have been attacked by the apple-worm, and that the larvæ enter the fruit through the perforation in the side made by the worm.

This species is apparently rare. I have never met with it, and I am not aware of any important contribution to its habits or life history by recent writers. It is not so much as referred to in Osten Sacken's revision of *Characters of the Larva of Mycetophilidæ*, in 1886. It will be of interest to know if the larva feeds on the pulp of the fruit or on the excremental or decomposed material associated with the presence of *Carpocapsa pomonella* and *Trypeta pomonella*—the latter the probable burrower of the apple in which the insect was found by Dr. Fitch.

Sciara coprophila n. sp.

The Manure-Fly.

(Ord. DIPTERA: Fam. MYCETOPHILIDÆ.)

Examples of the above fly were brought to me on March 20, 1889,* from a gentleman in Albany who was growing mushrooms in his cellar. He believed that the larvæ injured the mushrooms by eating into the stalk near the surface of the bed. Although I have no notes stating the fact—if my memory serves me correctly, some of the larvæ received at this time were carried to their winged state by feeding

*Reference to this was made in the *Fifth Report on the Insects of New York*, 1889, p. 265.

them on the injured mushrooms. If so, it is not improbable that the mushrooms may have decayed before they were eaten by the larvæ. Unfortunately, none of the larvæ were preserved at the time, so that no study may be given them at the present.

Injury to Mushrooms by the Fungus Gnats.

I have not met with any direct statement of injury to mushrooms by *Sciara*, nor is it established that serious injury to cultivated mushrooms is inflicted by any of the large family to which it belongs, although the following named species are among those that are recorded as "feeding on mushrooms" in Europe: *Mycetobia pallipes* Meig., on *Boleti*; *Mycetophila signata* Meig., on *Boletus edulis*; *M. lunata* M., on *Agaricus vitrinus*; *Rymosia fenestralis* M., on *Agaricus melleus*; *Exechia fungorum* Dg., on *Boletus*; *Docosia sciarina* M., on *Boletus scabra* and *B. edulis*; *Boletina*, several species; *Bolitophila cinerea* M.; *B. fusca* M.; *B. disponcta* Loew; *Plesiastina annulata* M.; *Sciophila striata* M., on "mushrooms." A recent English writer on the Diptera,† states: "Some of the fungus gnats [*Mycetophilidæ*] are certainly injurious, as the species that live upon the 'mushroom,' whole frames of this edible fungus being destroyed by these larvæ; but the amount of damage done is small compared to the amount of good which these maggots do in destroying fungi." And again: "The larvæ of these gnats act as 'scavengers'; not only do they do away with rotting fungi, but they cause these often injurious productions to putrefy and to become scarce by their destruction."

What the Manure-Fly Is?

Specimens of the fly were submitted to Mr. R. R. Meade, of England, for comparison with European species. He could not identify them with any species known to him, but they approached somewhat nearly to *S. nervosa*.

Probably a Harmless Species.

Some of the flies were also sent to Mr. William Falconer, of Glen Cove, N. Y., with the inquiry if he had ever found them troublesome in his extensive greenhouse experience or in his mushroom growing. He replied that he was familiar with their appearance from having known them for many years—ever since he had been led to study insects and their habits. They always appeared about hotbeds or where there was pretty well-advanced fermenting horse manure, and for this reason he had given them the name of "manure-flies."

† Theobald: *An Account of British Flies*, 1892.

If the winter is comparatively mild, they may be seen for the first in the latter part of February, but ordinarily they do not attract attention until in March. They are in great abundance in the last weeks of March and through April and become comparatively few in May, perhaps by deserting the cellars for outdoor life. He had never had reason to regard them as harmful to mushrooms. At the time of writing (March 25, 1889) there were thousands of the flies in the mushroom cellars, while at the same time the crop of mushrooms was the finest and cleanest that he had ever grown and showing no sign of attack by larvæ of any kind. They are certainly no hindrance to mushroom growing during the winter, for they never appear in the earlier months or until the manure is at least two months old; but they are disagreeable guests, for before the end of April the walls appear as if they had been washed with wet mud, so much dirt and moisture do they gather and leave upon the walls, on which they are constantly leaping from the beds and coursing over. Mr. Falconer did not think it possible that these flies can be identical with those that produce the "maggots" that infest mushrooms in the month of April. In this opinion he was correct, as will appear in subsequent pages.

Remedies Suggested.

If it should be found on closer observation that it is important that the larvæ of these flies should be destroyed, there should be no difficulty in killing them by occasional applications of pure and fresh pyrethrum in water, using it of the strength of one ounce to from four to eight gallons of water, as the larvæ may be deeper beneath or nearer to the surface of the beds. That they multiply with great rapidity is shown by the fact that the fifth day after some surface-feeding larvæ were seen to enter the ground the winged flies therefrom made their appearance.

A method for killing the flies, said by Mr. Falconer to be employed in mushroom cellars in France, might also be used in connection with pyrethrum solution. It is to place small lighted lamps in shallow pans filled with water, with a little kerosene floated on the surface. Vast numbers are attracted to the lights and killed by falling into the kerosene, but still it does not prove wholly effective, as there are always many left.

The Manure-Fly Undescribed.

Of the twenty-three United States *Sciaras* of the Osten Sacken Catalogue, the "manure-fly" (adopting Mr. Falconer's name for it) can not

be referred to any of the Say or Fitch species (11); there is no probability of its being identical with any one of the three Greenland species; and in the absence of types, it would be a loss of time to search for it among the five Walker species. From *S. ochrolabis* Loew - New York - it would be ruled out by its want of ochreous spots. There would then remain but three species for comparison, viz.: *S. nigra* Wied.—Savannah; *rotondipennis* Macq.—Carolina; and *sciophila* Loew — Dist. Colum. In the improbability of its being one of these, it is herewith described as a new species. The excellent illustrations of it, as also of the two following species, have been made by my assistant, Mr. E. P. Felt.

Its Description.

SCIARA COPROPHILA n. sp. *Larva*.—Length when full grown 8 mm. Head jet black, small, broadly ovate, and more or less retractile into the anterior segment. Body whitish; subcylindrical, tapering slightly toward each end; smooth and indistinctly divided into twelve segments; the dark contents of the convoluted alimentary canal may be seen readily through the semitransparent body-walls; terminal segment usually bent abruptly downward (Fig. 4).



FIG. 4. - Larva of *Sciara coprophila*.

Details of head.—Clypeus subtriangular, emarginate anteriorly, and with a pair of very large punctures, probably setigerous, at the anterior third, and three smaller ones in each antero-lateral corner; two pairs of the smaller punctures occur on the front close to the clypeus, one at its anterior, the other at the posterior third; a number of very small punctures on the clypeus and close to it are represented by dots in figure 5e; several more lateral punctures occur on the epicranium. Labrum; basal portion chitinous, narrow and with a large median tooth; distal portion broad, semimembranous, emarginate anteriorly, and bearing internally three groups of spines on each side of the median line; the antero-lateral group consists of a slightly curved row of six, the middle group of three closely set, and the posterior group of about three; the anterior and middle groups are represented in figure 5a. Antennæ composed of one segment, conical, chitinous; located close to lateral angles of clypeus. Mandibles stout; three large teeth, one smaller internal tooth (Fig. 5b). Maxilla composed of a small basal portion and a large distal part; basal portion composed of two pieces: an external piece bearing two punctures along its distal margin, and an inner piece with a prominent internal spine near the basal third; distal portion strongly concave internally, apparently divided longitudinally; inner edge armed with six well-marked teeth and a smaller basal tooth; two large punctures occur at the apical fifth, one on each piece; on the apex of the external piece there is a larger oval puncture, in which lies the rudimentary palpus (Osten Sacken); internal piece with a puncture near middle (Fig. 5c, d). On ventral surface of head there is a large cordate mem-

branous area, and the sclerites are slightly separated along the median line (Fig. 5a).

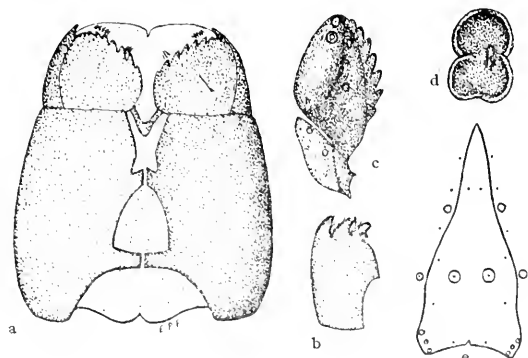


FIG 5.—*Sciara coprophila*: Details of head of larva; a, ventral aspect of head; b, mandible; c, maxilla; d, apical depression in maxilla with contained rudimentary palpus; e, outline of clypeus, showing location of punctures. All greatly enlarged.

Pupa.—Length, 2.5 mm. The form of the imago is readily seen; it is a little stouter than in the perfect state. Head and thorax black; abdomen brownish; coxæ yellowish; legs brownish-black. The wings extend to the third abdominal segment; the tarsi to the fifth.

In the earlier portion of the pupa state the eyes only are black and they connect behind the antennæ by a very narrow band; dark-brown patches occur on the base of the antennæ; the rest of the pupa is a variable yellowish-white. As the pupa develops, the antennæ, wing-pads and tarsi darken considerably and the head and thorax darken a little; finally the abdomen begins to darken.

Imago.—Plate I. Head and thorax black; antennæ and abdomen dark-brown; setaceous. Wings hyaline and in certain aspects somewhat iridescent. Coxa dusky-yellow; femur and tibia yellowish-brown; tarsi darker, especially on the terminal segments. Apical portion of the halteres dusky, basal portion yellowish.

Length, 2.5 mm. The general appearance of the female is given in figure 1.

Three ocelli occur, the median one being anterior,—figure 2. The eyes are deeply emarginate and extend to the median line behind the antennæ; facets separated by an unusually thick frame of chitine,—figure 3. Antennæ longer than the head and thorax, composed of 16 segments; the two basal segments are about as broad as long and bear a few stout setæ; the remaining ones are often slightly gibbous with extremities rounded; pediceled distally and invested with numerous fine setæ; width to length as 4 to 7, see figure 6. The ridges represented upon the epistoma in figure 2 are partly internal and the upper portion of the inner ones wholly so, but as they can be easily seen in semitransparency in a mounted preparation, they are, therefore, indicated. The palpi are composed of four segments,—figure 8: basal segment short; second, elongated, capitate distally and bearing a distinct sensory pit; third, similar in form and shorter; fourth,

long and slender: setæ on the basal portions of the three distal segments with a more or less verticillate arrangement; on the apical portions the arrangement is more irregular.

Wings hyaline and invested with numerous short hairs. The first longitudinal vein (the first branch of radius) joins costa before the fork of the fourth longitudinal (media). The venation is carefully represented in figure 1. The halteres are long; basal half slender and partially segmented; distal portion spatulate,—figure 4h. The scutum of the mesothorax is produced into a marked dorsal hump, which bears one or more stout setæ,—figures 1, 1a, 4, s'. The scutellum of the mesothorax has a more or less granulated surface. The hind coxa of the male extends to the basal third of the abdomen; in the female the hind coxa extends to about the basal fourth; the hind femur is twice the length of coxa; tibia one-fourth longer than femur; tarsi about equal to femur; middle legs shorter and fore legs still shorter than the hind legs; one apical spine occurs on the fore tibia and two on the middle and hind tibiæ.

The abdomen in both sexes is composed of nine segments; general form conical. The apical portion in the female quite extensile; on the eighth segment, a pair of ventral valves and between them a pair of slender processes; on the ninth segment, a pair of lateral valves, the apical portion of which is nearly circular,—figure 9. The abdomen of the male is shorter and apparently stouter; due to shortness of the terminal segments; the terminal segment bears within the larger jointed appendages a smaller pair of unsegmented, slightly diverging appendages; the apical fourth of these inner appendages is thickened, margin setose; beneath the dorsal plate a slender median organ may be seen arising from a forked base,—figures 11, 11a.

Length of body, 2.5 mm.; of wing, nearly 3 mm. Described from 30 females; 10 males.

EXPLANATION OF PLATE I.

Fig. 1.—Manure gnat, *Sciara coprophila*.

Fig. 1a.—Scutellar hump of the same, more enlarged.

Fig. 2.—Head of the same: *a*, antenna; *p*, palpus.

Fig. 3.—Portion of the compound eye still more enlarged and showing the relative proportion of chitine to the facets.

Fig. 4.—Lateral aspect of the thorax: *c, c, c*, insertion of the coxæ of the pro-meso- and meta-thorax; *h*, halter; *S*, spiracle; *s*, scutellar hump; *w*, base of wing.

Fig. 5.—8th, 9th, and 10th segments of the antenna of the greenhouse gnat, *Sciara caldaria*.

Fig. 6.—Ditto of *S. coprophila*.

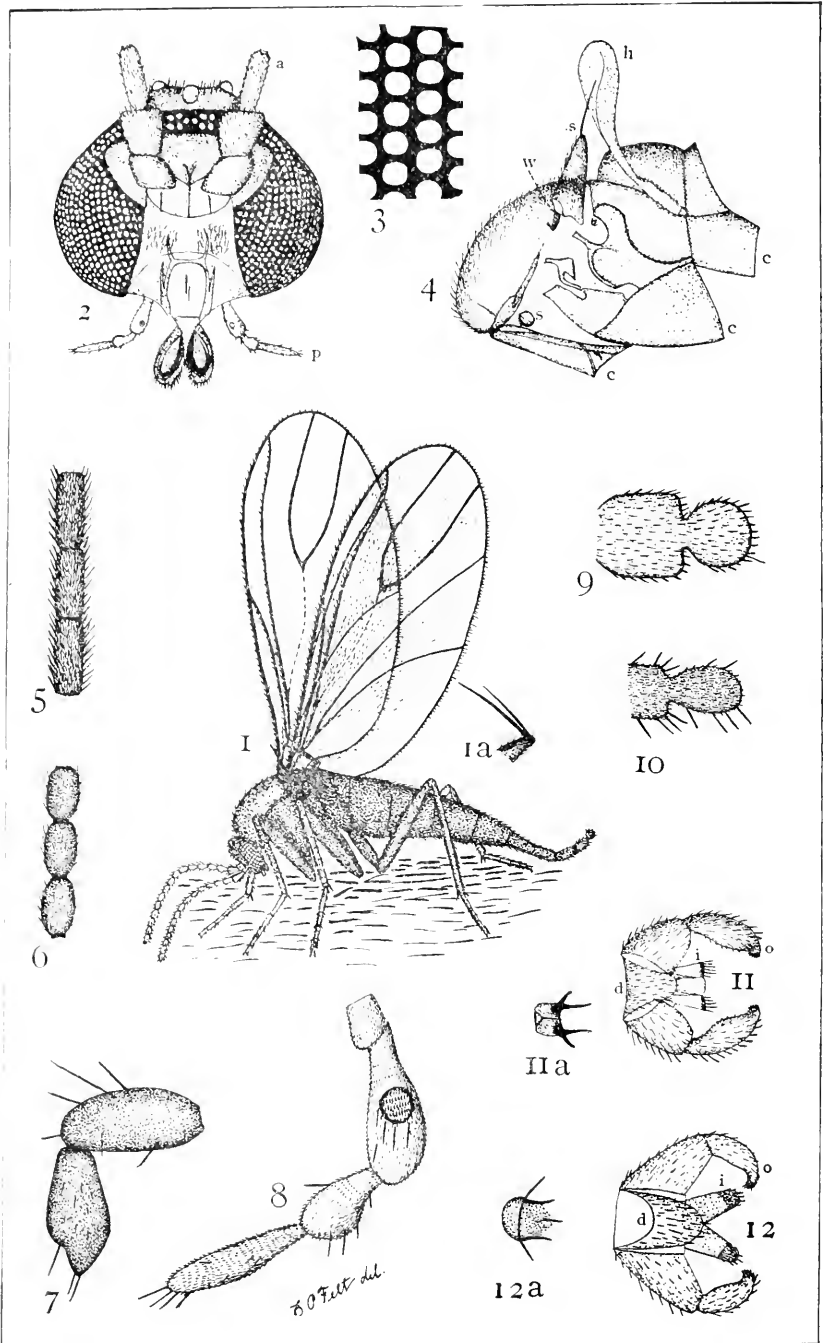
Fig. 7.—Terminal segments of the palpus of *S. caldaria*.

Fig. 8.—Palpus of *S. coprophila*, showing the sensory pit on the second segment.

Fig. 9.—Lateral valve of the female of *S. coprophila*.

Fig. 10.—Ditto of *S. caldaria*.

Fig. 11.—Dorsal aspect of the terminal segment of the male of *S. coprophila*: *d*, dorsal plate; *i*, inner, *o*, outer appendages.



SCIARA.

Fig. 11a.—Dorsal view of the chitinous processes beneath the median dorsal plate of the terminal segment in the male of *S. coprophila*.

Figs. 12, 12a.—Ditto of the male of *S. caldaria*.

Figure 1 is enlarged about twenty diameters; the others are much more enlarged.

Sciara caldaria nov. sp.

The Greenhouse Sciara.

(Ord. DIPTERA: Fam. MYCETOPHILIDÆ.)

A communication from a lady of Boise, Idaho (April 20, 1893), gives the following particulars of some "fungus gnats," believed by her to have been injurious in her greenhouse:

The fly, or flies more properly, for there are thousands of them in my greenhouse, congregate wherever there is the least leaf mold or manure (cow), no matter how old or well-rotted it may be. They lay their eggs in the soil or under the pots or boxes; they seem (some of them) to shed their wings, and produce a white worm which is very difficult to kill. I have fumigated the greenhouse twice a week, used lime and lime-water and kerosene emulsion in the soil — not in a half-way manner, but thoroughly, and still they are just as bad again the next day. I tried dipping the pots in raw kerosene; the next morning on lifting the pots, the little wrigglers ran in all directions. They have done much damage, and I hope, for the benefit of others as well as myself, that you can give an idea of how to rid the house of them. I send to-day a phial with the flies.

Not Known to be Injurious in Greenhouses.

It has not, so far as known to me, been satisfactorily determined if the "fungus gnats" are the occasion of any positive injury in greenhouses. We would be glad to learn from our correspondent the character of the damage which the insect of which she has written has caused her, and also the amount, and any other particulars that may add to our knowledge of its habits and life-history.

General Features of the Fly.

The mature insect is a small fly or midge, closely allied in classification, structure, and general appearance, to the destructive midges that infest our grain and clover crops. It is one-tenth of an inch in length, with a black head, and dark-brown body, rather large and finely haired, transparent wings showing brilliant gold and purple reflections, and having but few veins. The abdomen of the female is narrowed and quite prolonged posteriorly. It is active and restless in its movements, and its long legs serve their purpose in running and leaping.

Its Description.

For the reasons stated for recognizing the manure *Sciara* as previously undescribed, this also is accepted as new to science and its description herewith given :

SCIARA CALDARIA n. sp. Plate I.—The general features of the imago are much the same as in the manure gnat. It may be distinguished by the greater iridescence of the wings; by the light-brown coxæ; and by the smooth polished scutum of the mesothorax. The proportionate width of the intermediate segments of the antennæ to their length is as 2 to 5; form cylindrical,—figure 5. The two distal segments of the palpi are about one-half as long as broad, and bear several long setæ,—figure 7. The apical portion of the lateral valve of the female is nearly oval,—figure 10. The inner unsegmented appendages of the male widely divergent; the apical third thickened and setose,—figure 12. The median organ beneath the dorsal plate arises from an undivided base,—figure 12a. The other characters, so far as observed, agree with those of the manure gnat. The material at hand was not sufficient to permit of a proper study of the characters afforded by the head.

Length of body, 2.5 mm.; of wing, 3 mm. Described from eight males; two females.

Does *Sciara* Shed Its Wings ?

The statement made by the lady, that some of the flies in her greenhouse shed their wings, would be of so much interest from an entomological view that we would be glad to have it verified, if possible, beyond question. It apparently finds some support in the fact that quite a number of the beautifully iridescent wings of the flies were found in the small quantity of the soil that was sent with the winged insects. I can not think of any end or purpose that could be served by such an unusual proceeding. Where wings are not needed, they are usually withheld. In some insects we have, in the same sex, both winged and wingless forms, and in others the female is wingless. In the genus *Epidapus*, belonging to the *Mycetophilidæ*, in which *Sciara* is included, the "wings and halteres are wholly obsolete" (Theobald), but Prof. Hopkins has recently described and figured a species in which "there are two forms of the males—one with short wings scarcely half the length of the body, and the other with wings as long or longer than the body." Possibly some such wingless forms may have been seen in the Boise greenhouse.

It is well known that among some of the ants, after the colony has taken its "marriage flight" and a return to earth is made for founding new colonies, the wings of the females are torn off, either by themselves or their companions. A sufficient reason for this would seem to be, that as the remainder of their lives is to be entirely devoted to

maternal cares and duties within their subterranean abodes, wings would no longer be needed and could only prove an incumbrance to them.

Phora agarici nov. sp.

The Mushroom Phora.

(Ord. DIPTERA: Fam. PHORIDÆ.)

The successful cultivation of mushrooms during the warmer portion of the year -- in May and thereafter through the summer months -- even under the approved methods now quite generally adopted, is regarded as impracticable, owing to the attack and destruction of the plants by the larvæ of small flies that tunnel the stalk and burrow in every direction through the pileus.* This difficulty has long been experienced by mushroom-growers, but no means have been discovered by which it may be surmounted. Many efforts have been made in different directions, but from the peculiar character of the mushroom and its extreme susceptibility to injury from all of the insecticidal preparations that have been experimented with, nothing satisfactory has been accomplished, and further efforts seem hopeless.

In a preceding page, several species of "fungus gnats" (*Mycetophilidæ*) are named, which feed on mushrooms, but it is not believed that in this country, at least, any of those are chargeable with the annual arrest of mushroom culture in the month of April in this latitude, nor is it known that they are among those which infest, to a greater or less extent, *Agaricus campestris* and many other wild forms during the summer months.

A Serious Mushroom Pest.

My attention at different times during preceding years has been called by Mr. William Falconer to the mushroom pest now being considered, as something quite different from the "manure-fly," and which, in our correspondence, he has designated as "the maggot." Mr. Falconer informs me that it has been the common warm-weather pest of the mushroom-grower ever since mushrooms were first cultivated, but in all the literature of practical horticulture -- our own and that of Europe -- he has never been able to find any indication of its identity.

* It is stated in works on gardening that in deep, dark cellars, mushrooms are not affected in this manner, and that they can be grown throughout the summer with perfect immunity from insect attack. But this is not so. I never saw or knew of an artificially constructed mushroom cellar that was proof against "maggots." In caves away in the bowels of the earth and completely away from natural light, the immunity may possibly be perfect, but of this I know nothing through my own observation or experience. (Wm. Falconer.)

Diseased and Infested Mushrooms.

Under date of May 3, 1889, Mr. Falconer sent for examination some "diseased mushrooms," showing the "black-spot" as brown markings on the surface of the caps which Dr. Farlow had pronounced the work of *Anguillulide*. Adhering to the mushrooms by their wings were numbers of the manure *Sciara*. Rather deep cavities had also been eaten into them by slugs. "But the chief reason," he wrote, "why I send you these, is to show you the crowning evil of mushroom culture, namely the MAGGOTS. By cutting open the mushrooms you may see numerous worm-holes in some of them, both in the caps and stems, and no doubt can discover some of the maggots. They are tiny fellows with a white body and black head, measuring about one-fifth or one-sixth of an inch long, looking to me not much unlike the club-root maggot in cabbage and cauliflower.

The fly was not reared from this sending: possibly no larvæ were found in them, for no examples are contained in the State collection. This is a matter of regret, for if a conspicuous feature of the larva was its "black head" it would indicate a different species from that obtained in a later year in the autumn.*

Two Insects Infesting an Agaricus.

On October 1, 1894, Mr. Falconer sent another package of infested mushrooms which he had gathered in fields: they were "the new mushroom" of *Gardening*, viz., *Agaricus subrufescens* Peck, described in 1893, and an highly esteemed edible species. They were swarming with larvæ, by which, in a brief time, they were completely riddled. A number of the larvæ were preserved in alcohol for the State collection.

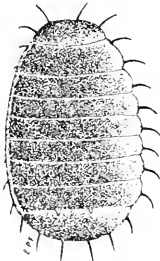


FIG. 6.—Puparium of a mushroom-feeding fly.

Although not observed at the time, there were two different larvæ feeding together in the mushrooms, for, after pupation, two distinct forms were found—one more than twice the size of the other, subelliptical in form, concave ventrally, dark brown in color, and with lateral and terminal spinose processes. The puparium is represented in a ventral view in figure 6.

Description of the Phora.

The small puparia disclosed a large number of the flies during the month of October—the length of time after pupation was not noted. They are not referable to any described species so far as known to me,

* Mr. Falconer has probably confounded the black-headed *Sciara* larvæ with these.

and are, therefore, assumed to be new, and the larva, puparium and imago described as follows:

PHORA AGARICI n. sp. Plate II. *Larva*.— Figure 5. Body nearly cylindrical, composed of 11 segments; length, 3 mm. Whitish, with two minute brown points on the ventral surface of the head. Under a high power the minute, 5-toothed, light-brown mandibles may be demonstrated and also the 3-jointed tubercle-like antennae on the lateral angles of the head. Dorsum convex; each segment divided into two nearly equal subsegments; hind margin of last segment flattened and produced into ten processes; a median pair; the others equidistant and opposite; posterior six larger. Ventral surface flattened, margined laterally, and segments 2-9 on fore and hind border, segment 10 on fore border only, by transverse ridges.

Puparium.— Figure 6. Light brown; suboval; ends obtusely pointed; length 2.5 mm. Dorsal surface slightly convex; the last six nearly equal segments, and lateral margin, distinct; on the anterior segment, which is about twice the size of the others, there are two slight subdorsal tubercles. Ventral surface very convex; segments and margin not well marked.

Imago.— Figure 1. Body jet black; antennae fuscous; apical portion of halteres yellowish-white; apical portion of coxæ, front and middle legs yellowish-brown; tarsi brownish; hind legs darker; palpi yellowish. Wings hyaline and with slight iridescence.

Ocellar triangle defined by a suture which extends down the front. Three transverse rows of bristles occur on the front; six in the posterior row, consisting of a median pair and four lateral; middle composed of four nearly equidistant bristles; six equidistant in the anterior row; in front of the median pair of the anterior row there is a small pair; the two pairs point downward, though in some examples the larger pair point upward. Compound eyes bordered behind and below by a single row of bristles; small setae occur at the angles of the facets (figure 2). Antennae five-segmented; first short, irregular; second very large, subspherical; third and fourth small, elongated; fifth, basal portion slightly enlarged and equal to fourth; distal portion setaceous, much elongated, plumose (figure 2a). Labium yellowish-brown, usually retracted (figure 3). Terminal segment of palpi long, slightly capitate and bearing several apical bristles; basal segment short, obscurely divided into several subsegments.

Dorsum of thorax thickly pubescent; several long bristles occur near base of wings. Wings hyaline; costal vein less than half the length of the wing; first heavy vein joining costa beyond middle between the humeral cross vein and the apex of the first branch of the second heavy vein; second heavy vein forked near apex; costal margin fringed with stout setae to tip of second heavy vein; first light vein curved at basal fourth and slightly at apical fourth. Halteres spatulate, basal portion segmented (figure 7). Several apical bristles on front and outer portion of coxæ; fore tibia unarmed; middle tibia with very long apical, posterior spine; hind tibia with one long anterior and several short apical, internal spines; anterior edge of middle and posterior edge of hind tibia fringed with a thick row of stout setae; internally and close to the hind margin of the posterior tibia there is a row of about nine stouter spines on the apical

three-fourths; tarsi of middle and hind legs bordered anteriorly and posteriorly by rows of stout spines.

Abdomen broad at base, slightly depressed; apex obtusely pointed, invested with short, scattering setæ. Terminal segment of female with a median process, laterally dilated at base and a pair of suboval appendages near the apex; width to length of median process as 1 to 4; lateral dilation nearly equal to length of median process; subapical appendage one-fourth the length of median process (figure 8). Terminal segment of male with an irregular, dorso-lateral plate, the ventral portion of which is prolonged. Two pairs of organs extend from the plate—an upper straight pair, bearing numerous long setæ on the entire surface, and a lower pair, slightly curved ventrally and bearing several long, usually sharply curved setæ at their tips. Below this armature there is a darker chitinous ring, within which are the essential organs.

Length of body, 1.5 to 2 mm.; of wing, 2 mm. Described from about 75 specimens of both sexes.

Close to the female of *Phora setacea* Ald. as described and figured in the *Canadian Entomologist*, xxiv, 1892, p. 144, fig. 2. This species may be separated by the anterior row of frontal bristles being a nearly straight transverse one, while in *setacea* they are represented as obliquing posteriorly from the median line; the anterior pair of proclivate bristles are also relatively smaller and more nearly in front of the other pair. The coxæ of the female, as well as those of the male, have a number of large sub apical bristles on the outer side, and the "conical protuberance" on the hind side of the third coxa is about equally developed in both sexes; the fore and middle legs are darker than in *P. setacea*.

None of the marked sexual features indicated by Mr. Aldrich, except those of the genitalia, have been observed in *agarici*. It is probable that the insect described as the male of *setacea* belongs to a distinct species from that of the female.

Peculiar Wing-Pores in *Phora*.

Mr. E. P. Felt, in his study of this insect in connection with its illustration, etc., has made some interesting observations upon the "wing pores" which he has detected, and of which he has written as follows:

An additional character which may prove to be of specific value is found in the number and location of certain "pores" or pore-like structures. The pores—four in number—occur in a slightly curved row along the middle line on the under side of the second heavy vein, where it anastomoses with the costal vein; a short stump extends beyond the anastomosis and inclines a little away from the costa.

The pores are less than half their diameter apart, the last one being close to the apex of the stump (figure 10). Each consists of a depression surrounded by a raised circular ring of chitine (figure 11). These pores must not be confounded with the scars on the costal vein left when a bristle is removed; they appear to have no connection with either bristle or setæ. Some twenty-five speci-

mens of *Phora agarici* were examined. In many cases the two wings were compared; in every case where the tip of the second heavy vein was apparent, these structures were found constant in number and position. It requires a mounted preparation and a one-fourth objective to bring them out clearly. Though occurring on the under side of the wing, in this species the veins are sufficiently transparent so that the pores may be seen from the upper side.

Subsequent study has shown that similar pores occur in the genus *Sciara*. They are found along the rudimentary subcostal vein and are much smaller than in *Phora*. In *S. coprophila* there are 10 pores along this vein -- an outer group of three, of which the antepenult is on the inner margin of the vein; the inner seven are nearly equidistant (figure 7a). In *S. callaria* there are but seven pores -- an outer group of three, with the antepenult as in *S. coprophila*; the inner four equidistant (figure 7b).

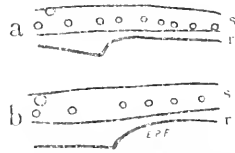


FIG. 7.—Diagram showing pores in veins of *Sciara*: a, *S. coprophila*; b, *S. callaria*; s, outline of subcosta; r, fore margin of radius.

Reference may be made, in connection with the above, to a paper published in 1889 in the *Transactions of the Royal Society of South Africa*, by the late Ezra P. Crawford, entitled "Notes on Certain Pores in the Veins of Some Diptera," and illustrated by several figures. Mr. Crawford found them to "number from five to eight, when present, and their number and position are constant in each species."

It is thought that they may be homologous with what Jurine, in *Nouv. Meth. Class. Hymenop. et Dipt.*, 1807, named "bullæ," as observed by him on the wings of certain Hymenoptera.

Infestation of Mushrooms by *Phora*.

Mr. Falconer has kindly sent, in response to request, the following observations on the occurrence of the *Phora* larvæ: "They make their appearance in early April, but do not increase to such an extent as to completely ruin the crop until the end of April or the first part of May. In outdoor mushrooms they are to be found from May into October. From August onward they are more numerous in wild mushrooms than at any time in cultivated ones, and they are apparently larger [but slightly so, judging from indication given of comparative sizes], but this may possibly be accounted for by a better food supply. In some

NOTE.—The following information relating to *Phora* infestation of mushrooms has been kindly communicated to me by Mr. Howard, of the Division of Entomology, at Washington, in reply to an inquiry made: "We have reared *Phora minuta* in considerable numbers from mushrooms received from Geo. Balderston, Coloma, Md.: and in Europe, Mr. Coquillett informs me, Scholtz has reared *Phora lutea* Meig. and *Phora flava* Fall. from an agaricus (Schiner, *Fauna Austriaca Diptera*, II, 1864, p. 343). Leon Dufour reared *P. nigra* Meig. from *Agaricus prunulus* Fries (l. c., 345), and Letzner reared *P. pumila* Meig. from an agaricus (l. c., 345). *Phora bovista* Gimmerth. was bred from *Lycoperdon bovista* (l. c., 346).

years and in some localities they are conspicuously more numerous than in others. In gathering a quart of field mushrooms several specimens may be entirely free from any sign of attack, and in others only a few newly-hatched larvæ are at work. Then, again, one may meet with particularly large mushrooms a day or two past their prime which are tunneled like a sponge and are living masses of maggots."

Remedies.

In consideration of the fruitless and long-continued efforts made by mushroom-growers to find an antidote against this insect, and a seeming general conviction that the culture must cease at the advent of warm weather, it may not be worth while to make suggestions for further experimentation. Still, much would be gained if the period of culture could be extended by a month or two. If an insecticide is to be sought, it might naturally be looked for among the vegetable ones. Of these, pyrethrum is certainly one of the most efficient, and the Diptera are known to be particularly sensitive to its influence. The pure, fresh, dry powder blown in the atmosphere with a powder-bellows, or made up into slightly dampened cones for slow burning, would unquestionably kill nearly all, if not all, of the ever-active, leaping and running flies in the apartment. If their eggs have not been previously deposited, their further propagation would be prevented. There seems no reason why a newly-made solution of the powder (largely soluble in water), liberally sprinkled over the soil, should fail to kill the young larvæ at the moderate depth in the bed at which they occur before entering into the base of the stalk, and at the same time be harmless to the plants.

Some Literature of Phora

- LATREILLE: Hist. Nat. des Crust.-Ins., xii, 1804 (genus founded).
 MACQUART: Hist. Nat. Ins.—Dipt., ii, 1835, pp. 625-631, pl. 24, figs. 1-4 (30 French species characterized).
 WESTWOOD: Introduc. Classif. Ins., ii, 1840, pp. 574, 575 (habits), f. 132, 12, 13 (larva and imago).
 LOEW: Mon. Dipt. N. Amer., Pt. I, 1862, p. 4 (antennal structure), p. 47 (family characters).
 PACKARD: in Amer. Nat., ii, 1868, pp. 196, 197, pl. 4, figs. 1, 2, 3 (*P. incrassata* parasitic in larva of honey-bee in England); the same, in Cotton Insects, 1879, p. 209; Guide Stud. Ins., 1869, p. 127 (parasite of hive-bee), p. 416 (figures of *P. incrassata* as cause of "foul brood"); the same, in Entomol. Begin., 1888, p. 126, f. 146; in Amer. Nat., v, 1871, p. 745, f. 123 (of cave Phora).
 SCUDD.-BURG.: in Proc. Bost. Soc. Nat. Hist., xiii, 1870, p. 283, f. 17 of plate (asymmetrical genitalia of *P. microcephala*).

- GLOVER: MS. Notes Journ.—Dipt., 1874, pl. 6, figs. 19, 20 (*P. incrassata* imago), pl. 7, f. 37 (larva of *P. dauci*), pl. 9, f. 20 (Phora imago from Mammoth cave), pp. 39, 40 (reference to seven species).
- OSTEN SACKEN: Cat. Dipt. N. A., 1878, p. 212 (eight N. A. species listed); in Amer. Entomol., iii, 1880, p. 277 (is Phora parasitic?); the same, in 4th Rept. U. S. Entomolog. Commis., 1885, p. 117.
- COMSTOCK: Cotton Ins., 1879, pp. 208-211, fig. 49 (*P. aleticæ* in larva, pupa, and imago described and figured); Man. Stud. Ins., 1895, p. 475 (characters of *Phoridae*).
- HUBBARD: in Amer. Entomol., iii, 1880, p. 39 (Phora in the Mammoth cave), pp. 82, 83 (larva of same described, figured, and compared), p. 228 (*P. aleticæ* a scavenger, not a parasite); the same, in 4th Rept. U. S. Entomolog. Commis., 1885, p. 116 (parasitized by a Chalcid); in id., Notes [112], from Amer. Entomol., p. 228.
- RILEY: in Amer. Entomol., iii, 1880, p. 277 (*P. aleticæ* not parasitic), p. 293 (a Chalcid parasite); in Amer. Nat., xvi, 1882, p. 747 (habits of *P. aleticæ*); in 4th Rept. U. S. Entomolog. Commis., 1885, pp. 108, 116, 117 (not parasitic).
- BUGNION: in Psyche, iii, 1881, p. 212 (Phora parasitic on *Lina tremulæ*).
- SCHWARZ: in 4th Rept. U. S. Entomolog. Commis., 1885, pp. 117-119 (*P. aleticæ* not parasitic).
- SCUDDER: in Bull. U. S. Geolog. Surv., No. 31, 1886, p. 86 (eleven amber species recorded by Loew).
- BETHUNE: in 16th Rept. Ent. Soc. Ont., 1886, p. 30 (foul brood due to Phora).
- WILLISTON: Synop. Fam.-Gen. N. A. Dipt., 1888, p. 64.
- BRUNETTI: in Entomol. Month. Mag., xxv, 1889, p. 282 (*P. rufipes* a quite general feeder).
- NEWSTEAD: in Entomol. Month. Mag., xxvii, 1891, p. 41 (*P. rufipes* in nests of *Vespa Germanica*).
- RILEY-HOWARD: in Insect Life, 1892, v, p. 5 (Phora sp., reference).
- ALDRICH: in Canad. Entomol., xxiv, 1892, pp. 142-146, 5 figs. (new western species of Phora); in Bull. 30 S. Dak. Agr. Coll. Expt. Stat., 1892, p. 7.
- COQUILLET: in Canad. Entomol., xxvii, 1895, pp. 103-107 (synopsis of the genus).
- MÉGNIN: Les Parasites Articulés, 1895, p. 471 (*Phora aterrima* in buried human bodies).

EXPLANATION OF PLATE II.

Phora agarici.*Mushroom Phora.*

- Fig. 1.—Female. The terminal segments are retracted within the body and the base of the abdomen is shrunken (x 20).
- Fig. 2.—Dorsal aspect of head; *a*, antenna.
- Fig. 3.—Labium and appendages from behind.
- Fig. 4.—Palpus, dorsal aspect.
- Fig. 5.—Ventral aspect of larva (x 8).
- Fig. 6.—Dorsal aspect of pupa (x 8).
- Fig. 7.—Halter.

- Fig. 8.—Dorsal aspect of the terminal segment of the female: *s*, subapical appendage.
- Fig. 9.—Lateral aspect of a portion of the terminal segment of the male: *d*, dorso-lateral plate; *u*, upper, *l*, lower organ.
- Fig. 10.—Portion of wing showing location of "pores" at the tip of the second heavy vein; its branch and a portion of costa also shown.
- Fig. 11.—A "pore."
- All figures greatly enlarged, except where otherwise stated.

Agrilus ruficollis (Fabr.)

The Gouty-Gall Beetle.

(Ord. COLEOPTERA: Fam. BUPRESTIDÆ.)

A severe attack of this insect — known by the name above given from the peculiar swelling in the cane that its larva produces, and also as the "red-necked Agrilus," from its copper-colored thorax contrasting with the brownish-black wing-covers — was reported by Mr. E. Winne, of Delmar, Albany county, N. Y., in the early part of May. He was growing raspberries extensively, and the injuries of this insect threatened the destruction of the crop — so large a proportion of the canes being infested with it. A number of the canes were brought to me, in which the pupæ were found at the time. Several of the beetles subsequently emerged, but they were dead when discovered some weeks thereafter.

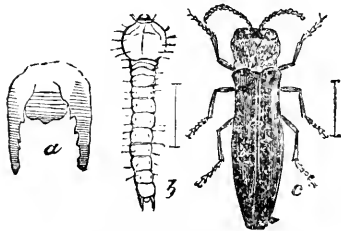


FIG. 8.—The red-necked Agrilus, *AGRILUS RUFICOLLIS*: *c*, the beetle; *b* the larva; *a*, terminal horns of the larva — all enlarged.

as the "red-necked Agrilus," from its copper-colored thorax contrasting with the brownish-black wing-covers — was reported by Mr. E. Winne, of Delmar, Albany county, N. Y., in the early part of May. He was growing raspberries extensively, and the injuries of this insect threatened the destruction of the crop — so large a proportion of the canes being infested with it. A number

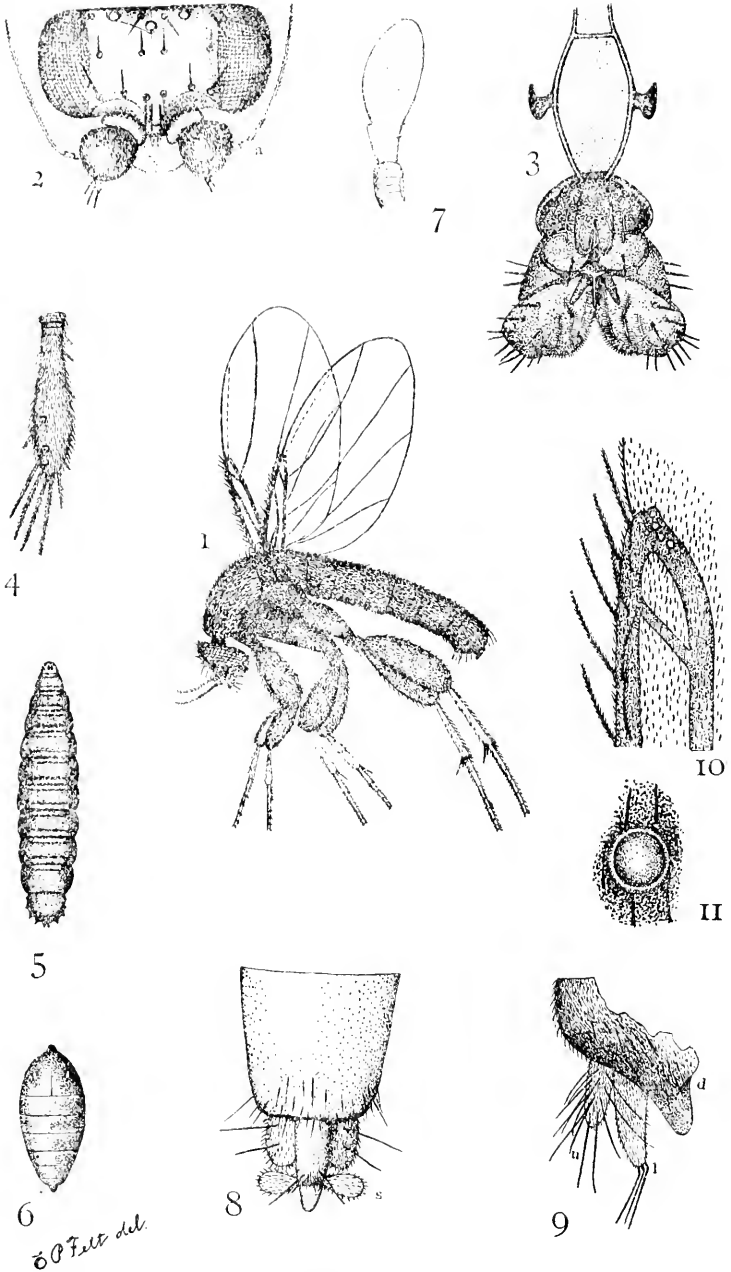
A serious attack of the same insect was also brought to my notice in April by Mr. M. Brooks, of Athens, N. Y.

Remedy.

These gentlemen were informed that the injury from this insect could be, to a large extent, if not entirely, arrested, by cutting off all the canes below the "gouty-gall" produced by the burrowing of the larva in the wood, and burning them, in the early spring before the beetle could mature and escape and deposit eggs for the continuance of the attack.

Operations of the Insect.

According to Walsh-Riley, the beetle makes its appearance early in the summer, but sometimes as late as the fore part of July, and deposits



PHORA.

its eggs shortly thereafter. Prof. Webster states that in a serious attack observed and studied by him of the insect on the dewberry (*Rubus Canadensis*) in Southern Ohio, where the culture of this berry had developed into an important industry, it was learned that the beetles appeared about the middle of May and remained until the last of June or about the time of the ripening of the first berries.*

Dr. J. B. Smith, who represents it as a chief pest of the blackberry in New Jersey, gives for the time of the emergence of the beetle from May 20 to July 10. He is of the opinion that the egg is not inserted in the tissue of the cane as generally stated, but is simply laid at the base of the leaf-stalk or in the bud. See the interesting account by him of the peculiar burrowing operations of the larva as given in *Insect Life*, iv, 1891, p. 28.

Notwithstanding occasional instances of such extensive infestation as above noticed, the beetle seldom falls into the hands of collectors in New York. The only examples (2) taken by me were captured in Schoharie, N. Y., over thirty years ago, probably in my garden.

This insect has been previously noticed in my sixth report, pp. 123-125, where its transformations are briefly given, the gall that it produces figured and some literature cited where fuller details may be found.

Its Distribution.

Dr. Horn, accompanying his detailed description of the beetle in "The Species of *Agrilus* of Boreal America,"† has given the following as its distribution: From Canada and the New England States southward to Virginia and westward to Missouri.

Respecting *Agrilus anxius*.

The *Agrilus torpidus* Lec., mentioned in my fifth report as taken in large number from cut poplars at Elk Lake, Essex county, N. Y., in the latter part of August, 1883, had been described by Gory in 1835 as *Agrilus anxius: torpidus*, therefore, becomes a synonym. Its range is said to be from Massachusetts and New Hampshire westward to Colorado. Mr. G. C. Davis has found it producing galls in branches of the willow (*Salix discolor*) in Michigan. The gall is an oval swelling, from which an oval gallery is bored downward, sometimes in the pith, but oftener through the wood, opening outwardly an inch and a half below the gall (*Insect Life*, iv, 1891, p. 66).

* *Bulletin 58 Ohio Agricultural Experiment Station, December 1894*, pp. 29, 30.

† *Transactions of the American Entomological Society*, xviii, 1891, pp. 277-336.

Anomala lucicola (Fabr.).*The Light-loving Grapevine Beetle.*

(Ord. COLEOPTERA: Fam. SCARABÆIDÆ.)

- FABRICIUS: Supp. Ent. Syst., 1793, p. 132, no. 64-5, *Melolontha mærens*; no. 66-7, *M. lucicola*; no. 66-7, *M. atrata*; Syst. Eleuth., ii, 1801, p. 174, no. 82, *moerens*; no. 85, *lucicola*; no. 86, *atrata*.
- MELSHEIMER: in Proc. Acad. Nat. Sci. Phila., ii, 1846, p. 141 (described as *A. pinicola*).
- FITCH: in Count. Gent., xiv, 1859, p. 171 (descriptions of varieties); 3d Rept. Ins. N. Y., 1859, p. 85 (mention); 4th Rept. do., 1859, p. 61 (as *A. pinicola* feeding on pine).
- HARRIS: Ins. Inj. Veg., 1862, p. 34 (description, on grapevine).
- GLOVER: in Rept. Commis. Pat. for 1861, 1862, p. 602, figs. 39, 40 (features of larva and imago); in Rept. Commis. Agricul. for 1868, 1869, p. 88, fig. 74 (mention).
- WALSH: in Pract. Entomol., i, 1866, p. 101 (mention, on grape).
- KIRKPATRICK: in Ohio Farmer, Jan. 11, 1868 (injury to grape).
- LE BARON: 1st Rept. Ins. Ill., 1871, pp. 54-56 (injury to grape); 4th Rept. do., 1874, p. 89 (mention).
- THOMAS: 6th Rept. Ins. Ill., 1877, pp. 105, 106 (description and habits).
- SAUNDERS: Ins. Inj. Fruits, 1883, p. 284, fig. 294 (features, habits, remedies).
- HORN: in Trans. Amer. Ent. Soc., xi, 1884, pp. 162-3 (description).
- LINTNER: in Count. Gent., liii, 1888, p. 565 (features, injuries, remedies); 5th Rept. Ins. N. Y., 1889, p. 305 (abstract of prec.).
- HAMILTON: in Insect Life, iv, 1891, p. 132 (*pinicola*=*lucicola*).
- SMITH: in Insect Life, v, 1892, p. 95 (larval development).
- WICKHAM: in Canad. Entomol., xxvi, 1894, p. 260 (in Canada: diagnostic characters).
- COMSTOCKS: Man. Study Ins., 1895, p. 562 (brief notice).
- CHITTENDEN: in Insect Life, vii, 1895, p. 356 (mention).

Several examples of this little Scarabæid, *Anomala lucicola*, were received from Highstown, N. J., on July 13th, taken from grapevines on which they were feeding voraciously.

Exception has been taken to the specific name, meaning *light-loving*, given it nearly a century ago, for although the beetle, like some of the flower beetles, may love to spread its wings in the sunlight, yet its feeding is believed to be done mainly under cover of darkness.

General Features of the Beetle.

It resembles in form the well-known June-bug, *Lachnosterna fusca*, to which it is nearly related, but is of a considerably smaller size, measuring only from three-tenths to four-tenths of an inch in length.

Dr. Fitch, in his *Third Report on the Insects of New York*, has described it as "pale, dull yellow, with the thorax black, except on each side and on the middle of its hind edge; the hind part of the head, the scutel and under side of the body being also black, with the abdomen brown or sometimes dull yellowish."



The great range in variation in color of the individuals of this species ascribed to it, is in all probability largely sexual. Two males of the examples received were in entire accord with the description of Dr. Fitch above given. The remaining seven were females, and had the thorax yellow and concolorous with the elytra, except a small black spot on each side in front (as has also the male in its yellow margin), and another black spot centrally and more or less distinct, near its hind margin. The wing-covers are narrowly margined with black or brown. The abdomen beneath is yellow.

FIG. 9.—The light-loving grapevine beetle, ANOMALA LUCICOLA. (After Glover.)

Description.

As a further aid to identification when detected feeding upon the foliage of the grape, the following is copied from Dr. Horn's "Notes on the Species of *Anomala* Inhabiting the United States," *loc. cit.*, pp. 157-164.

Form oval, robust; color variable from entirely yellow to entirely black; head moderately densely punctured; clypeus transverse; sides very little divergent, angles rounded, margin in front narrowly reflexed, thorax convex; sides regularly arcuate, gradually narrowed to the point, basal marginal line obliterated, surface rather coarsely but not densely punctured; elytra with moderately deep striae of rather coarse, closely-placed punctures, the intervals nearly equally convex; pygidium sparsely punctured; body beneath coarsely but sparsely punctured; the pectus very slightly hairy. Length, .35-.40 inch; 9-10 mm.

The front claw of the anterior and middle tarsi is deeply cleft at tip, the two portions nearly equal.

Habits and Destructiveness of the Beetle.

The beetle is noted for its fondness for the foliage of the grape. Dr. LeBaron, in his *First Report on the Insects of Illinois*, has recorded their destructiveness and habits, particularly that of their peculiar flights. They were noticed at about sunset on an evening during the latter part of June, flying close to the ground in a zig-zag

manner, as if they were hunting for something, and were in such numbers as to sound like a swarm of bees. Later in the evening they were seen to have settled on some grapevines. If the vines were shaken they would drop readily and "play possum" for a few minutes, and then fly up and commence feeding again. The following morning not a beetle was found on the leaves, but they had eaten one-half of the foliage from two hundred and fifty vines. In searching for them, large numbers were found on the ground under the vines.

Of several vineyards attacked at the same time, only a particular variety, known as Norton's Virginia, was eaten. Their feeding seemed to be confined to the night-time, notwithstanding their specific name of *lucicola*.

Reported Feeding on Pine.

With a single exception all writers on this insect in giving its observed feeding, have reported it on the grape. Dr. Melsheimer has described as *A. pinicola*, beetles "very abundant in Pennsylvania, in July, on the Red or Pitch Pine." Dr. Fitch, *loc. cit.*, mentions the same as "feeding on the leaves of pine in June and July," but probably from no knowledge of his own, as he only knew it in specimens received from the south (? Pennsylvania). Dr. Horn and Dr. Hamilton agree in their reference of Melsheimer's *A. pinicola* to *A. lucicola*.

Remedy.

When the beetles are not very abundant on the grapevines, their feeding may be largely prevented by dusting the foliage with air-slaked lime, but probably the best method of protection would be jarring them from the foliage on cloths stretched on a frame or spread on the ground beneath, and quickly turning them into a vessel of water and kerosene.

Distribution.

The insect is pretty generally distributed over the Northern, Middle, and Eastern States, but does not frequently make its appearance in destructive numbers. For this reason it has not been given special study, and but little seems to be known of its life-history.

From the Fabrician references and synonymy as above given, it would seem that in strict obedience to the rules of priority this insect should be known as *Anomala moerens*, as in each of the works cited, while the three names appear upon the same page, *moerens* precedes the other two.

Anomala marginata (Fabr.).*The Margined Anomala.*

(Ord. COLEOPTERA: Fam. SCARABÆIDÆ.)

FABRICIUS: Ent. Syst. em., i; pars ii, 1792, p. 164 no. 40 (as *Melolontha*).

HORN: in Trans. Amer. Ent. Soc., xi, 1884, pp. 163-164 (description).

BURMEISTER: Handb. Entomol., iv, i, 1894, p. 266.

MUNSON: in Insect Life, i, 1889, p. 220 (operations in Louisiana).

RILEY-HOWARD: in Insect Life, i, 1889, p. 220; in id., v, 1892, p. 45 (identification and remedy).

HOYT: in Insect Life, v, 1892, pp. 43-45; in Count. Gent., lviii, 1893, p. 523 (abundance and injuries in North Carolina).

LANTNER: in Count. Gent., lviii, 1893, p. 523 (distribution, injuries, remedies).

A more destructive species of *Anomala* than the one noticed in the preceding pages is *A. marginata*, if we may judge from the prolonged wail of utter hopelessness from a North Carolina correspondent of the *Country Gentleman*, following a fruitless contest with a horde of the beetles, apparently as irresistible as the rose-bug in New Jersey vineyards. Listen to his cry:

And now we have the *Anomala marginata*. This is the too modest name of a bug, a species of May-beetle, which for "pure cussedness" can give the rose-bug points and come out ahead. It resembles the May-bug, is about half the size and in color is metallic bluish-green. This creature appeared for the first time last summer in this section just as the rose-bug was leaving, and promptly began devouring everything that the other hadn't time to eat. While blessed with the appetite of the rose-bug and the elephant combined, it is not so formal as the former, but brings all its luggage along and remains with us until fall. While the rose-bug has slighted us this summer, the *A. M.* has come again in millions. It began eating its breakfast about six days ago and hasn't knocked off yet to get ready for lunch. Some of my vines are already quite defoliated. I have found them to some extent on blackberry, raspberry, and rose bushes, but its preference is the grapevine.

I tried hand-picking and shaking them into a vessel with water and kerosene. I had three men working in a plat of thirteen hundred Cynthiana vines for an entire day. In this way they destroyed gallons of them. The next morning they were there in unbroken ranks, not a vacancy visible. I then tried spraying with London purple, a pound to one hundred and fifty gallons of water. If this treatment has caused them any unpleasantness I have yet to discover the fact. One might as well try to convince the Sabbatarians that there are other people in the world who have rights.

If any of your readers having vineyards have been troubled by these pests and have succeeded in getting rid of them I would like to learn their methods. Kerosene emulsion might act as a deterrent, but

I fear that it would spoil the grapes for wine-making. In the meantime, my emotions are too great for utterance. I think that Job makes no mention of ever having contended with the *Anomala marginata*. I would he were here. His opinions expressed in choice Chaldaic might possibly fit the case and give me some relief.

J. K. H.

A Southern Species.

Fortunately, *Anomala marginata* rarely occurs in such overwhelming numbers as recorded in the above communication, and then only in the Southern States. It has an extensive distribution from Texas eastward and northward into Tennessee. It has not, so as far as known to me, been taken in the State of New York, although Dr. Hamilton reports it as occasionally seen in southwestern Pennsylvania, and Dr. J. B. Smith, the same in New Jersey, but occurring over most of the State. It is markedly a southern species, as is, indeed, the genus, for of the twelve contained species, only four pertain to the Middle States.

Little Recorded of its Habits.

Very little has been written of this insect,—its habits having received but little attention. The only notices of its injuries found in the many volumes consulted, are these: in *Insect Life*, i, 1888, p. 220, a gentleman writing from Denison, Texas, who had received specimens from Louisiana, states that they come in June and July, and are ravenous feeders on the leaves of the grape, completely skeletonizing them, and also eating out the young buds and tips of the shoots. When disturbed, they drop to the ground and remain motionless for some time, unlike another species associated with them (*A. minuta*), which at once runs to cover.



FIG. 10.—The margined
ANOMALA, ANOMALA
MARGINATA, natural
size. (Original.)

Another notice is in *Insect Life*, v, 1892, from the gentleman whose communication to the *Country Gentleman* has been given herewith. The additional facts mentioned in this later letter are these: It had been noticed in former seasons, but only in isolated examples. In addition to the grape, it had also attacked the foliage of apple and plum—not the pear. The beetles drop to the ground the moment a leaf is touched.

Description.

The beetle is described as follows, by Dr. Horn:

Oval, robust, pale rufescent, disc of thorax and head darker; surface with æneous lustre; head densely punctured; clypeus short, broader

at base, margin narrowly reflexed; thorax narrower in front; sides arcuate, base not margined, color brownish, broadly margined at the sides with testaceous; surface coarsely but sparsely punctured; elytra rather deeply striate, with coarse, closely-placed punctures, the second stria composed of a double row of punctures, intervals equally convex; pygidium densely rugulose and pubescent; body beneath sparsely punctured, pectus slightly hairy. Length, .44-.60 inch; 11-15 mm.

The front claws of the anterior and middle tarsi are cleft at tip, the two portions nearly equal. [The middle tarsus is shown in fig. 11.]



FIG. 11.—Middle tarsus and claws of *ANOMALA MARGINATA*, enlarged. (Original.)

Remedies.

The strong instinct of the beetle, above mentioned, to remain motionless for some time, or to "counterfeit death," as generally phrased, would indicate as the best method of reducing their excessive abundance, that of shaking them on cloths, as recommended for *A. lucicola*. For securing them as they drop, one of the different forms of "collectors" described and figured by Dr. J. B. Smith in his Bulletin on the Rose-Bug (No. 82 of the New Jersey Agricultural Experiment Station), would prove convenient and effective, and decidedly preferable to attempting to gather them into a vessel of water and kerosene.

Dr. Riley has recommended for the attack of this grapevine pest, spraying the vines, upon their appearance, with Paris green and water, at any time before the grapes begin to ripen. A strong kerosene emulsion should also kill the beetles, and if used in June or July, it is hardly possible that it could remain to affect the grapes when converted into wine.

Other Grapevine Anomalas.

In addition to the two species named, at least three others are known to feed upon grape foliage, viz., *A. undulata* Mels., *A. minuta* Burm., and *A. binotata* Gyll.

Diabrotica vittata (Fabr.).

The Striped Cucumber Beetle.

A correspondent has sent the following statement of a supposed protection afforded by a black walnut tree from the attack of the striped cucumber beetle, *Diabrotica vittata* (Fabr.):

My apple orchard joins my garden on the north side and my yard on the east side. Just inside the yard at the junction of these two fences is a black walnut tree, shading that northeast corner of the garden. In

this, as far as the walnut shade goes, I can raise all the cucumber and canteloupe plants that I choose to plant, but as soon as I get out of reach of this walnut tree — in one good hour of sunshine they are eaten so suddenly that I almost feel like saying they are swallowed whole by the bugs. All of these plants that I have raised of late have been grown in this corner until old enough to withstand the bugs (just ready to vine), when they are taken up on a large shovel and carried to the places prepared for them. I might think that it was the shade on the east side, but that this walnut tree is a volunteer that came up quite near one of the largest apple trees that I ever saw, which shaded the same ground. This is now old and dying out while the walnut tree takes its place. As the walnut gets larger my plant-bed, to the same extent, is extended in area.

See a brief note in the *Fifth Report on the Insects of New York*, 1889, p. 159, entitled — Beans for repelling the Striped Cucumber Beetle. There are many statements in agricultural journals of the supposed effects of various plants in repelling insect attacks, but they all need verification before they can be accepted.

Dibolia borealis Chev.

A Plantain-Leaf Miner.

(Ord. COLEOPTERA: Fam. CHRYSOMELIDÆ.)

Dibolia borealis CHEVROLAT: Guer. Icon. Règne Anim., 1845, pl. 49 bis., f. 12.

Dibolia ærea MELSHEIMER: in Proc. Acad. Nat. Sci. Phila., iii, 1847, p. 167.

Dibolia ærea Melsh. HENSHAW: List Coleop. N. Amer., 1885, p. 113, no. 7057.

Dibolia borealis Chev. HENSHAW: 3d Supp. List Coleop. Amer., 1895, p. 29.

Plantain leaves (*Plantago major*) containing larvæ mining them, were received, through favor of Mr. C. L. Shear, of Alcove, N. Y., on June 22d. They were placed in a box where they were overlooked until in the autumn, when two small beetles, dead, were found in the box. They were identified by Dr. John Hamilton as *Dibolia ærea* Mels., now *Dibolia borealis* Chev.

Dr. Hamilton did not know of the mining habits of the larva, but was familiar with the beetle in its abundant occurrence on plantain leaves, at Allegheny, and elsewhere. He called my attention to the following note by S. H. Scudder, in *Psyche*, ii, 1878, p. 154:

Prof. F. H. Storer, of the Bussey Institution, Jamaica Plain, Mass., writes me that in the latter part of May, 1876, it was next to impossible to discover a single leaf of plantain (*Plantago*) that was not completely riddled by beetles (*Dibolia ærea* Melsh.). Several thousand plants from all sorts of situations had passed through his hands, and the only perfect ones that he could find were from particularly cold, sunless places on the north side of buildings.

Habits, Etc., of the Insect.

Prof. P. H. Rolfs has given the following account in *Entomological News*, ii, 1891, p. 13, of the habits and pupation of this insect:

The habits of this little beetle appear to be familiar, but the following notes on its period of development may be of interest: The larvæ were found abundantly on plantain (*Plantago major*) at La Claire, Iowa, about August 1, 1890. They make an opening in the epidermis of the leaf which they enter, gradually eating their way. Sometimes a larva makes a tunnel, then goes back and starts a branch to it. If the leaf becomes too dry some will leave and enter a fresh one, but in ordinary cases they remain in their leaf until they are ready to pupate. When full-grown they are about three-fourths mm. in length. The period of pupation is fourteen days. Up to the twelfth day the pupa is yellow; on that day a slight coloring of the eyes is noticed, the following day the tarsi become black, and the fourteenth day the beetle appears, becomes entirely black and begins to move about. Eight beetles lived five days without food; after plantain leaves were introduced they ate freely.

A Miner in Turnip Leaves.

Prof. Comstock has noticed this insect in his Report as Entomologist of the U. S. Department of Agriculture for the year 1879. Early in March of that year, turnip leaves being mined by a larva were received from Atlanta, Ga. "The larvæ were found burrowing into the leaf-stems as well as into the turnip itself, the eggs having evidently been deposited near the base of the leaves. It was at first thought that these might be the larvæ of the turnip-flea beetle, as they bore a resemblance to them, but rearing to the perfect state showed them to belong to a closely allied species, *Diabolia urea*." The larva not having been previously described, Prof. Comstock accompanies the above notice of its feeding habits with its description (page 248 of the *Report of the Department of Agriculture for 1879*).

The Beetle Abroad.

Prof. Herbert Osborn has taken the beetle, in several examples, in sweeping the grass of a lawn in Washington, D. C. (*Insect Life*, vi, 1891, p. 198.)

Of the life-history of this insect little has been recorded. Mr. E. A. Schwarz, of the Entomological Division at Washington, in writing from Vicksburg, Miss., on January 28th, incidentally mentions his having seen during the few preceding warm days *Diabolia urea* commonly flying about or sitting on fence posts, etc., but had not found it in its winter quarters.

Description of the Beetle.

A description of the beetle by Dr. Horn may be found in his "Synopsis of the Halticini of Boreal America" in the *Transactions of the American Entomological Society*, xvi, 1889, at page 307. It is "oval, slightly oblong, convex, piceous, surface distinctly bronzed, either aeneous, slightly cupreous, or bluish. Head shining, indistinctly punctate. Thorax * * * closely punctate with coarse and fine punctures intermixed. Elytra * * * disc convex, with striae of coarse punctures which are rather closely placed, some of the striae rather irregular. Body beneath piceous. * * * Length, .12 inch.; 3 mm."

Its Distribution.

Widely distributed over the entire eastern United States and Canada. It has also been received from Nevada. It has also been reported as occurring in Mexico, but it may have been confounded with *D. ovata* Lec.—believed to be a distinct species, although referred by Crotch as a variety of *borealis*.

Otiorhynchus ovatus (Linn.).
The Ovate Snout-Beetle.

(Order COLEOPTERA : Family OTIORHYNCHIDÆ.)

LINNÆUS: Syst. Nat., i, Pars ii, 1767, p. 615, 69 (original description as *Curculio ovatus*).

OLIVIER: Entomologie, v, 1807, p. 378, pl. 31, f. 473.

LABOULBENE: in Ann. Soc. Ent. France, iii, 1853, i, Bull. 48 (larval notes).

LECONTE-HORN: Rhyn. N. Am.; in Proc. Amer. Philosoph. Soc., xv, 1876, p. 61 (description as *ligneus*).

WEED: in Rept. Mich. St. Bd. Agr. for 1883, pp. 425-429 (life-history, as *ligneus*; in Cook's Notes on Injur. Ins.—Ent. Lab. Mich. Agr. Coll. [1884], pp. 6-10, figs. 7-9 (general notice, as *ligneus*); in 14th Rept. Hort. Soc. Mich. for 1884, 1885, pp. 84-88, figs. 7-9 (natural history, description, food, enemies, remedies; as *ligneus*).

— in Psyche, iv, 1884, p. 233 (injurious to strawberries, as *ligneus*).

LINTNER: in Can. Ent., xvi, 1884, p. 182 (infesting a house, as *ligneus*); the same in 15th Ann. Rept. Ent. Soc. Ont., 1885, p. 13; the same in detail, 2nd Rept. Ins. N. Y., 1885, pp. 51-52; 3rd Rept. do., 1887, p. 141 (from beneath carpets); 4th do., 1888, p. 141 (in dwellings, as *ligneus*); 6th do., 1890, pp. 107, 118, 189 (in dwellings and on strawberries; mention); in New Eng. Farmer, June 4, 1890, p. 1 (on strawberries); 7th Rept. Ins. N. Y., 1891, pp. 321, 360 (in dwellings and on strawberries; mention); 9th do., for 1892, 1893, pp. 297, 422, 463 (infesting dwellings; mention).

- HENSHAW: List Coleopt. N. Am., 1885, p. 131, no. 1882 (*ovatus* Linn., *ligneus* Lec., erroneous identification).
- HAMILTON: in Trans. Am. Ent. Soc., xvi, 1889, p. 153 (distribution); id., xxi, 1894, p. 402 (introduction and distribution).
- TOWNSEND: in Psyche, v, 1889, p. 234 (in Michigan).
- SCHWARZ: in Insect Life, iii, 1892, p. 37 (in notice of Otiorynchidae).
- HARRINGTON: in Can. Ent., xxiii, 1891, p. 22 (mention); in 25th Ann. Rept. Ent. Soc. Ont., 1894, p. 49 (common at Sydney, N. S.).
- RILEY-HOWARD: in Insect Life, v, 1892, pp. 46-47 (infesting houses; habits).
- WEBSTER: in Can. Ent., xxiv, 1892, p. 207 (feeding upon leaves of muskmelon); the same, in Insect Life, v, 1892, p. 99; in do., vi, 1893, p. 186 (in grass).

This curculionid or snout-beetle has been noticed in the Second, Sixth, and Ninth Reports of this series as infesting dwelling-houses. In the first instance a house in Lycoming, Oswego county, N. Y., which had been closed for four years, on being opened in the month of May was found to be harboring an immense number of the beetle, although containing nothing upon which they could feed. They continued into June, the last disappearing about the middle of the month. In the second instance reported they invaded many dwellings in Potsdam, N. Y., in 1889. In the third, they proved a great annoyance to the occupants of a house at Moriches, on Long Island, in the month of August.

As their appearance at Potsdam was merely given incidental mention in the Sixth Report, some further particulars subsequently communicated may be of interest.

Infesting a House in Potsdam, N. Y.

Examples of the beetle were received for identification the latter part of July, 1887, from a lady, with the statement that they had appeared in the house in quantities and seemed particularly to infest woolen goods. The writer was assured that they were harmless to woolens, as both the larva and the beetle fed only on vegetable matter. The following year, in August, the lady wrote that the beetles had appeared in great numbers outside the house, usually coming from their hiding places at about 9 o'clock in the evening. Many were seen upon the outer walls (a stone building). They ate the leaves of the shrubbery, particularly of the rose bushes, of which little was left but the stems. They were also found so abundantly in the gutters on the top of the house that they could be taken up by

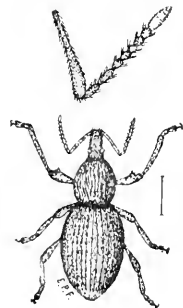


FIG. 12.—The ovate snout-beetle, OTIORYNCHUS OVATUS, with antenna more enlarged. (Original.)

the handful. Many of the rooms of the house abounded with them to the extent that their frequent gathering with a broom was necessary. At the time of writing, August 24th, they were not quite so numerous as they had been about the first of the month. In May of 1889 they again reappeared and gave promise of being more numerous than before. A number of other houses in the vicinity had also become infested.

As a Strawberry Pest.

Very little has been recorded of the life-history of this insect, particularly of that portion which is of the greater economic importance, viz., the larval food-habits. Dr. C. M. Weed had observed the larvæ girdling the crowns of strawberry plants on the grounds of the Michigan Agricultural College, in May and June. The name of the "strawberry crown-girdler" was proposed for it, as, instead of burrowing into and excavating the crown as does the "strawberry crown-borer," *Tyloderma fragarice* (Riley), "it seems to prefer the outer portion, but in many cases it cuts horizontally through the center of the crown." The mature insect, the beetle, seems to be somewhat of a general feeder, as, according to Miss Clarkson's statement, it was destructive to the foliage of roses and other shrubbery; but no other record of the larval food is known to us than the one above cited.

The Insect Destructive to Cabbage.

During the year, the insect has come to our notice as a serious cabbage pest. Examples of the beetle were received from R. J. Dimon, M. D., of Hastings, Oswego county, N. Y., on August 15th, through Dr. Collier, of the New York Agricultural Experiment Station, for name. Dr. Dimon kindly sent me, under date of October 11th, the following information in regard to its operations.

I have been observing its habits and effects for some time. It commences its attack on the cabbage soon after it is established in the field. The first indications are the turning yellow, then brown, of some of the bottom leaves. The beetles are found on the ground under leaves as soon as the head begins to form. Rotten leaves appear, and sometimes one side of the head rots off entirely. When they do not commence their attack so early, the head forms nicely and nearly attains its growth, when the rot appears and the leaves separate from the heart. The cabbages thus infested are a total loss, and nearly one-half of my field of two thousand plants was ruined in this manner, this year. The injury seems to be done by both the beetle and the grub. I have taken fifty beetles from under a single leaf which had turned brown from their drawing the sap from it; and later, the stalk is found punctured and filled with little white larvæ, about one-third of an inch long, which destroy the center of the stalk and leave it a foul smell-

ing jelly-like mass. The eggs are deposited just below the first leaves -- many in a plant.

Dr. Dimon has been requested to send, another season, examples of the cabbage stalk infested by the larvæ mentioned, that it may be determined beyond question if they are those of *O. ovatus*. The species of *Otiorhynchus* in their larval stage are root-inhabiting. *O. sulcatus* and *O. picipes* frequently occur in England, as burrowers in mangel-wurzel. Both of these species have been introduced into this country.

While *O. ovatus* is very abundant in New York, none of the other species have been collected by me in the State. *O. sulcatus* is taken rarely.

As the above notes relate only to the economic relations of the insect, a number of references have been given, where further information of it may be found.

Conotrachelus cratægi Walsh.

The Quince Curculio.

(Ord. COLEOPTERA: Fam. CURCULIONID.E.)

Conotrachelus cratægi WALSH: in *Prairie Farmer*, for July 18, 1863, p. 37 (original description).

From an orchard in Geneva, N. Y., two quinces were sent on October 11th, from which eight larvæ of this species were taken — six of the number occurring in one quince. The insect had been very injurious in this orchard in 1893. Spraying with an arsenite, recommended for preventing attack of the plum curculio, had apparently little influence in lessening its injuries, for the trees had been given three sprayings with London purple during the season — one pound to two hundred gallons of water; and yet, a large proportion of the fruit was destroyed. The attack in this and other orchards of the owners had continued for many years, especially in 1887, when of one thousand bushels of quinces grown, one third was more or less affected, as stated in my Fifth Report, 1888.

Fortunately, this is rather a local insect. The injuries in Western New York have not been as serious as in New Jersey, where Dr. Trimble reported in 1870, that in a quince orchard of two hundred and

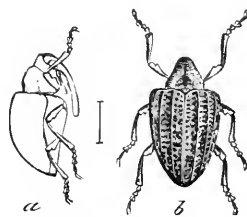


FIG. 13.—The Quince Curculio, *CONOTRACHELUS CRATÆGI*; side and back views. (After Riley.)

eighty trees, upon a most careful search, he was unable to find a single specimen perfect or clear of one or more blemishes caused by the punctures of this insect. Besides the quince, it had been quite destructive to Lawrence, Seckel, and Duchesse pears.

The quince curculio has not been treated of, in detail, in any of the New York reports. It was not noticed by Dr. Fitch, and was probably unknown to him, at least, as occurring in the State of New York, having been first described by Mr. Walsh in 1863, as found abundantly ("swarming") on wild haws in the West. A brief notice of its feeding habits, transformations, its injuries and remedies for it, is to be found in the *Second Report on the Insects of New York*, 1885. Prof. Riley has given an extended account of it in his *Third Report on the Insects of Missouri*. The literature relating to it is quite limited.

The Seventeen-Year Locust in the State of New York in 1894.

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

The "Hudson river valley brood" of this interesting insect (*Cicada septendecim*), which was previously seen in the year 1877, made its return at its expected time — during the latter part of May, continuing during the month of June and gradually disappearing in the early part of July. It is the largest in number and the most extended in its range of any of the six New York broods. This alone would render its visit of more than ordinary interest, but in addition thereto the interest always attaching to it was largely increased by the discovery in a number of places in the State of curiously formed clayey structures built by the pupal insect upon the surface of the ground to a height of two or three inches, in continuation of the underground burrows, frequently in many thousands and occasionally in hundreds of thousands. Why they were exceptional, and were in some places found intermingled with the ordinary open burrows, and what cause led the pupæ to construct them — notwithstanding the study that has been given them and the explanations that have been offered — these and other questions connected with them still remain to be satisfactorily answered through future observations and study.

That the occasion might be improved in obtaining information of the precise territory occupied by this brood, of its building operations, and of other matters relating to it, the following was prepared as a circular and largely distributed throughout the Hudson river coun-

ties, and was also, by request, copied in many of the local papers of the several counties :

UNIVERSITY OF THE STATE OF NEW YORK, }
OFFICE OF THE STATE ENTOMOLOGIST. }

THE PERIODICAL CICADA, OR THE "SEVENTEEN-YEAR LOCUST."

Perhaps no known insect has more interest connected with it than the one above named. The life-period of none other approaches it in length. Although its remarkably long life is doubted by many, yet no scientific fact has been better established than that from the time its eggs are deposited in the slits made in the twigs of trees, to that in which the perfect insect is developed from the eggs and appears abroad, soon to deposit its eggs, seventeen years (less about one month) will have intervened.

In some localities in the United States the periodical Cicada (usually but improperly known as the seventeen-year locust) appears at shorter intervals than this — in four or six or other number of years; but these are of other broods which extend over certain localities of greater or less extent, but each one always true to its appointed time of seventeen years. The only exception to this is, that in some of the Southern States, a race occurs, indistinguishable in appearance from the others, but the several broods of which appear every thirteen years.

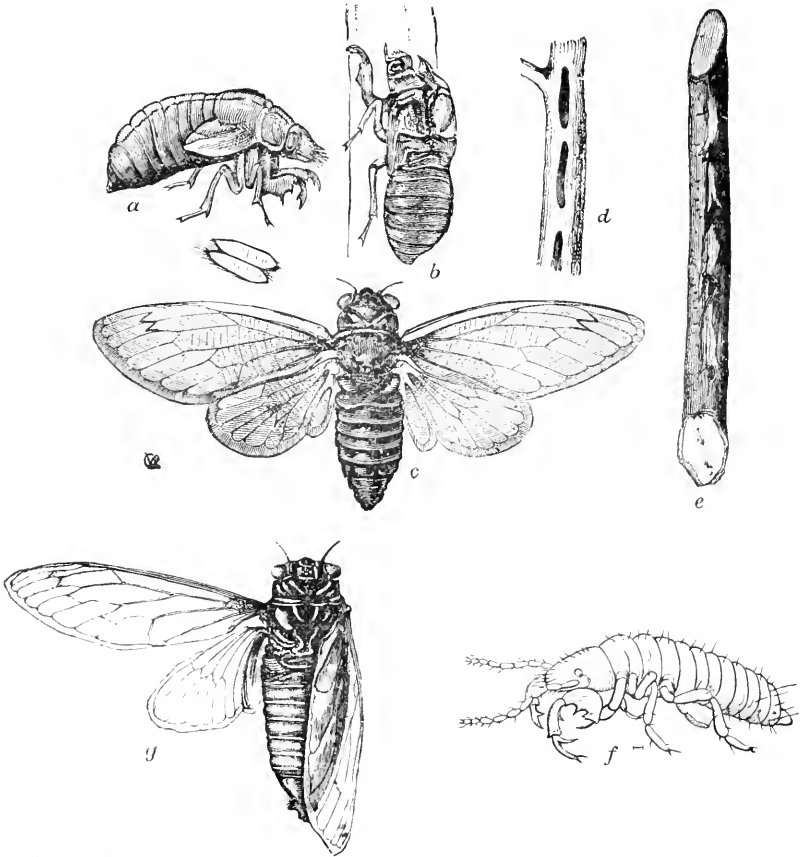
In the State of New York, six distinct broods of the seventeen-year cicada are known. The one that is with us at the present time, and of which the first insects made their appearance about the 25th of May, has been designated as the Hudson river valley brood. Dr. Fitch, who was the first to indicate its boundary, states, in his *First Report on the Insects of New York*: "Its northern limit is in the vicinity of Schuylerville and Fort Miller [Saratoga and Washington counties], and thence reaches south along both sides of the Hudson to its mouth, where it extends east at least to New Haven in Connecticut, and west across the north part of New Jersey and into Pennsylvania."

How far inward in each direction from the river this brood extends is not known, nor whether in any instance it reaches the outer limits of any of the twelve eastern river counties. Definite knowledge of its range would be of interest and of use, and would aid in mapping the infested region. Such a map, made from sufficient data, would serve to show in subsequent returns, whether the successive broods are lessening, both in the number of insects and in the territory occupied by them, as is generally believed.

Most persons who can recall a "locust year," are familiar with the appearance of the insect in its pupal and winged stages; but as aid to

its recognition by those not acquainted with it, the following figures are given:

At *a* the *pupa* is shown. This is the form that the larva assumes as it approaches maturity in its sixteenth or seventeenth year, and is that in which it comes out of the ground in May or June and climbs up and fastens itself by its sharp claws to the trunk of a tree, shrub, fence or some other convenient upright object. In a short time the pupa-case (the outer horny covering of the pupa) splits on its back and the mature insect (in a white color at first) comes out of it, leaving it as seen at *b*. When the wings have expanded and dried and the insect has changed to its natural colors of red eyes and red veins



of the wings, it is ready for flight, as represented at *c*. At *d* is intended to be shown the slits bored into the twigs for its eggs (two

eggs enlarged are figured underneath the pupa), but their peculiar appearance, as made by repeated thrusts of the ovipositor, is more correctly given at *e*. A greatly magnified figure of the young cicada (the larva) just as it hatches from the egg and drops from the tree to enter the ground and feed on the sap of the rootlets is given at *f*. Figure *g* is another representation of the winged insect, in which one of the wings has its natural position when at rest.

The pupa comes from the ground through a smooth round hole extending some distance downward, of the diameter of the tip of a man's little finger.

A remarkable departure from this usual habit has come to our notice this year at a locality in New Baltimore, N. Y., sixteen miles south of Albany, where, at least as early as the last week in April, the pupæ had brought up from apparently a considerable depth, masses of a soft clay-like material and moulded it above ground into rudely conical or cylindrical structures, for their temporary occupancy, it is supposed. The ground was almost covered with them. In places twenty-five could be counted to the square foot. They inclined at a considerable angle from the perpendicular and measured from two to three and a half inches in height. The chamber within was uniform in diameter with the hole in the ground. Figures *h* and *i*, taken from photographs on wood made for the *Country Gentleman*, are of about two-thirds the natural size. The pupa, when its full time has come, breaks a round opening through the upper part of the chamber for its escape.

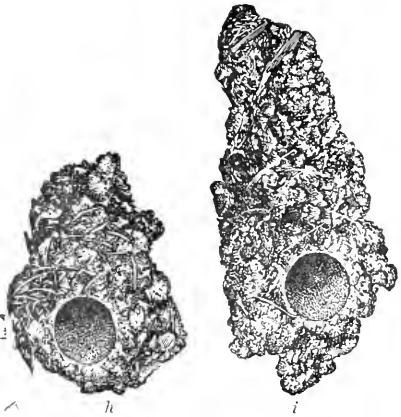


FIG. 15 — Clay buildings of the seventeen-year cicada.

It is not known when they were built or how they were made. Why they were constructed by all of the insects in this locality and not elsewhere is a mystery full of interest and for which no satisfactory conjecture can be offered. Only two other instances of their occurrence in former years have been given by writers, and only one specimen up to the present is known in any collection — in that of the National Museum at Washington, deposited there about twenty-five years ago.

The purpose of the present circular is to obtain all the information of this interesting insect that can be secured during the remainder of

its brief stay with us. It will disappear gradually during the early part of July without, it is believed, having been the occasion of any special harm. Unlike the devastating locusts, its injuries are seldom serious except to young fruit-trees and in nurseries.

Replies are requested from all whom this circular may reach to as many of the questions proposed below as can be conveniently given. Any other notes of interest would be acceptable. Even a few words on a postal card giving locality or abundance or other item might prove of special value.

1. At what place was the Cicada seen? Locate it so that it can be indicated on a map.
2. When was it first seen — in May, or not until early June?
3. What was its comparative abundance — few, many, very abundant, or “millions”?
4. How abundant compared with the 1877 appearance?
5. Were holes seen in the ground from whence they came? Statements sometimes represent the ground as “honey-combed” by them.
6. Were any of the clay or mud above ground houses seen? Ground burned over in the early spring might be examined for them.
7. When were their peculiar noises or “screeching” first heard?
8. When were their first egg-deposits in the twigs seen?
9. Do the slitted twigs show wilted leaves and break, and later fall to the ground?
10. Has any particular injury been done to fruit-trees or grape-vines?
11. In what trees, shrubs, or plants have the egg-deposits been seen?
12. Is any instance of its “stinging” a person known? A painful or harmful sting from it is not credited.
13. Does the English sparrow feed on it, and if so, to what extent?
14. What birds or mammals have been seen to eat it?
15. What insect attack on it has been observed?
16. Do many of the old males, when the body is broken open, show a dry, powdery, brownish fungus attack?
17. Of the two distinct forms of the Cicada — variety *Cassinii* being about two thirds the size of the other and the rings of its body beneath being without the orange border — are many of *Cassinii* seen? Or, a number of specimens taken as they come to hand, might be sent to me for identification.
18. Has the noise or cry of the insect (made only by the male) been heard later than July 1st?
19. How late in July were any of the insects seen?

20. Has it failed to appear in any locality where it occurred in 1877? In answer to any of the above, the question may be indicated by the number prefixed to it.

J. A. LINTNER,
State Entomologist.

ALBANY, June 13, 1894.

Nearly a thousand copies of the above circular were distributed, but, with the usual result that attends such inquiries, comparatively few replies were received — less than one hundred. It is strange that when so simple a task is asked for as a few words upon a postal card, that so few persons are disposed to comply with the request, but negligently withhold what might be an important contribution to science.

The answers returned to question 1, gave insufficient data for the preparation of the map proposed, to show the portions of the Hudson river counties occupied by the insect, but much interesting and valuable information upon other points was obtained which will be put in form for as early publication as is possible.

A number of photographs were secured of the pupal buildings thickly dotting the ground at the New Baltimore locality, and of others, illustrating various forms and conditions from specimens placed in the State Museum Collection, from other localities in the State where the buildings were also found.

Psylla pyricola (Foerster).

The Pear-Tree Psylla.

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

In writing of the distribution of *Psylla pyricola*, in the preceding report (Ninth, for 1892), it was stated that the insect had been studied in Central New York by Mr. M. V. Slingerland, at Ithaca, Tompkins county, but "in Western New York it must occur sparingly if at all," for reasons stated.

Its Occurrence in Western New York.

Since then, two notices of its presence in western counties have come to my knowledge. Mr. Sherman Williams, of Bluff Point, Yates county, has written that about one hundred of his pear-trees, twelve years old, showed attack in 1891, of what he now recognizes as the pear-tree Psylla. The blossoms dropped and the blackened leaves

covered with the "honey-dew" drew numbers of wasps to feed upon the sweet substance. None of the trees were killed but many presented an unhealthy appearance. The attack was not renewed in 1892.

Mr. John H. Brown, of Mt. Morris, Livingston county, sends the information that he has had the *Psylla* with him during the past ten years. The blackened leaves and the honey-dew indicated the attack. It had been more severe during the two years past, in which time it had killed a hundred of his trees.

In Eastern New York.

In Eastern New York the *Psylla* was reported as unusually abundant and injurious in orchards of Mr. M. Brooks, in Athens, Greene county, in 1893, preferring the Bartlett and Anjou to the other varieties. It does not appear to have been numerous in most of the localities where reported in former years.

Remarkable Abundance of Aphides or Plant-Lice in 1893.

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

The early spring did not bring to notice, either through personal observation or that of my correspondents, the usual number of injurious insects. The earliest to claim attention were the aphides, or plant-lice -- more or less abundant every year, but in some seasons becoming very numerous and correspondingly destructive.

The opening of the apple-tree buds in early May was attended with such an unusual abundance of the apple-tree aphid, *Aphis mali* Fabr., as to excite apprehension of their effect upon the coming fruit crop. Many letters were sent to me in relation to them. The necessity of preventing their increase by spraying was urged on my correspondents, unless a heavy and continued rain should occur before they would be sheltered by the leaves -- say within ten days or a fortnight after their hatching. Mr. C. C. Risley, Chairman of the Executive Committee of the Hop Growers' Association, of New York, writing under date of May 9th, stated that hop-growers were reporting large numbers of plant-lice on the buds and blossoms of fruit-trees and on rose-bushes, recalling the conditions existing in the spring of 1886, in which year the hop crop of the State of New York was almost wholly destroyed

by the hop-vine aphid. This year the fruit-trees seemed even more infested than they were at that time. He especially wished to know what significance, if any, this might have with respect to hop injuries the present year.

Answer was made that the past winter had apparently been very favorable for the protection and preservation of aphid eggs, and unless the young, recently hatched or now hatching, could be speedily destroyed by a heavy rainfall, which, at this stage of their existence, is so fatal to them, we would, in all probability, find the present year characterized by an abundance of aphides equal to that of 1886. It was, therefore, recommended that, if natural causes did not intervene to prevent this multiplication, the hop-growers, on the first appearance of the insect in their yards, should proceed to kill them by proper spraying before they could produce new generations and extend over the entire yards. Directions for spraying with kerosene emulsion — perhaps the best insecticide for use against this insect — and how to make the emulsion, accompanied the letter.

In response to a request from the editor of the *American Farmer*, for information for the benefit of its readers in regard to the multiplication of plant-lice as reported from New York, the following communication was made and published in the issue of that journal for June 1, 1893:

“The remarkable abundance of these destructive little pests on the opening buds and tender leaves of fruit-trees in the State of New York this spring is exciting a great deal of interest and considerable apprehension among fruit-growers. The apple-tree has been particularly infested, the insect occurring on it, the *Aphis mali*, being one that multiplies under favoring conditions in excessive numbers, entirely covering twigs and standing one on another, and sucking out all the sap until the parts attacked are blighted.

“From some portions of the State, reports have reached me of the opening buds of apple-trees being literally covered with these plant-lice, or aphides as they are scientifically known. As the reports have come from eastern, central, and northern counties, it would appear as if the condition was general throughout the State. Whether it also extends into adjoining and other States is as yet unknown to me.

“To inquiries made of the probable effect of this attack on the coming fruit crops, I have replied that it was unusually severe, and apparently exceeded anything that we had experienced since the year 1886, when the superabundance of plant-lice of different species inflicted serious losses, and the hop-vine aphid almost destroyed the hop crop of

the State of New York. It was, therefore, desirable that fruit-growers should spray their trees at once with kerosene emulsion, strong soap suds, or tobacco water, and not wait until the aphides have greatly multiplied and found shelter within the curled leaves where the insecticide could not reach them. A long, cold rain following in a week or ten days the appearance of the insect, would probably be quite as beneficial as the spraying recommended, if we could judge from observations in preceding years, but, of course, this providential aid could not be counted upon.

“Since then we have had throughout the State heavy rains, continuing with more or less intermission, amounting to from two to three inches of fall. It was not a cold rain, however, and judging from a few reports since received (I have not been able to make personal observations), it failed to prove very efficient in the desired direction, for the apple aphid is said to be about as abundant as before.

“Our hop-growers also are feeling considerable anxiety, for the same conditions that favor an unusual number of the apple aphid would naturally tend to the multiplication of the hop-vine aphid, as was so markedly illustrated in 1886.

“The hop-growers have, therefore, been advised to keep close watch for the first appearance of the hop aphid on the upper leaves of the outer rows of their hop yards. They will probably be seen there about the last of May or the first of June as full-grown, winged females, which have just flown from neighboring plum-trees, where the winter had been passed in the egg and the early spring as wingless females. If these, the mothers and progenitors of a number of successive broods through the summer, are killed at this time by proper spraying with suitable insecticides — in the proportion that they are destroyed, will subsequent injury to the crop be prevented.

“It is said that in England the hop growers do not attempt to grow a hop crop without their regular ‘hop washings,’ which we call spraying.”

[Mr. C. C. Risley, under date of June 5th, reported that the aphid was at that time to be found in several of the yards in the vicinity of Waterville, not only on the outer rows, but also in the central part of the fields — an unusual occurrence for so early in the season. Soon after (June 7th), Mr. Risley sent, as illustrating the abundance of the aphid, a small hop-vine leaf of not more than one-fourth of an inch in area, having upon it twenty-five of the winged migrants from plum trees. Still later, Mr. Turnboul, of Glen, estimated that, assuming an average in former years of twenty-five of the winged migrants on a

large leaf, the average number this year would be two hundred and fifty.]

Reports of unusual abundance of aphides on fruit-trees came from the following counties, indicating that they were not confined to any particular part of the State: Westchester (on apple and cherry in June), Dutchess, Schoharie (buds literally covered in June), Schenectady, Chenango (on apples and pears in May), Oneida and Onondaga in May, Madison, Oswego, and Chautauqua.

Of the hop vine aphid, *Phorodon humuli*, the most severe injury seems to have been caused in the southern part of Dutchess county, where hop yards were entirely stripped, save here and there a blackened, perforated leaf of a new shoot. Nothing was done to stop the ravages of the insect; so quickly did it do its work that it was almost done before it was discovered. The crop is an entire failure (*New York State Weather Crop Bulletin*, July 8, 1893). In Madison county the destruction of the crop was threatened in early July, but a more favorable condition was reported later. Spraying was resorted to in several of the counties—in Franklin and others—with gratifying results (*Report of the Entomologist to the Regents of the University of the State of New York for the year 1893*).

Are Aphides Eaten by Spiders?

Mr. Charles A. Green has sent, with inquiry of its correctness, the following published statement of D. C. Keller: "Spiders protect fruit-trees from aphides. I have fed spiders in captivity, and have found aphides to be their natural food."

That spiders feed on aphides has never come under my observation, nor do I remember any record of such habit.

The utility of spiders in the destruction of aphides could alone be established by reliable observations made under natural conditions. The fact of spiders in captivity, in the absence of other food, feeding on plant-lice would be of no economic importance. We would expect them to do so, as well as to prey upon any other small insects furnished them.

It is not possible that plant-lice can be the natural food of spiders, or the fact would have been observed and reported over and over again during the close studies that have been made of these pests of our gardens and orchards and grain fields. They find their natural enemies in the lady-bugs and their larvæ (*Coccinellide*), and in species of the lace-winged fly (*Chrysopa*). If the plant-lice abounded on forest trees,

then their natural enemies would be sure to find them out promptly, and not leave them to be discovered and destroyed by spiders.

We may safely conclude that spiders are of inappreciable service to us in the war we are compelled to wage against the aphides. We would gladly welcome them as allies in this contest, if there was any evidence of their service. That some of them may feed at times on some of the smaller Hemiptera would appear from the following:

In the *Entomologist*, London, for July, 1894, Prof. T. D. A. Cockerell, of the New Mexico Agricultural Experiment Station, has recorded his finding a little Attid spider in some numbers on a grapevine in Las Cruces, N. M., to the foliage of which a small leaf-hopper of the genus *Typhlocyba* was quite injurious. Although the spider was not observed actually preying upon the leaf-hopper, Prof. Cockerell entertained no doubt that it fed upon it.

The *Attidae* are known as "jumping spiders." They spin no web, but capture their prey by leaping upon it, either from ambush or by approaching under cover until sufficiently near for the leap.

The *Typhlocibina* belong to the Hemiptera, and some of the species do not exceed the *Aphididae* in size.

Pentatoma juniperina (Linn.).

The Juniper Plant-bug.

(Ord. HEMIPTERA : Subord. HETEROPTERA : Fam. PENTATOMIDÆ.)

LINNÆUS: Systema Naturæ, i, pars ii, 1767, p. 722, no. 48 (original description as *Cimex juniperinus*).

AMYOT-SERVILLE: Hist. Nat. des Insectes — Hémiptères, 1843, p. 132 (brief description).

GLOVER: "Manuscript Notes from My Journal. Order Hemiptera," 1876, pl. 7, f. 21, p. 57 (listed).

PROVANCHER: Petite Fauna Entomologique du Canada — Hémiptères, iii, 1886, pp. 41-2, pl. i, f. 4 (as *Lioderma ligata*).

SAUNDERS: Hemiptera Heteroptera of the British Islands, 1892, pp. 28-29 (description).

VAN DUZEE: List of Hemiptera of Buffalo and Vicinity; in Bull. Buff. Soc. Nat. Hist., v, 1894, p. 171 (food-plants).

A correspondent at Brockport, N. Y., has sent me (June 14) several examples of a plant-bug which he states had nearly destroyed his crop of peaches in 1892, by puncturing them and sucking their juices until they became rough and pithy and entirely worthless.

What the Insect Is.

The insect is one of the numerous species of "plant-bugs," as they are commonly called (sometimes also known as "stink-bugs," from their disgusting odor), which take their food by suction, and are quite injurious to many crops. This is a large green form, measuring one-half inch long by three-tenths of an inch broad. It is suboval in outline, being destitute of the prominent prothoracic lateral angles characterizing most of the family of *Pentatomidae*, to which it belongs. Fig. 16 represents it in

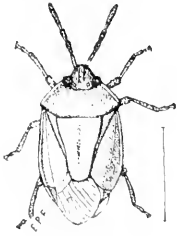


FIG. 16 — Juniper plant-bug, about twice its natural size. It is an European species and was described by Linnæus in his *Systema Nature*, as *Cimex juniperinus*. It is now known as *Pentatoma juniperina*.*

Its Description.

The following description of it is from "The Hemiptera Heteroptera of the British Islands," by Edward Saunders:

Convex, bright olive-green, margin of pronotum and of the base of the elytra pale. Head punctured, antennæ darker toward the apex; pronotum very closely punctured, its lateral margins narrowly raised and ochreous, slightly rounded, posterior angles simple; scutellum and elytra closely punctured, the former slightly wrinkled transversely and with the apex pale, the latter with the lateral margins at the base narrowly rufescent; legs concolorous with the upper surface. Length 12-13 mm.

Three localities in England named: on Junipers. (Rare.)

Its Occurrence in Europe.

Amyot et Serville describe it briefly,† giving its European synonymy with its distribution as follows: "It inhabits particularly the north of Europe: it is extremely rare in the vicinity of Paris. M. Rambur and Carreno have taken it on the juniper at Fontainebleau."

American Distribution.

Nothing seems to have been published of the habits of this insect in this country, and even its name has been seldom recorded. Yet it appears to have a wide distribution, Mr. Uhler having had it from Colorado. Mr. E. P. Van Duzee lists it as "occasional on various trees and bushes, especially on willows and junipers, from May to

* Determined by Mr. P. R. Uhler.—not given in his Check-list of the Hemiptera-Heteroptera, of 1836.

† *Histoire Naturelle des Insectes.—Hémiptères*, 1843, page 132.

October: young in July and August." Provancher has figured "*Pentatoma juniperina* Linn." in explanation of a plate, but in the text refers to it as *Lioderma ligata* Say—"a very common species found everywhere in fields and gardens," further remarking of it: "Confounded by several authors with *Pentatoma juniperina* of Linné, but differing from it in several of its characters." Mr. Glover, in his "Manuscript Notes from my Journal—order Hemiptera," 1876, pl. 7. fig. 21, has given a fairly good figure of it.

Habits of the Family.

The *Pentatomide* are both phytophagous and carnivorous, sucking the juices of the leaves and twigs of shrubs and trees, and of caterpillars and other insects which they puncture with their beak and speedily kill by extracting their fluids.

Remedy, if Abundant.

P. juniperina is probably too rare a species to become a serious fruit pest. Its numbers at Brockport must have been an exceptional occurrence. In such instances, probably an effective method of dealing with it would be to jar them from the branches while young and before the fruit has attained a large size upon sheets spread underneath, from which they may be shaken into vessels of water and kerosene.

Leptocoris trivittatus (Say).

The Box-elder Plant-bug.

(Ord. HEMIPTERA: Subord. HETEROPTERA: Fam. COREIDÆ.)

SAY: in Journ. Acad. Nat. Sci. Phila., iv, 1825, p. 322 (original description, as *Lygæus trivittatus*); Compl. Writ., Lec. Edit., ii, 1883, p. 246.

STAL: Enum. Hemipt., i, 1870, p. 226 (in Missouri, Mexico).

UHLER: List Hemipt. West Miss. Riv. (Separata), 1876, p. 35; the same, in Bull. U. S. G.-G. Surv. Terr., i, no. 5, 1876, p. 301 (distribution); in id., iii, no. 2, 1877, p. 408 (in Arizona, Colorado, and Utah); Ch. List Hemipt. N. A., 1886, p. 13, no. 606.

GLOVER: MS. Notes Journ.—Hemipt., 1876, p. 43, pl. 4, fig. 24 (cites Say).

POPENOE: in Am. Ent., iii, 1880, p. 162 (habits and appearance); in Industrialist, v, no. 47, 1880 (habits and remedies); id., vi, no. 31, 1881 (habits); in 3rd Bien. Rept. Kans. St. Bd. Agr. for 1881-82, 1883, pp. 612-613 (general account, as *Lygæus trivittatus*); in 1st Ann. Rept. Kans. Expt. Sta. for 1888, 1889, pp. 220-225 (extended account with plate); the same, in Industrialist, xiv, 1889, p. 101.

DISTANT: in Biologia Centrali-Americana: Rhynchota, 1882, p. 172 (North America, Mexico).

- RILEY: in Bull. 12 Div. Entomol.—U. S. Dept. Agr., 1886, p. 41, pl. 1, fig. 5 (injuring apples in Utah; remedies).
- LINTNER: in Count. Gent., lii, 1887, p. 69 (description, habits, remedies; brief); 4th Rept. Ins. N. Y., 1888, pp. 156-158, fig. 64 (description, food habits, distribution, etc.), p. 193 (abstract of notice); in Count. Gent., lix, 1894, p. 699 (in Iowa, and remarks on), p. 841 (in N. Dakota); in id., lx, 1895, p. 786 (in Eastern Iowa).
- BRUNER: in Nebraska Farmer, Nov. 8, 1888 (brief notice; the same, in Bull. 5 Nebr. Agr. Expt. Sta., 1889, pp. 36-37, fig. 19); Bull. 14 do., 1890, pp. 126-130, figs. 87, 88, (habits, description from Popenoe, enemies).
- GILLETTE: in Prairie Farmer, lxi, 1889, p. 833 (in So. Dakota; brief notice).
- RILEY-HOWARD: in Insect Life, i, 1889, p. 325 (in Utah and Nebr.); in do., iii, 1890, p. 72-73 (on box-elder in Kans.); in do., iv, 1892, p. 273 (injurious to fruits in the State of Washington); in do., vi, 1894, p. 328 (in houses in Wash. State).
- KELLOGG: Com. Inj. Ins. Kans., 1892, pp. 99, 100 (life-history, description, habits, Kansas notes).
- WEED: Insects and Insecticides, 1891, pp. 145-147, fig. 78 (food-plants, habits, remedies).
- OSBORN: in Proc. Iowa Acad. Sci., i, 1892, p. 122 (in list of Iowa Hemiptera, as *Leptocoris*).
- FLETCHER: in Naturaliste Canadian, xxi, 1894, p. 192 (common in Manitoba and the Northwest).
- GILLETTE-BAKER: Bull. 31 Col. Agr. Expt. Stat., 1895, p. 21 (localities, etc.).
- COCKERELL: Bull. 15 New Mex. Agr. Expt. Stat., Jan., 1895, p. 75 (in the Middle Valley of New Mexico).
- LUGGER: 1st Rept. Entomol. Minn. Agr. Expt. St., 1896, pp. 108-111, pl. 13 (habits, etc., as *Leptocoris trivittata*).

Although this insect is not a member of the insect fauna of the State of New York — if we may judge from the progress that it is making in this direction, steadily, although not as rapidly as that of another southern allied form, *Murgantia histrionica* — not many years will elapse before its unwelcome presence will be announced in the Middle and Eastern States.

Its Northward Spread.

At the time of the notice of this insect in my 4th Report above cited, it had not been recorded north of Missouri. In 1891 it was reported from the State of Washington, in Columbia and Garfield counties, in the southeastern corner of the State, near Idaho, in latitude 46°, where it had appeared the preceding year, and was now destroying large quantities of plums, peaches, apples, and some grapes. The same year Prof. Osborn catalogued it among the Hemiptera of Iowa, as common in the western part of the State. Soon thereafter it had

increased to such extent as to appear in myriads in some localities and command popular attention, as appears from the following extract from a communication to the *Country Gentleman* of September 27, 1894, written from Shenandoah, a city in the southwestern part of the State:

While rambling along the city sidewalks I noticed an insect the like of which I never saw before. It was in all stages of existence and of all sizes. The immature bug was of a lively red color, while the mature form was from one-half to three-fourths of an inch in length. Its wing-cases were divided into two equal sections by lines; the forward portion was heart-shaped, and the bug in shape reminded me of the potato-bug (*Cantharides*). The fore-half was a dusty black color, the after-half deep black. In the brief space of time that I had for investigation I found that it fed on fruit, especially plums, which it tapped, sucking the juice. It is also a cannibal, for I saw them eating one another. The smaller ones will bite a person on provocation. They are quick in their movements, hiding at once on the approach of man. I was told that it was supposed to have been brought from the West in fruit four years ago. It is a pest, having increased at an alarming rate. I should like very much to know what it is, and whether it is likely to become a dangerous nuisance. So far as yet known, its area is limited.

Although no examples were sent for identification, from the characters given by the correspondent, there could be no question of its being the box-elder plant-bug. When mature and provided with wings, it is one-half inch long by two-tenths inch broad, flattened above, and of an elongate-oval form. The terminal leathery portion of the wing-covers are red-bordered on their outer and hind margins. Its thorax is red on its outer sides, with

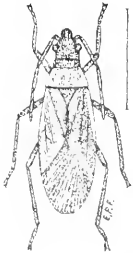


FIG 17.—The box-elder plant-bug. *LEPTOCORIS TRIVITTATUS*. (Original)

a narrower central longitudinal line of the same color. The lower side of the body is red, in places. Its original description by Say, is given in the *Fourth Rept. Ins. N. Y.*, cited.

Not Entirely a Plant-Bug.

The statement above made that this bug is cannibalistic is interesting, as probably the first time that it has been observed. It is not at all probable, however, that its feeding upon one another is practised to any great extent, for if such was its established habit, its immense assemblages without the visible presence of a food-supply (as in the instance to be given below), would not be so frequently seen. That it will, also, inflict a wound under provocation, is also of interest. That it will bite even without provocation, has been stated of it, as in *Insect Life*, vi, p. 328: "We have previously heard unsubstantiated rumors

that the insect will enter beds and bite human beings," when in its adult stage it had sought the warmth and shelter of dwellings (Riley-Howard). One of these rumors is probably the following, from a gentleman in Columbia county, Washington: "These bugs are a tolerable make-shift for bed-bugs when young, crawling into beds and biting quite sharply" (*Insect Life*, iv, p. 273).

The proboscis of this insect, while certainly a formidable weapon, is not correctly represented in the figure given in my 4th Report. It is there shown in an extended position, which it is doubtful if it ever assumes (at rest it is folded appressed to the body beneath), and of a length equal to one-half of the insect, including the wing-covers, while its true length scarcely exceeds the one-third.

Its Abundance in North Dakota.

The present year (1894), the insect has been found in such immense numbers in North Dakota as to excite unusual interest. A gentleman writing October 29th, from Jamestown, N. D. (N. Lat. 47°), on the Northern Pacific Railroad, gives several particulars which add to our knowledge of its life-history and habits which are worthy of transcription.

A strange insect has made its appearance in this locality in large numbers, and has been the occasion of much speculation as to its character, habits, and name. It has been seen for many weeks past in myriads in certain localities, and is now met with, as it has made its presence felt for weeks past, in stores, offices, barber-shops, hotels, and on the trees and walks. Where it came from and where and when it will go, are yet unanswered questions. Prof. Waldron, of the State Experiment Station at Fargo, says that it is closely allied to the chinch-bug. * * * He is of the opinion that these bugs came from South America, where most of their allies live.

The insects were first noticed in this portion of the State about the middle of August, at Spiritwood Lake. The bugs were seen in all stages of growth — from the red-coated young to the black-winged adults — hanging in clusters from the limbs and in large numbers on the trunks of the trees. The next instance known of their presence was on September 20th, when thousands of the young were found in the timber at the junction of the Pipestone and James rivers, in this city. Nearly a dozen patches of the young, varying from four or five feet to sixty feet in diameter, were discovered. The wingless larvæ, crimson in color, were several feet deep and formed a writhing mass. A few fully developed bugs were noticed among the young. Thousands were seen on the brush, logs, trees, and stones. The insects, while in the larval state, remained in this locality for about two weeks, and then suddenly disappeared.

The description given in continuation of the above established the identity of "North Dakota's New Bug" with the *Leptocoris trivittatus*.

Its Problematic Food-supply.

No other account that we have had of it has represented it as occurring in such remarkable numbers, massing in such innumerable multitudes and entering buildings of various kinds. It is evidently gregarious, as we are told of its hanging in clusters like bees from the limbs of trees; but the cause of its assembling in so large companies and swarming in stores and other business places cannot be explained. In both cases the food that the young would require for their development would not be procurable, and speedy death would therefore seem to be the natural result of placing them in such positions. As the insect is one of the Hemiptera (belonging to a family next in classification to that in which the notorious chinch-bug has place), it must find its food by means of its piercing and sucking beak in the sap of shrubs, trees, and fruit.

The insect has been given the name of the box-elder plant-bug, from its having been usually found upon that tree, *Negundo aceroides*, one of the common names of which is the ash-leaved maple; but it does not appear to be known if it actually breeds upon it or merely resorts to it for food.

It Reaches the Mississippi River.

In October, 1895 (delayed publication permits this mention), examples of the insect were received by me from McGregor, Iowa, with the statement that they had become so numerous in that vicinity as to be a nuisance to housekeepers, flying or crawling into every open space. This occurrence is an interesting feature in the distribution of the *Leptocoris*, since from the location of McGregor, on the west shore of the Mississippi river, it is highly probable that the insect, through flight or commercial transportation, has already reached the opposite shore and entered Wisconsin and Illinois.

Its Present Known Distribution.

While at first known only as a southern insect, it has now become a western one, since it presumably occurs in each State and Territory west of the Mississippi river, ranging from the river to the Pacific ocean, through Missouri, Kansas, Colorado, Utah, Arizona and California. To the southward, it has been found in New Mexico, and outside of the United States—in Mexico. Northward, it is known in Iowa, Nebraska, North Dakota and Washington. Intermediate States would cover the entire western region.

According to Mr. Fletcher, as quoted by P'Abbé V. A. Huard (*loc. cit.*), "It is very common in all Manitoba and the North-West, on the *Negundo aceroides*. I have found it in abundance at Regina and in the environs of Winnipeg."

Probable Eastern Spread.

It is strange that with its adaptability to such varied degrees of temperatures — from North Dakota and Washington to Mexico — and other even more dissimilar conditions, that it has not extended its range, so far as known, to the eastward of the Mississippi river. Its favorite food-plant — the box-elder — and the only one on which it has been said to breed, is widely distributed over most of the eastern half of the United States.

Its more specific distribution, given by Sargent, is herewith quoted, as of interest in connection with possible future spread of the insect :

Acer Negundo is one of the most widely distributed, and in some parts of the country one of the commonest trees of the North American forest. It occurs on the banks of the Winooski river and of Lake Champlain in Vermont, on the shores of Cayuga lake in New York, in Eastern Pennsylvania, and ranges to Hernando county in Florida, and northwestward to Dog's Head lake in Winnipeg and along the southern branch of the Saskatchewan to the eastern base of the Rocky Mountains; in the United States it is found as far west as the eastern slopes of the Rocky Mountains in Montana, the Wahsatch Mountains in Utah, Western Texas, New Mexico, and Eastern Arizona, extending south along the mountain ranges of Northeastern Mexico. It is comparatively rare in all the region east of the Appalachian Mountains and is much more common in the basin of the Mississippi, being the most abundant and reaching its greatest size in the valleys of the streams which flow into the lower Ohio river. (*Sargent's Silva of North America*, ii, 1891, p. 112.)

Accepting the popular belief that the insect breeds on the box-elder* and that it is or was originally its preferred food-plant, then we may expect that within a few years, perhaps five, it will have reached in Illinois the region drained by the streams flowing into the lower Ohio river, where the *Negundo* finds its best conditions for growth and multiplication, soon thereafter to extend over the entire drainage area of the river, computed at 214,000 square miles, and thence gradually over a large portion of the eastern United States.

From the fondness that this insect has recently shown for ripe fruit, and not always waiting for the ripening, it is hoped that eastern fruit-growers may long be spared from the foreshadowed spread of this pernicious fruit pest and its injuries.

* Mr. A. L. Siler, of Rouch, Utah, in sending examples of the insect to Prof. Riley, in 1885, stated that they were bred on the box-elder shade-trees.

Habits of the Insect.

Prof. Popenoe, of the State Agricultural College of Kansas, has been a close observer of this insect, and was the first writer to call popular attention to it. The account given by him in 1889, in the *Industrialist*, of its habits is apparently so complete that it will be read with interest whenever and wherever the insect displays its gregarious tendency. The article is accompanied by figures illustrating its early stages, and contains recommendations for its destruction, etc., but only the portion relating to its habits is herewith quoted:

The species has been known in this locality for over ten years as a tree pest, appearing at times in great numbers upon the box-elder, and occasionally attacking the ash. During the winter the adults are hidden in sheltered nooks and corners everywhere, but are especially abundant in crevices of stone walls and the angles of stone buildings, on the south sides of which they appear, singly and in clusters, every warm day during the season. As soon as the increasing warmth of spring allows they leave these shelters and seek the trees attacked by them. From the time of their scattering in the spring until the appearance of the first adults after midsummer they are much less conspicuous, and are not likely to be noticed except upon search directly for them. It is at this time, however, that their eggs are laid, and the numerous young are hatching and beginning their work on the trees. After midsummer their gregarious tendency is again manifested in the flocking of the bugs of all sizes and in great numbers in lines up and down the trunks and branches of the trees. Not infrequently they may be seen crowded in a broad line extending from the ground to the secondary branches, the company including larvæ of all sizes, pupæ, and fully matured individuals. This habit persists more or less completely until October and November, or until the trees are bare. During the warm days of Indian summer the bugs fly everywhere, flocking to the warm sides of buildings and entering houses where, though otherwise harmless, they become troublesome through their abundance and through their propensity to fall clumsily into pails of water, crocks of milk and other articles of food left uncovered.

They are principally found, as stated, upon box-elder trees, but observation shows them to be much more general in their selection of food-plants. They feed also on the ash, and I have observed them in abundance sucking the sap from the *Ampelopsis* clinging to the south side of a stone building. Into the greenhouse many make their way during the autumnal flight, and such are specially fortunate; for they find there not only the desired warm shelter, but abundance of food as well. They are not slow to test the qualities of the juices of the plants growing in the house, and we have seen them with beaks inserted in the stems of geraniums, cactuses, lilies, *Coleus*, *Ageratum* and other plants.

Remedies.

Attack from Hemiptera (suctorial insects) are particularly to be dreaded, as they cannot be reached by the arsenites, of which are

several of our best insecticides. Kerosene emulsion would probably be the best application that could be employed when the bugs occur on trees. When assembled on the ground in patches or large areas, as reported from North Dakota, kerosene mixed with water by brisk stirring or, better still, unmixed, could be effectively used for their speedy destruction. Hot water, when convenient, would be a simple remedy. Any one of these applications would be more effective upon the insect in its early stages, before the development of wings has given a degree of protection.

The Grasshopper Plague in Western New York.

(Ord. ORTHOPTERA: Fam. ACRIDIDÆ.)

The injuries from grasshoppers (locusts) in the State of New York noticed in the brief undistributed report for 1893, which were so severe as to have been characterized as a "grasshopper plague," have been followed by similar injuries in 1894. The following notice of it, given to the *Country Gentleman* of October 12, 1893, and in part included in the report above named, will apply, in the main, to the visitation of the present year.

The Rocky Mountain Locust.

It is fortunate for the agricultural interests of the Eastern United States that it is exempt from the ravages of the destructive grasshopper of the West, *Melanoplus spretus*, or the "Rocky Mountain locust," as it is familiarly called, which in years gone by brought fearful losses, suffering, starvation, and death to many families and communities in Kansas, Nebraska, and Iowa. In these three States, with Missouri added, the loss to crops in the year 1874 was estimated at one hundred millions of dollars. It is probable that severe injuries by this particular species will never occur east of the Mississippi river. Its permanent breeding grounds lie far to the westward; and, as in its most extended migrations it has not crossed the Mississippi, there is no fear that it will do so hereafter, now that, thanks to the labors of the United States Entomological Commission, its eastward migrations and its ravages have been virtually brought under control.

In the eastern portion of the United States -- of the more than one hundred species of locust (commonly called grasshoppers) that are known to science, there are, strictly speaking, no migratory ones. The reason of this is obvious; there are no arid regions of elevated, treeless plains

within this limit, of the character of the breeding grounds of the *M. spretus*, the sparse vegetation of which compels the immense broods to take flight as soon as winged, often for hundreds of miles into adjoining States in search of food.

Destructive Locusts of the Eastern United States.

Our two most common species are the *Melanoplus femur-rubrum* (DeGeer) and *Melanoplus atlantis* (Riley)—each having a wide range, extending from Florida into British America and occurring on the Pacific coast. Of the two, the former, known to many under the common name of the “red-legged grasshopper”—is the more frequently met with while feeding in our pastures and meadows; the latter, *M. atlantis*, which has been designated by Dr. Riley as “the lesser migratory locust,” is, at times and in localities, the more destructive, for, as indicated in its popular name, when so abundant as to have devoured everything edible, it takes wing and flies for miles to new feeding-grounds. It has been particularly abundant and destructive in the New England States. Dr. Harris, in his Treatise on the Insects of New England, records of what was undoubtedly this species: “At times, particularly before their final disappearance, they collect in clouds, rise high in the atmosphere, and take extensive flights. I was authentically informed that some persons employed in raising the steeple of the church at Williamstown were, while standing near the vane, covered by them, and saw, at the same time, vast swarms of them flying over their heads.” In Williamson’s History of Maine, quoted by Dr. Harris, it is stated: “In 1743 and 1756 they covered the whole country, and threatened to devour everything green. Indeed, so great was the alarm they occasioned among the people that days of fasting and prayer were appointed.”

In recent times they have committed great ravages in the Merrimac valley in New Hampshire, during the years 1872-1885, and again in 1889, when sixty bushels of the grasshoppers were collected and destroyed from one oat field of three and a half acres, under the stimulus of a State bounty of \$1 per bushel. In collecting them, the sheet-iron coal-oil pan, known as the “hopperdozer,” employed in the Western States against the Rocky Mountain locust, was used.

So serious were the losses sustained that the farmers of the Merrimac valley made application to the United States Department of Agriculture at Washington for such aid as might bring them relief. Dr. Riley was commissioned to make examination, and ascertain what could be done in practically dealing with the pest. His report was

published in the Annual Report of the Department for the year 1883 (pp. 170-180, pl. 2), and as it contains a full discussion of the history, characters, range and life-history, natural enemies of, and remedies (5 pp.) for, the species, it will amply repay perusal, especially by those who may hereafter be called to contend with this voracious insect.

Our Two Most Injurious Species.

Melanoplus femur-rubrum, the red-legged grasshopper, although not known ever to become migratory, from its being the more abundant of the two, is probably chargeable with a greater aggregate amount of injury to gardens, fruit-trees, and crops than the *M. atlantis*. Both of these species belong to the same genus with the Rocky Mountain locust, and resemble it closely in life-history and habits. The three are so much alike in appearance that a close inspection by an ordinary observer would only show that *M. spretus* of the West is the better



FIG. 18— The Rocky Mountain Locust, *M. SPRETUS*.

fitted for long flight by its considerably longer wings. *M. atlantis* was confounded with *M. femur-rubrum* until within less than twenty years

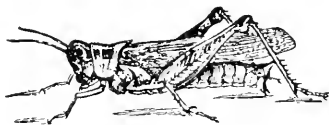


FIG. 19— The Red-Legged Locust, *M. FEMUR-RUBRUM*.

ago; it is hardly separable except by comparison of the last segment of the abdomen. Until lately, and up to the present by some writers, the above three species and their associates have had place in the genus *Caloptenus*.

Operations in New York.

The present year (1894) has been a favorable one for grasshopper multiplication, from the dry weather that has prevailed over a large extent of the country—in one locality in Illinois “not a drop of rain having fallen in three months.”

It is very unusual that occasion arises for complaints of grasshopper injuries to crops in the State of New York, but this year, in its western counties, they have, for the first time in several years, proved to be a

veritable plague. About the middle of July, even while *M. femur-rubrum* was yet in its wingless larval stage, their abundance, and damage caused by them, began to arouse apprehension and alarm. From that time up to the last of August their destructiveness continued to increase, until certain crops were entirely ruined, and of others only a small portion escaped. Fortunately, after a heavy rainfall on the 28th and 29th of August, amounting to over five inches* in some localities, a material diminution in their number was observed.

They appear to have been particularly injurious in the more western counties. Mr. J. A. McCullom, of Niagara county, writing toward the latter part of August, states that most of the crops have been destroyed entirely by the ravenous insects or so damaged as to be worthless. From Erie county it is reported: "Grasshoppers have settled down on this section of Western New York and eaten every green thing in sight. The loss will be very large. Acres on acres which a short time ago were fresh and green with ripening crops are now barren wastes of leafless stalks and branches. At first but little attention was paid to the flying and hopping pests, but as they increased in number hourly, the farmers became alarmed and steps were taken to drive them away. A strong mixture of salt and water was used, but had little effect."

In Chautauqua county fields of oats were stripped of their grain early in August and "garden truck" wholly destroyed, while in Cattaraugus and Allegany counties they were very numerous at the same time. In Wyoming county, after consuming the corn, they began to eat the leaves of the fruit-trees. In Genesee county they were reported as "eating every green thing." In Orleans county "they had never been seen in such numbers before."

Along the southern range of counties they were quite destructive in Steuben (many oat crops were cut prematurely for fodder in order to save it), in Chemung and Tioga. In Central New York they inflicted much damage in Madison county and northeasterly toward the lake shore in Oswego county, where, among others, the cabbage crop suffered severely. In the northern part of the State, as in Franklin county, they were less destructive, but pastures and meadows were reported as suffering from them. Even in the Adirondack Mountains of Essex county they were observed by me in July and August in far greater abundance than I had ever before known them to occur in that region. In walking through the meadows hundreds were continually

* At the stations of the N. Y. State Weather Bureau at Sacketts Harbor and at Watertown in Jefferson county, the rainfall at this time was 5.25 inches and 5.51 inches.

being driven up before me, but no complaint was made of injuries sustained, although they must have been of considerable importance.

Species Chargeable with the Injuries.

As usual in the State of New York a large proportion of the injury committed on the crops this season is chargeable to *M. femur-rubrum* and *M. atlantis*, but in their destructive work they had nearly a score of active assistants in other members of their family, which were also unusually abundant, among which were *Melanoplus femoratus*, *Circotettix verruculosa*, *Camula pellucida*, *Dissosteira carolina* and *Chimarocephala viridifasciata*.

The Present Condition.

With the crops of the year for the most part harvested, comparatively little is being reported at the present of grasshopper injuries; but as the creatures are still existing in force and will continue until the coming of heavy frosts, much apprehension is being entertained that in the absence of other as desirable food they will turn their attention to the winter grain and entirely destroy it. There is reason for this fear and in all probability it will be a consideration with farmers, where the insects still abound, in their usual fall sowing of rye and wheat.

Will the Insects Abound the Coming Year?

This question, of deep interest to many, cannot be definitely answered. When the *M. atlantis* apparently became domiciled in the Merrimac valley in 1872, it continued to ravage the region for several successive years, as before stated, but this may not be accepted as the rule. Annual recurrences of a grasshopper scourge — as with that of the chinch-bug in Illinois and other of the Western States — is dependent largely on seasonal conditions, particularly the occurrence of drouths, on the number of its parasites and predaceous enemies, and on fungus attacks. Each female of *M. femur-rubrum* and *M. atlantis* that survives in a healthful condition until their lives are ended by the frosts of October, will have deposited in the soil about one hundred eggs. Quite a large proportion of these eggs will doubtless be destroyed during the winter or before the time for their hatching in the coming month of May. Those that hatch will be exposed to many enemies and dangers — perhaps so many and potent that any unusual abundance will be prevented. It can only be said, from present knowledge, that in the event of severe drouths again prevailing during the

coming summer, the ravages of this year will probably be repeated, and more disastrously, unless measures shall be taken for their prevention.

To Prevent the Ravages.

The investigations of the Rocky Mountain locust, by the commissioners appointed by Congress to study its life-history and methods for its control, have given us several means by which the injuries of any of our locusts, when occurring abundantly, may be greatly reduced.

1. *Destruction of the eggs.*—The eggs are deposited in masses of about one hundred, cemented in a “pod,” in holes bored by the female, at a depth of about an inch in the ground. Experiment has shown that most of these will be destroyed by harrowing the ground to a moderate depth in the autumn, or in mild winter weather. Rather bare places along roadsides, and even in roadways, seem to be preferred for oviposition.

2. *Plowing under.*—Plowing the infested land in the spring, as the grasshoppers are about hatching, to a depth of from four to six inches, and following this with rolling, has proved a very satisfactory method of killing the young hoppers and those about ready to emerge.

3. *The use of the hopperdozer.*—Whenever the young insects appear in sufficient numbers to warrant it, the “hopperdozer”—a long sheet-iron pan containing tar or kerosene for catching and killing them, as it is drawn over the field—may be effectually used. For its construction and manner of use in the Western States, and in the Merrimac valley of New Hampshire, see the Annual Reports of the U. S. Department of Agriculture.

4. *The bran-mash poison.*—When the above methods have not accomplished their purpose, or all active measures have been neglected until the insects have become winged, the poisoned bait may be resorted to, with every prospect, if we may judge from the testimony borne, of its successful working. The bran-mash recommended by Mr. Coquillet, after its use on the devastating locusts in San Joaquin valley, California, may be made in the following manner: To a washtub or half-barrel about three-fourths full of dry bran, add about five pounds of arsenic and mix thoroughly with a spade or shovel. Dissolve five pounds of sugar in a pail of water, pour it on the bran and arsenic, and stir thoroughly, adding more water until the mash is entirely saturated.

The mash may be distributed in spoonfuls throughout the field, in such quantity as is eaten by the grasshoppers. Mr. Coquillet used a teaspoonful for each tree, shrub, grapevine, or plant infested, at a cost of less than 50 cents for each acre of orchard or vineyard, and as a

result, hardly a living locust could be found a day or two thereafter, while the ground was literally covered with their dead bodies.

To those who have been sufferers from the locusts in New York this year—in the event of a prospect of a recurrence of the visitation another season—it would be well if they write to the Department of Agriculture at Washington, asking to be furnished, if possible, with Bulletin 25 of the Division of Entomology, entitled, “Destructive Locusts,” by C. V. Riley, Ph. D. Its more complete title is: “A Popular Consideration of a Few of the More Injurious Locusts (or ‘Grass-hoppers’) of the United States, together with the Best Means of Destroying Them.” Several of the facts embodied in the above communication have been taken from this publication.

Julus cæruleocinctus Wood.

With Associated Potato-Scab.

(Class MYRIOPODA: Ord. CHILOGNATHA: Fam. JULIDÆ.)

From being nearly allied to insects and at times similarly destructive to important crops, the millepedes, or “thousand-legged worms,” and their operations are frequently brought to the notice of the entomologist.

Boring into Potato Stems.

Mr. D. J. Garth, of Scarsdale, Westchester county, N. Y., has sent a potato plant dug on June 3d, in which most of the stems had been eaten by *Julus cæruleocinctus* from the surface of the ground downward six inches to the seed tuber, burrowing into which were a number of this milleped.



FIG. 20. — Thousand-legged worm, JULUS CÆRULEOCINCTUS Wood.

A similar attack is published in the *Rural New Yorker* for June 22, 1889 (page 416), where the stems were found fallen over and either dead, wilted, or wilting. Investigation showed that a thousand-legged worm was the cause. “In some instances the vine was girdled; in others from one to four of these millepedes were found eating into the stems; in others they had bored into and up the stem. The vines at

length rot about the infested part or become so weakened that they fall over and die. They are attacked always just beneath the soil or from one inch to an inch and a half below. It is learned that potato vines in certain parts of Monmouth county, N. J., are similarly affected."

In all probability the above was also the work of *Julus caeruleo-cinctus*, the most common species in the State of New York.

Infesting Scabby Potatoes.

Mr. Garth has also sent at another time some "scabby" potatoes, containing in cavities several of the same *Julus*. The potatoes had been grown in an orchard about ten years old, which had been in grass for several years and was broken up the preceding year. The soil was good and in lieu of barnyard manure, ground bone and muriate of potash was used for fertilizing. Mr. Garth desired to know the name of the worms and if injurious to crops, how they could be destroyed; and also the cause of the scab.

A Common Pest of Potatoes.

In reply the name was given with the statement that it was a well-known potato pest, frequently found occupying and feeding in cavities of potatoes, as in those received. My "third report" (*Report to the Regents of the University for the Year 1886*) contains a four-page notice of it, in which some serious attacks are recorded, as in one instance where fully one-half of a potato crop in Cooperstown, N. Y., was destroyed. In other of my reports it is charged with eating the interior of corn lying on the ground, roots of geraniums, of cabbage, stems of lilies, etc. As it often occurs in association with scabby potatoes, it has commonly been thought to be one of the causes of the scab, others being other species of millepedes, wire-worms, earth-worms, grubs and mites. The truth, however, is that the diseased potatoes merely offer an attractive feeding-ground to the various forms above named.

Potato Scab Caused by a Fungus.

Dr. Roland Thaxter, in his reports as mycologist to the Connecticut Agricultural Station, has, it is thought, shown beyond all question that the "scab" observed by him and prevalent in this portion of the United States is caused by the attack of a fungus, which he has described and named as *Oospora scabies*.*

* *Report of the Connecticut Agricultural Experiment Station for 1891-1893*, p. 159.

One Form of the Scab may be Caused by Bacteria.

It was believed a few years ago that Prof. Bolley, now of the North Dakota Agricultural Experiment Station, had demonstrated that at least one form of potato scab was produced by bacteria, but later studies favor the idea that the bacteria observed merely accompanied the fungus disease, and that it rarely, if ever, becomes parasitic under mature conditions.

A Potato Scab Caused by Fungus Gnats.

Quite recently the studies of Prof. A. D. Hopkins, Entomologist of the West Virginia Experiment Station, on the connection of species of *Sciara* (small flies) with scabby potatoes and the potato rot, have resulted in his showing that one form of scab may be caused by species of these flies, commonly known as "fungus gnats." He concludes a paper* on the subject read before the Entomological Society of Washington in these words:

While I admit that one or more forms of the so-called potato scab may be due to the action of fungi and that the true potato rot is a fungous disease, I am confident that there are forms heretofore recognized as scab and rot which are not due to fungous disease, but are the direct result of the attack of insects belonging to the family *Mycetophilidae* and to the genera *Sciara* and *Epidapus*.

The species that he found especially instrumental in producing the potato scab blemish was a new and interesting, *Epidapus* which he has described, named and figured as *Epidapus scabies*. The fly is so minute, being only from 1 to 2 mm. in length, that it would escape observation in ordinary examination of potatoes affected with the scab.

How to Prevent Potato Scab.

Replying to the important inquiry of how to prevent the scab, Dr. Thaxter, while not able from the results of his experiments to indicate any remedy for it, has named the following as preventive measures: 1. The seed must be free from scab. 2. Land where scab has prevailed must not be planted to potatoes. 3. Scabby potatoes should not be fed to live stock unless they have been first thoroughly cooked. 4. Use any other fertilizer in preference to barnyard manure. 5. If a crop is found to be infested with scab, dig it as soon as possible in order to stay its increase.

The following treatment, it is claimed, will almost insure a crop against the scab, if planted in soil not already infested. It is known

* Notes on the Habits of Certain *Mycetophilids*, with Descriptions of *Epidapus scabies* sp. nov.

as "the corrosive sublimate treatment" and was proposed by Prof. Bolley, in 1891, in *Bulletin No. 4 of the North Dakota Agricultural Experiment Station*, on "Potato Scab and Possibilities of Prevention." The directions are: Dissolve two ounces of finely pulverized corrosive sublimate in two gallons of hot water and let it stand over night or until all dissolved. Pour it into a barrel containing thirteen gallons of water and allow it to stand for four or five hours, stirring it several times thoroughly. Selecting as fair seed potatoes as possible, wash all the dirt from them and immerse as many as you can in the solution for one hour and a half. Pour off the solution, which may be used several times if needed. After the potatoes are dry, cut and plant as usual, or they may be cut before the treatment if preferred. The corrosive sublimate is a strong *poison* and should be used with care. The solution named is the same as used in surgery and will not injure unless taken into the stomach.

Remedies for Thousand-Legged Worms.

The injuries of the *Julidæ* have long been known and borne without the discovery of any simple remedy or preventive. Where they are very abundant the ground might be treated in the autumn with a liberal coating of gas-lime if obtainable. Salt freely applied broadcast or dropped over each hill after planting should make the tuber or the stalk distasteful to the worm, as it does the roots of young corn to the white grub. Application of soot and water has been recommended by English writers, but it would be difficult to procure it in sufficient quantity for use in large fields. Dr. Smith, Entomologist of New Jersey, has had excellent results in treating infested crops with potash and with kainit. Of the latter he states: "Where potato ground is infested with wire-worm (*Julus*), a heavy dressing with kainit will bring relief;" and of potash — "it is effective against * * * the wire-worms (*Julus*) on potatoes."* Although the quotations leave us in doubt whether wire-worms or *Julidæ* were experimented with, the applications should be equally successful with either, as their habits are much alike. Kainit was found to be the more valuable as an insecticide, especially against wire-worms.

In a communication on "The Thousand-legged Worm," by Dr. Fitch, to the *Country Gentleman* of July 14, 1859, p. 27, it is stated that thousands of a species of *Julus* (not determined) had been destroyed by hot water after they had been drawn to shelter beneath boards laid on the walks in the evening. The boards might prove more effective

* *Annual Report New Jersey Agricultural Station for the Year 1890, 1891, page 436.*

if slices of potatoes or of other vegetables of which they are known to be fond, were placed beneath them to serve as baits.

Curtis in his *Farm Insects*, page 207, among other remedies, recommends strewing old cabbage leaves over a field, in the same way as when slugs are troublesome, and employing children to turn them over and collect the millepedes secreted beneath.

Miss Ormerod states that a species of *Julus*, *J. guttatus*, has a special fondness for mangolds, and where slices had been placed for bait, she had seen them swarming, when removed, with the millepedes crawling over them in all directions. Cotton-cake had also been found to attract them from special crops. "A strong solution of common salt or of nitrate of soda rapidly killed the spotted millepede."

Mites Attacking Mushrooms.

(Class ARACHNIDA: Ord. ACARINA: Fam. ?TROMBIDIDÆ.)

A mushroom-grower, writing from Newburgh, N. Y., who has three thousand square feet of mushroom beds in cellars, asks for a remedy for "the millions of small, reddish crawling lice which attack each 'pin head' as soon as it shows through the soil."

Prolificacy of Mites.

No examples were sent, but with hardly a doubt the little reddish creatures were mites, belonging to the Order of *Acarina*, as no other living forms (unless *Anguillulide*) would occur "in millions" in connection with mushrooms, except the minute and rapidly multiplying acarids. Thus, in an instance recorded by Murray — in a barn on the Imperial farm at Vincennes, where Australian potatoes had been stored, such an immense number of mites had been developed in less than eight days that the soil of the ground was completely covered with a bed of the *Tyroglyphus*, looking like an animated dust, of a gray color, and composed of myriads of millions of these little animals.

An European Mushroom Mite.

It would be of interest to know the particular species that has attacked the pin-head mushrooms of the above inquiry, as it might aid in prescribing the proper remedy. In Europe, *Rhizoglyphus rostriserratus* is very destructive to the cultivated mushrooms, particularly to the common *Agaricus campestris* grown in the vicinity of Paris, but this is described as of a feeble, gray, rusty color; it produces, or is

associated with, a moist black rot, which in less than forty-eight hours reduces the mushrooms to a state of black and deliquescent putrescence.

Probably *Bryobia pratensis*.

It is not improbable that the mites of the Newburg cellar may be the *Bryobia pratensis*, known sometimes as "the clover-mite" from its being often found upon that plant, although frequently met with on other vegetation. It is a common species in the State of New York and many of the other States, and reports are received, from time to time, of its occurrence in dwelling-houses, in conservatories, in roadways and elsewhere. (See account and illustration in the sixth and seventh reports of this series.)

Remedies for Mites.

The best remedy that we have for mites is sulphur. An application, by means of a powder bellows, of the flour of sulphur over the mushroom bed when the "pin-heads" make their appearance, ought not to interfere with their edibility. The experiment might also be made of sublimating sulphur by placing it on the steam pipes, or by burning brimstone. The last-named method has been made very convenient for use under almost any conditions, in the sulphur candles of about a pound weight each, which have lately been put in market for disinfectant purposes, and may be purchased in most drug stores. It is possible, too, that the vapor of bisulphide of carbon might be employed for killing the mites. A small quantity -- an ounce or two of the liquid -- may be placed in an open vessel near the ceiling so that the vapor in descending might diffuse itself over the ground area. The cellar should be closed, and no lamp or light or fire of any kind brought in which might ignite the inflammable vapor.

Caution in Use of Insecticides.

It would be well, before using either the sulphur or the bisulphide of carbon as above suggested, to consult Mr. William Falconer, of Glen Cove, L. I., who is intimately acquainted with mushroom culture in all its phases and an authority on the subject, and his opinion asked as to the possibility of injury to the mushrooms, either in their development or for the table, from the use of the substances named. If it shall be found that they may safely be used, we will have in them convenient and effective methods of ridding mushroom beds not only of mites, but of the larvæ of a small fly and other insect forms that are frequently so detrimental to mushroom culture as to arrest it completely at certain seasons.

Mites Infesting Potatoes.

(Ord. ACARINA: Fams. ACARIDÆ, GAMASIDÆ.)

Some "scabby" potatoes received from Westchester county, N. Y., had large cavities eaten into them, which were nearly filled with "thousand-legged worms," *Julus cœruleocinctus*. Associated with them were hundreds of mites occupying, and apparently feeding in, the cavities excavated by the millepedes. Examples of the mites were sent to Prof. H. Osborn, of the Iowa Agricultural College, who is studying these creatures, for his identification. He returned answer as follows:

Food-habits of *Rhizoglyphus*.

"The specimens I take to be a species of *Rhizoglyphus*, near or identical with the *R. (Tyroglyphus) phylloxere* of Planchon and Riley, the habits of which were recorded as very similar to this — feeding upon the vegetable tissues of the roots infested with *Phylloxera*.

"I have seen examples apparently identical with this, in large numbers, in various vegetables and roots that were injured by insects or in a partial state of decay, and I surmise that they feed mainly, if not entirely, on decaying vegetable matter, although Riley reported them as, when full-grown, preying upon the *Phylloxera*" (*Sixth Report on the Insects of Missouri*, 1874, p. 53).

Associated with Potato Scab.

This mite is identical in appearance with a species of which a photograph was sent me a few years ago by a correspondent in Eastern New York, who claimed, and was very confident, that he had made the discovery that it was the cause of the "potato scab." From this it may be inferred that it is not infrequently an attendant on the scab disease.

Other Mites in Potatoes.

In *Third Report on Insects of New York* I have recorded the appearance of two species of mites in cavities of potatoes associated with *Julus cœruleocinctus*, one of which was *Tropoda Americana* Riley — an occasional parasite of *Julus*, and the other a vegetarian, apparently undescribed, and for which, if it proved to be new, I proposed the name of *Gamasus obovatus*.*

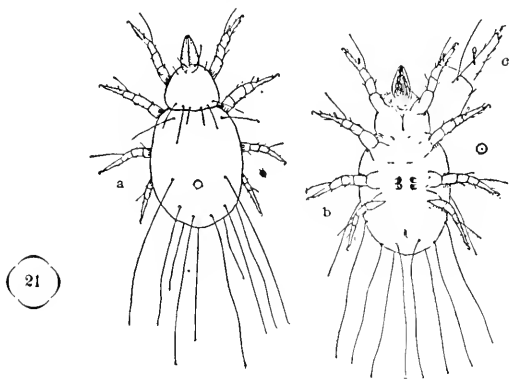
* *Third Report on the Insects of New York* — "Report to the Regents for the Year 1886," 1887, pp. 133, 134.

Tyroglyphus Lintneri Osborn.*A Mushroom-Infesting Mite.*

(Ord. ACARINA: Fam. ACARIDÆ.)

In December, 1892, some mushrooms were sent to me from Jamesport, Suffolk county, Long Island, suffering from an attack of mites. The mites abounded in blackened cavities in both the pileus and stalk. They were white, shining, and long-haired, and were apparently an undescribed species of *Rhizoglyphus*. When submitted to Prof. Herbert Osborn for examination, he found the mite to approach nearly to *Tyroglyphus phylloxera* Riley, but to differ from it in several structural details, and has described it under the name of *Tyroglyphus Lintneri*, in *Science*, xxii, 1893, p. 360, with figures. For convenience of reference, the description and figures and accompanying remarks are herewith given:

Some time ago I received from Prof. J. A. Lintner specimens of a mite which had been found infesting mushrooms quite seriously, and from its habits and the statements concerning its numbers, it is likely to prove a very important pest of this crop. From the literature which is available, it does not appear to be described, and is certainly different from the species described as infesting mushrooms in Europe. It approaches more nearly to the *Tyroglyphus phylloxera* of Riley, but is quite different in many structural details. Since it is likely to prove of importance, it seems desirable to describe it, even though it may possibly prove identical with some of the described European forms.



Tyroglyphus Lintneri n. sp. a, dorsal view; b, ventral view; c, tarsus more enlarged—length shown in circle to right. (From nature, by H. Osborn.)

Description.

Tyroglyphus Lintneri n. sp. The mandibles are large, chelate, strongly toothed, the palpi terminating with a strong hook. The tarsi

hooked with no sucker visible, the last segment long, slender, spiny at tip and on the two anterior pairs bearing a clavate appendage. The hairs are very long, those on the posterior part of the body equal to or greater than the length of the body, and their origin marked by chitinous rings, six located on the posterior portion of the anterior division of the body and standing quite erect, ten on the posterior portion, two at anterior angles, two behind the middle, and others near the margin on the posterior third of the body; abdominal suckers, four, located between the abdominal legs.

This species differs from *T. phylloxera* Riley, particularly in the greater length of the tarsal joints, greater curvature of tarsal claw, and the much greater length of the hairs—those at the end of the abdomen being as long or longer than the body, while those of *phylloxera*, Riley describes as about one-third the diameter of the body. It is also larger than specimens I have determined as *phylloxera*, and the second pair of legs is further back on the body than shown in Riley's figure.

Prof. Osborn found the above species different from the *Tyroglyphus* which I had sent to him occurring in cavities in potatoes (see page 451).

Phytoptus pyri (Scheuten).

Pear-Leaf Blister-Mite.

(Class ARACHNIDA: Ord. ACARINA: Fam. PHYTOPTIDÆ.)

SCHOUTEN: in Wiegman's Archiv., 1857, p. 104 (original description as *Typhlodromus pyri*).

PACKARD: Guide Study Ins., 1869, p. 666 (brief notice, as *T. pyri*).

GLOVER: in Rept. Comm. Agricul. for 1872, 1874, p. 113, fig. 2 (brief notice, as *T. pyri*).

MURRAY: Econom. Entomol.—Aptera [1877], p. 358 (brief account).

BURRILL: in Gard. Monthly and Horticult., xxii, January, 1880 (general account).

RILEY: in Am. Ent., iii, 1880, p. 26 (review of Burrill's account), p. 74 (reference to Glover's account, as *T. pyri*).

GARMAN: in Rept. Ins. Ill., xii, 1883, pp. 125, 134, 140, figs. 24, 25 (Burrill quoted).

OSBORN: Bull. no. 2 Iowa Agr. Coll., 1884, p. 56 (brief account).

CRAWFORD: Rept. on Fusicladium, etc., in Australia, 1886, p. 46 (general account).

OSBORN-UNDERWOOD: in Canad. Entomol., xviii, 1886, p. 12 (listed).

GILLETTE: in Rept. Mich. Hort. Soc. for 1886, 1887, p. 87 (mention).

WEBSTER: in Insect Life, i, 1889, p. 363 (mention); in id., v, 1892, p. 105 (abundant in Ohio); the same, in 23d Ann. Rept. Ent. Soc. Ont., 1892, p. 40; also in Canad. Entomol., xxiv, 1892, p. 207.

- COMSTOCK-SLINGERLAND: Bull. 23 Cornell Agr. Expt. Stat., 1890, pp. 103-107, figs. 1-4 (detailed account).
- LINTNER: in Count. Gent., lv, Oct., 1890, p. 781 (general account); 7th Rept. Ins. N. Y. for 1890, 1891, p. 365 (summary of preceding account); in Insect Life, v, 1892, p. 105 (abundance in Eastern N. Y.); the same, in 23d Ann. Rept. Ent. Soc. Ont., 1892, p. 40; also in Canad. Entomol., xxiv, 1892, p. 207; in Count. Gent., lvii, 1892, p. 504 (remedies); 9th Rept. Ins. N. Y. for 1892, 1893, p. 442 (reference to Count. Gent.); in Count. Gent., lix, 1894, p. 468 (general account).
- FRENCH: Destr. Insects Victoria, 1891, Part 1, p. 119 (general account, col. plate).
- RILEY-HOWARD: in Insect Life, iii, 1891, p. 308 (reference); in do., v, 1892, p. 1 (reference); in do., vii, 1894, p. 278 (on Pacific Coast).
- WEED: Insects and Insecticides, 1891, p. 68 (general account).
- FLETCHER: in Exper. Farms Repts. for 1891, 1892, pp. 198-200, figs. 5, 6 (general account); in 24th Ann. Rept. Fruit-Growers Assoc. of Ont. for 1892, 1893, p. 113; in Ann. Rept. for 1892, p. 146 (mention).
- COBB: in Agr. Gazette N. So. Wales, iii, 1892, pp. 287, 288, fig. 11 (general notice).
- SLINGERLAND: in Insect Life, v, 1892, p. 104 (general account); same in brief in 23d Ann. Rept. Ent. Soc. Ont., 1892, p. 40; also in Can. Ent., xxiv, 1892, p. 207; in Count. Gent., lvii, 1892, p. 629, c. 2 (remedy); in Bull. 61 Cornell Agricul. Expt. Stat., Dec., 1893, pp. 317-328, figs. 1-5; the same in 6th Ann. Rept. id. for 1893, 1894, pp. 321-330, fig. 1-4 (life-history, remedy, bibliography, etc.); in Canad. Entomol., xxvii, 1895, p. 320, in foot-note (*Nalepa writes *Phytoptus pyri* n. sp.*).
- SMITH: in Insect Life, v, 1892, p. 105 (remedies); the same in 23d Ann. Rept. Ent. Soc. Ont., 1892, p. 40; also in Canad. Entomol., xxiv, 1892, p. 207).
- MCCARTHY: Bull. 92 N. Car. Agr. Expt. Stat., 1893, p. 99 (brief notice).
- BETHUNE: in 23d Ann. Rept. Ent. Soc. Ont. for 1892, 1893, p. 9 (spread in Ontario and Maritime provinces).
- ORMEROD: 17th Rept. Inj. Ins. for 1893, 1894, pp. 84-88 (general account); 18th Rept. id. for 1894, 1895, pp. 86-92 (general account).
- ALDRICH: in Insect Life, vii, 1894 p. 202 (in Idaho).
- WASHBURN: in Bull. 33 Oregon Agr. Expt. Stat., 1894, pp. 9-12, 2 figures (attack and remedies).
- COMSTOCKS: Man. Stud. Insects, 1895, pp. 44-45, figs. 52-54 (mite and galls illustrated).

The injury caused to the leaves of pear-trees by this mite has long been known to fruit-growers in this country, but its true cause was not understood, until detected by Prof. Burrill, and, in 1882, recognized as identical with the *Phytoptus pyri* of Europe. The nature of the attack had been known for a number of years earlier, in Europe.

The mite as occupant of the galls had been seen by Dr. Thomas Taylor, microscopist of the U. S. Department of Agriculture, in 1872, as appears from Glover's Report for that year, in which he states:

"In May, many leaves of the pear-tree were observed to be covered by dark-brown blotches somewhat like a fungoid growth, but upon examination by Mr. Taylor, microscopist of the department, these blotches were found to be inhabited by myriads of small mites almost invisible to the naked eye. These mites appear to run all over the leaves, but especially to burrow in the brown patches, which appear to be entirely eaten out by them. Their bodies are long, cylindrical, yellowish-white, with only two pairs of legs placed very far forward toward the head, and they move with considerable agility. They are also marked with a multitude of rings, and have two long hairs or bristles and two shorter ones on the end of the abdomen."

A figure of the mite accompanies the above, and comparison is made with the *Typhlodromus pyri* Schenten, figured by Dr. Packard on plate 10 of his Guide.

Nature of the Attack.

In the early spring, as the buds are unfolding, the leaves may be seen to be studded with small red spots or blotches which, on close examination, show themselves on each side, but more conspicuously on the upper, as slightly thickened areas of the leaf. They soon present a fuzzy appearance when seen under a lens, resembling a particular form of fungus, for which they had been for many years mistaken, it not being then known that they were galls produced by a mite. On the under side of the leaf, a small opening may be seen in each gall through which the mites emerge at their maturity. The galls, at first red, or red on one side and green on the other, soon change to blackish or brown upon the destruction of the cells and tissues of the affected spot. If a section is made of a gall, the two surfaces are seen to be separated by a cavity of disorganized tissue. When the attack is severe, and the galls numerous, they coalesce into patches of various sizes until they cover large areas of the leaf, when the normal action being arrested, the leaf dies and falls to the ground.

The attack at its commencement is usually slight, but under ordinary conditions it spreads rapidly and proves quite injurious if allowed to continue through the season and for successive years. It seems to be extending from orchard to orchard, and is becoming quite widely distributed, not only in New York but throughout the States generally.

How the Attack may be Recognized.

The attack can be recognized by comparison with the features given above and in other publications on it. Its identification must usually depend upon the characters shown in the galls or blisters. The mite producing them, even when traveling on the surface of the leaf, is invisible to the naked eye, and can only be seen with the aid of a high magnifying power. Using an achromatic triplet, when some infested leaves sent to me were carefully examined, three or four of the four-legged, long, white mites could be distinctly seen moving rather rapidly over the surface.

Is the Kieffer Pear Particularly Liable to Attack.

A gentleman writing to the *Country Gentleman* from Haddonfield, N. J., in 1894, makes the following statement:

Enclosed are leaves from Kieffer pear-trees planted in the spring of 1893, and two years old when planted. The trees are vigorous and green, but some of the leaves are shriveled and marked in blotches of a reddish-brown, as the inclosed show. Other leaves on the same branch are healthy. Will you inform me what the trouble is, and how to remedy it? I have two thousand trees of this age and, as far as I can see, the Kieffers are the only ones affected.

Another gentleman, writing from Charlotte, N. C., sends leaves of four-year-old LeConte pear-trees which show a severe attack of the blister galls.

Another correspondent, from Carlton, N. Y., has written: "Find inclosed Bartlett pear twigs and leaves. Can you inform me what the disease is and what causes it, and if there is a remedy for it? There is a dwarf Duchess planted by the side of the Bartlett that does not seem to be affected with this mildew or rust, or whatever it is."

It will probably be found that the mite will attack all or most of the varieties of pear without special preference, such as the pear-midge has shown for the Lawrence pear.

Its infestation of a single tree in an orchard may be the result of its having been accidentally carried to it by the wind or upon a bird or insect, as the San José Scale insect is known to be conveyed. Should the mites fall to the ground with the leaves, they would not probably survive the winter; and it is hardly possible that they would travel from one tree to another unless by contact of interlocking branches.

Characters of the Phytoptidæ.

The *Phytoptidæ*, the family to which the pear-leaf blister-mite belongs, are popularly known as gall-mites from the deformities that

they occasion on the leaves of the plants that they infest. Not all, however, produce galls, some of them living within the buds and arresting their development, while others occasion a singular growth of curled or twisted hairs on the under side of the leaves in which they live. The galls that they produce are of various forms and sizes, but they frequently appear as rounded swellings or pouches on the upper surface of the leaf, with a slit-like opening below, through which the mites may pass in and out. They are to be found upon several of our trees and shrubs and plants, as the maple, ash, the elms, oaks, linden, willows, pear, grapevine, arbor vitæ, verbena, etc.

The artificers and occupants of these galls are very peculiar creatures. They are exceedingly minute — most of them disclosing hardly any form to the naked eye. Some of them are “so small and transparent (as the *Phytoptus* of the ash), that it cannot be seen in the gall at all, and it is only by washing out the galls and searching for them in the water in which they have been washed that it can be known that there have been living creatures there.” Under the microscope they show extraordinary structure. Mites, as a rule, possess four pairs of legs, while these have but two pairs, and for this reason they were for a long time regarded as the undeveloped larvæ of other species of *Acarina*. Their legs are five-jointed, and terminate in a single curved claw and an associated feathered organ. They have a tubular rostrum and a pair of feeble maxillæ, enabling them to feed both by biting and suction; their cylindrical, long, transversely multi-ringed abdomen ends in a sucker capable of being extended and withdrawn.

The *Phytoptidæ* have recently been separated into subfamilies by Dr. Alfred Nalepa, of the Royal and Imperial College, Vienna, as published in the Reports of the Proceedings of the Imperial Academy of Science, of Vienna. His writings have not been seen by me, but quoting from Miss Ormerod's 17th Report, 1894, the main distinctions on which divisions are based, are “on such points as the body being cylindrical, as is generally the case with the genus *Phytoptus*, or the abdomen being the largest immediately behind the thoracic shield, or other variations of form; also on the abdomen being similarly ringed throughout, or the rings broader on the back and narrower below, or other variations.”

The Pear *Phytoptus* — *P. pyri*.

Through the kind permission of Dr. Nalepa, one of the excellent figures with which he has illustrated the mite and its operations, is herewith reproduced.

The fruit-grower will need no further detail of the appearance of the mite to serve for its recognition, than has already been given. The

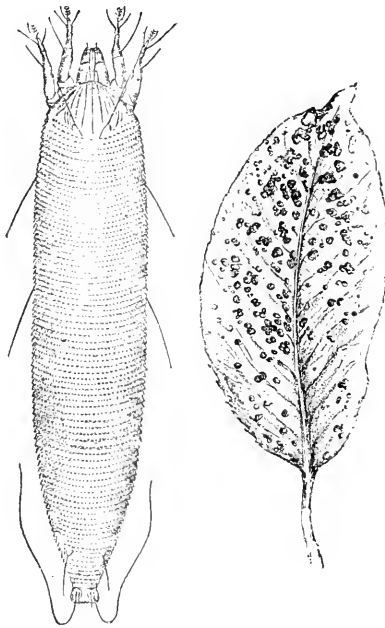


FIG. 22.—The pear-tree blister-mite, *PHYTOPTUS PYRI*, largely magnified; and a leaf showing the blister galls, natural size.

entomological student, in the absence of Dr. Nalepa's paper, may be glad to have the following abridgment of Dr. Nalepa's description, as given by Miss Ormerod, in her 17th Report:

Body cylindrical, 0.2 mm. long, about 5-6 times as long as broad. Thoracic shield very small, semicircular. * * * The proboscis is strong, slightly curved, directed forward, and 0.025 mm. long. The legs are rather weak and short. The holding-claw ("haftklaue") is very small, exceedingly slender, and four-branched. (This is sometimes described as a "feather-bristle.") * * * The abdomen is uniformly ringed (about eight rings), and rather finely punctured.

Remedies.

Most of the mites can be destroyed by applications of sulphur in some form, as the simple flour of sulphur thrown upon the foliage when wet with dew; sulphur, soap, and water mixed; combined with an alkali in the proportion of one pound of sulphur and two pounds of fresh lime boiled in four gallons of water; or, four ounces of sulphuret of lime, purchased at the druggist's, and two ounces of soft soap,

stirred into one gallon of water. The Bordeaux mixture and other similar preparations which are now being extensively employed for fungoid diseases should be efficient in killing various species of mites.

But as the *Phytoptidae* are usually concealed within their galls, they are but slightly amenable to sulphur or other insecticides. Their attacks are ordinarily, for a considerable time at least, quite local, being confined to a single tree, or even to a limb.

If taken at the very commencement of the attack no better remedy can be found than to pick off all of the infested leaves, or remove the infested branches, from time to time, whenever the presence of the blister galls is noticed, and burn them. When there are no conveniences for spraying, trees more generally affected should be heavily pruned in spring or winter for burning.

The best method, however, where proper spraying can be done, for arresting an established attack of this most troublesome pest, has recently been published by Mr. M. V. Slingerland of Cornell University, in an excellent paper on the "Pear-Leaf Blister," contained in Bulletin 61 of the Cornell Agricultural Experiment Station, December, 1893. Careful experiments carried over two seasons have shown Mr. Slingerland that the insect "can be nearly exterminated in a badly infested orchard by a single thorough spraying of the trees in winter with kerosene emulsion diluted with from five to seven parts of water."

This is a valuable discovery, for there need not, hereafter, be any difficulty in arresting attacks which, hitherto, we have been entirely unable to control.

A Peach-Tree *Phytoptus* -- P. ?persicæ.

Dr. Thomas Taylor, of Washington, has given me verbally, the following information: In the year 1872, soon after he had discovered the pear-leaf blister-mite, now known as *Phytoptus pyri*, in association with its galls, and had called Mr. Glover's attention to it (see page 455 of this report), he observed, also, immense numbers of a similar mite, but of only one-half the size, whitening the leaves of a peach-tree, in Washington, and running rapidly over the surface of the leaves. It had but four legs, and in all other particulars gave evidence of being a *Phytoptus*.

Dr. Taylor has not seen the mite from that time to the present. No published record of its observation was made by him or by Mr. Glover to whom it was shown, nor does it appear to have been noticed by any one else in this country.

It is probably identical with *Phytoptus persicæ*, noticed briefly by Murray, in his *Economic Entomology—Aptera*, p. 354, where it is represented as whitening the leaves of peach-trees, at times, in Montreuil, near Paris, as noticed by M. Guérin-Méneville, in 1851, in *Ann. Soc. Ent. France*. The white dust covering the trees gave to the attack the name of "the miller" (le meunier).

A Plum-Tree Phytoptus.

Mr. Slingerland has recently had brought to his notice, a mite inhabiting small, subspherical excrescences encircling the base of buds and shoots of plum twigs received from Industry, Pa. Dr. Riley, several years ago, had examples of probably the same mite sent to him from plum-trees in New York and in Ohio. Mr. Slingerland, in the *Canadian Entomologist*, for December, 1895, has referred the mite to *Phytoptus phleocoptes* Nalepa, and given a figure of the mite and infested twigs.

Undoubtedly a large number of these gall-mites will be discovered in the United States. Professor Garman has indicated fourteen species of *Phytoptus*, of which ten (the other four undescribed) are given in the *Preliminary List of N. A. Acarina*, 1886, of Osborn and Underwood. A large number of *Phytoptus* galls have been observed. So long ago as in 1885, Dr. Hagen, in a paper contained in the February issue of the *Canadian Entomologist*, states, that there are fifty-one American *Phytoptus* galls in the collection of the Museum of Comparative Zoölogy, and that sixty-eight are known from North America, belonging to forty-two species of plants, thirty-three genera and twenty-three families.

APPENDIX.

(A)

THE SCORPION-FLIES.

By E. P. FELT, D. Sc.

(Read in abstract before the American Association for the Advancement of Science, September 3, 1895, at Springfield, Mass.)

The scorpion-flies are to be found more commonly in damp, waste places, where little of value grows and, consequently, their powers for either good or evil are limited by the surroundings. In the larval state they are most probably predaceous and may aid in keeping some of the smaller injurious insects in check. In the imago state the evidence of the predaceous habits of *Panorpa*, the typical scorpion-fly, is not so clear as one might desire, yet there is nothing to prove it injurious.

The scorpion-flies, together with the closely-related genus *Bittacus* and a few other allied forms, were long included in the old order Neuroptera. Within recent years some authors have assigned these insects to a separate order, the Mecoptera, which is placed between the now more limited order Neuroptera and the Lepidoptera. The Mecoptera

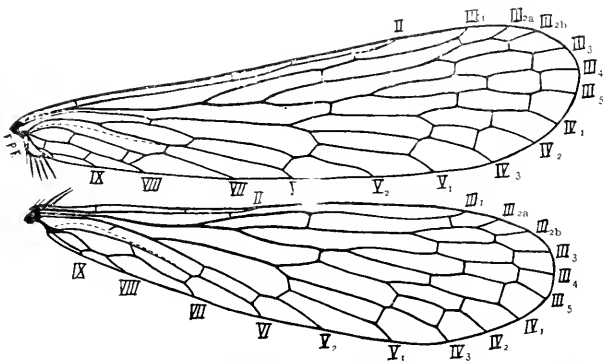


FIG. 23.—Venation of *PANORPA RUFESCENS*. The homology of the veins was determined by Prof. J. H. Comstock
are distinguished by possessing four numerous veined membranous wings (Fig. 23); the head is prolonged into a beak; metamorphosis

complete. The enlarged forceps-like appendages of the male *Panorpa* has led to the popular name of Scorpion-fly for members of this genus (Pls. iii, iv, fig. 12), and it appears that some authors include the genus *Bittacus* under the term "scorpion-flies," though the male appendages have no likeness to those of a scorpion. This is due, most probably, to the lack of a more appropriate common name. Up till 1863 almost nothing was known concerning the life-history of these insects, but, thanks to the most excellent work of Brauer,* the student of the order need no longer labor in the dark. I have failed to find any important contribution to our knowledge of the habits of these insects since his time, and nothing in this line appears to have been done upon the American species.

The breeding and field observations upon which this paper is based were carried on under the direction of the Entomological Department of Cornell University.

Panorpa rufescens Ramb.

This was the most common species of *Panorpa* in the vicinity of Ithaca, N. Y., during the summer of 1895. In 1894 *P. maculosa* Hagen was extremely abundant in the ravines along the shores of Lake Canandaigua, N. Y. These species resemble each other so closely that in the working out of the life-history of one it is quite likely that we have obtained a very good idea of that of the other. They are found in moist woods during July and August, especially along streams and where nettles abound. The markings upon the wings in both species vary considerably not only in extent but also in depth of color, and there is some variation in the smaller veins. The scorpion-flies seem to be no favorites with collectors. This may be due to an indefinable, uncanny appearance, which leads the entomologist to look for more agreeable specimens; or it may be due to the unprepossessing qualities of the mounted insect—it shrivels so badly that it cannot be made to look nicely. Though quite common, these insects are rarely listed.

Appearance and General Habits.

The perfect insect may be seen resting upon a leaf eyeing the intruder critically or else flitting to a safer position. The elevated fore part of the body, the gracefully curved, erect antennæ and the large eyes, together with the long beak (Pl. iv, figs. 4, 5), give this insect a wary look. Though apparently watchful, they are easily taken in a net. When held in the hand, they show their indignation by

* In *Verhandl. der k. k. zool. bot. Gesellschaft*, xiii, 1863, p. 310, Taf. 13, 14.

biting at the confining fingers and exuding from the mouth, grasshopper-like, a dark-colored fluid. The males bear the seventh and following segments of the abdomen curved over the fifth and sixth, so that the enlarged, forceps-like genitalia not infrequently touch the dorsal spine of the sixth abdominal segment (Pl iv, fig. 12).

The males use the genital armor as a weapon; they can pinch harder with the large harpe (Pl iii, fig. 12 h.) than with the mandibles. The mobile, extensible abdomen enables them to use this weapon quite effectively. European species (*P. germanica* or *P. communis*) are said to "dart out a long, slender tube toward the disturbing object. Through this tube a little drop of malodorous, whitish fluid is forced, which is undoubtedly repugnant to its enemies."* At least fifty of these insects were handled while alive, and yet nothing of the kind was observed in our species.

A Peculiar Organ.

Several times two scorpion-flies were seen standing side by side and facing in nearly opposite directions—the tip of the long beak of one nearly resting upon the abdomen of the other about midway of its length. No importance was attached to this seemingly accidental position at the time. Later studies of the male revealed a curious organ at this point. Near the anterior margin of the fourth abdominal segment there is a median tuberculate process or globular elevation bearing a large, conical, spine, which points in an antero-dorsal direction (Pl. iv, fig. 6). The large spine appears to be the opening of some kind of a gland. The posterior margin of the preceding segment is produced backward as a bilobed extension thickly set with stout setæ. This process has the appearance of a separate sclerite and is probably protective in function, as it not infrequently nearly conceals the organ on the fourth segment. In *P. maculosa* this organ is more fully developed. No trace of it has been found in the female. From the above it would seem probable that this organ secreted a volatile oil attractive to the female.

The male of *Panorpa nematogaster* McLachl. from Java "possesses a curious appendage to the third joint" of the abdomen † As the third segment of McLachlan is what I have found to be really the fourth, it is possible that this "curious appendage" is homologous with the similarly located organ occurring in our native species. As a description of this interesting appendage of *Panorpa nematogaster* is not

* PACKARD: in *Kingsley's Standard Natural History*, ii, *Crustacea and Insects*, 1884, p. 161
† CUDDER: in *Bull. z. U. S. Geol. Geograph. Surv.*, iv, 1878, p. 54.

accessible at the time of writing, it is impossible to do more than suggest a possible homology between the organs.

Is *Panorpa* Predaceous ?

If one cares to watch these insects, they usually may be seen sitting upon the upper side of a leaf. From time to time the wings are slowly elevated and the abdomen caused to vibrate rapidly a few times. This is most probably a respiratory movement. Occasionally one or two may be found feeding upon a dead fly or a dead larva. They seem to bite the tissues for the sole purpose of liberating the body fluids, so that feeding is a combination of biting and sucking. They appear to pay no attention to living, intact insects, although they do not hesitate to suck the fluids from a wounded caterpillar. Some small *Halisidota* and *Datana* larvæ were placed in cages with *Panorpa*, but in no instance were they injured. One of these larvæ crawled against the leg of a female; she simply moved out of the way and finally flew off. But when an injured larva was placed in the cage, it was quickly pounced upon and the fluids sucked from the wound. They do not hesitate to feed upon the dead of their own species, and they will also feed greedily upon raw flesh. A number of individuals were kept in cages and fed upon meat, which was renewed every morning. Within ten minutes after the change, most of them would be feeding eagerly. There was no tearing and pulling; the tip of the long beak would be thrust into the most juicy parts with evident delight. Cooked meat was given them once, but it was not relished so well, probably from being too dry. The next morning several appeared sick. One female lived upon nothing but meat for eighteen days. She was kept in a tumbler with a little sand in the bottom and muslin stretched over the top. The sand frequently got pretty dry — she might have lived longer had the conditions been more natural. From the foregoing it would seem that *Panorpa* does not prey on living animals, although Kirby and Spence record the following:* “Terrible as is the dragon-fly in the insect world in general, putting to flight and devouring whole hosts of butterflies, May-flies, and others of its tribes, it instills no terror into the stout heart of the scorpion-fly (*Panorpa communis*), though much its inferior in size and strength. Lyonnet saw one attack a dragon fly of ten times its own bigness, bring it to the ground, pierce it repeatedly with its proboscis; and had he not by his eagerness parted them, he doubts not it would have destroyed this

* *Entomology*, vol., ii, p. 253. 1828.

tyrant of the insect creation." This statement has been referred to in a number of more recent works on entomology, and may be considered the accepted character of the insect. A French writer has observed the same species "eating portions of fishes which had been placed on a sunny bank."* Prof. Davis of the Michigan Agricultural College has recorded a species of *Panorpa* as "very common in the fields and noticed to attack the cotton-worm."† In response to a special inquiry, Prof. Davis kindly writes: "As to the *Panorpa* sp. reported by me, can only say that I do not now recall the instance under consideration. What I saw may possibly and quite probably was eating on an injured caterpillar and I felt warranted in classing it with the ones I did." It is possible that *Panorpa* does attack and kill its own prey, but there appears to be no undoubted proof of this at present, unless the account of Kirby and Spence is credited—it does not seem possible that it could be true of our species, at least. The wounded and dead cotton-worms would readily explain the presence of *Panorpa* there, as referred to above. From an economic standpoint, it makes quite a difference whether *Panorpa* preys upon living, uninjured insects or not. Our species were under close observation, indoors and outside, for six weeks, yet they were not seen to touch a living, uninjured animal of any kind and they were seen a number of times in nature feeding upon partially decayed insects: neither the mandibles or the maxillæ of this insect are well adapted to piercing. This is quite different from the closely allied genus *Bittacus*, which will touch nothing but living prey, so far as observed, and its mouth parts are well adapted for piercing. The two genera agree in taking very little or no solid food in the imago state.

Egg-laying Habits.

A number of *Panorpas* were kept in a roomy cage with several potted plants set in moist sand. The sides of the cage were of glass or wire screen and permitted ready observation. At various times in the afternoon females were seen walking slowly about and exploring every crevice in the sand with the long, mobile abdomen. Occasionally one would back down into a crevice till nearly out of sight. Frequently these explorations would continue some twenty minutes—the same ground being gone over several times. Finally a female would remain fixed with her abdomen thrust into a crevice. Later investigation usually revealed an irregular mass of yellowish-white eggs one to two centimeters below the surface; twenty-four to twenty-nine being the number counted in each of several clusters. The ovaries were found to

* *Psyche*, vol., lii, 1886, p. 212.

† In *Bull.* 15, *Ark. Agr. Expt. Station*, 1890, p. 10.

consist of about twenty-five tubes, in each of which there were seven to eight ova. In the enlarged end of each tube there was a well-developed ovum; the next was smaller and less developed; the size and degree of development of the ova decreased toward the small end of the tube (Pl. iv, fig. 11). Observation showed that from twenty-five to thirty eggs are laid at one time — presumably one from each tube; dissection would indicate that more than one lot of eggs are deposited, and this is supported by the extended imago existence, which lasts several weeks. If the seven or eight ova of each tube mature during this time, a single female is capable of depositing between one hundred and fifty and two hundred eggs. Examination of two other females resulted in the finding of twenty-three well-formed eggs in one and twenty six in the other. In these notes no allowance was made for those destroyed before they could be counted, of which there were several in each instance. They adhere together slightly on account of the small amount of a viscid fluid covering them. There was nothing to show that the female excavates a nidus; she appears to depend upon finding a suitable hiding place. The appendages of her abdomen are so slender that they could hardly be used for excavation. In at least two cases the eggs were laid in irregular, diffuse masses on the surface of the sand, there being no crevice. One lot was deposited partly under a piece of meat, but in most no attention appeared to be paid to the future wants of the larvæ.

Eggs and Young Larva.

If the eggs were allowed to lie upon a dry surface they quickly dried and shriveled up. Two from a lot which subsequently hatched were placed upon a glass slip. Within thirty minutes they had shrunken to a noticeable extent, and within three hours they had shriveled up completely. The shell is thin and must be quite porous.

The Egg. — (Pl. iv, fig. 10.) Elliptical oval; long diameter .625 mm.; short diameter .6 mm. The egg is pale yellow when first laid, turning in a day or two to sooty-yellow. The shell is finely marked with sub-hexagonal depressions; in the center of each depression there is a circular elevation.

Several clusters were dug up immediately after being laid, placed in vials and covered with about half an inch of moist sand. Most of the time the vials were kept tightly corked. If moisture gathered abundantly on the sides of the vial the cork was removed and some of the moisture allowed to evaporate. The eggs hatched in from six to seven days — they were laid in the afternoon and the larvæ were found on the morning of the sixth or seventh day.

Young larva.— When first hatched the larva is whitish, with a light brown head. The head soon darkens and the body becomes a gray color. The general appearance of the larva is that of a caterpillar (Pl. iii, fig. 1), though there is a strange look about it — the antennæ and eyes are unusually prominent. Each antenna is composed of four segments; the fourth is long and slender; the third is longer, much stouter and bears a special sense organ (Pl. iii, fig. 5 s). Each eye is composed of a group of about twenty ocelli. A well-marked thoracic shield occurs upon the first thoracic, and an irregular slightly chitinized area upon the dorsum of each of the remaining body segments. The most striking feature of the young larva is the row of annulated, pilose spines each side of the median line on the abdominal segments, except on the tenth, which bears a single median process. The spines on the eighth, ninth, and tenth segments persist through all the larval stages; those of the others become rudimentary after the first stage. Small setæ with rudimentary ones at their base occur on the body segments; their relative position and number are shown in Pl. iii, figs. 10, 11. Spiracles occur, as in caterpillars, on the first thoracic and on the eight anterior abdominal segments; they have a peculiar radiate structure (Pl. iii, fig. 7). The abdominal segments bearing spiracles have each a pair of rudimentary prolegs, the anterior pair being the most reduced. On the last segment there is the peculiar, retractile, four-branched anal-fork of Brauer (Pl. iii, fig. 19).

Rapid Growth of Larva.

The larva grows rapidly during its early stages. The first stage lasts five days; at the end of this time the thoracic segments become thickened considerably; the thoracic shield and the dorsal portion of the old head-case split along the median line (one was preserved in just this condition), and through this rent the larva leaves its old skin in much the same way as many caterpillars. Dull, apparently dead larvæ were repeatedly seen; in many cases this condition was most likely incident to molting. At the end of the first stage the reduction of the annulated spines on abdominal segments one to seven to mere rudiments, renders the recognition of this period easy (Pl. iii, fig. 1a). Between the other stages there are less marked differences. The segmentation of the body is plainer and there is also an increase in width of the head. The ratio between the width of the head in the first and second stages was calculated, and from this was estimated, by Dyar's rule,* the width of the

* DYAR: *Psyche*, v, p. 420. 1890.

head in the succeeding stages. The ratio was found to be 1.178. From time to time larvæ were taken from the cage, measured, and the results tabulated. A definite increase in the width of the head was attributed to molting. Considering that the larvæ measured came from several lots of eggs laid at different times, the figures given below are remarkably constant. Occasionally a larva would be found with a width of head intermediate, but most of the time they were easily referred to one stage or the other. In the earlier stages there was greater constancy, as one might expect.

WIDTH OF HEAD.

STAGE.	Measured.	Calculated.	Differences	Proportionate error.*
	mm.	mm.	mm.	
1.....	0.5625
2.....	0.6625
3.....	0.7750	0.7800	.0050	.0066
4.....	0.9375	0.9194	.0181	.0193
5.....	1.0625	1.0830	.0205	.0183
6.....	1.3255	1.2760	.0495	.0373
7.....	1.5000	1.4950	.0050	.0033

If this ratio be constant, seven stages were recognized within two weeks after the first larva was found. It was probably several days old when found, and there may have been older larvæ in the cage. There could have been none more than six days old at the time, because it takes six days for the eggs to hatch, and the insects had been in the cage but twelve days. It is hardly likely that oviposition occurred during the first few days. The seventh stage was reached within twenty, and possibly, within sixteen days after the larva emerged from the egg. In another cage, one reached the sixth stage within twelve days after it emerged from the egg. That is, it molted six times in seven or eight days. This result was obtained with larvæ of known age, and the time of the first molt was also known. The seventh stage was attained by one larva August 14. Up till August 22 the cage, from which this was taken, was under the closest supervision, a constant watch being kept for a possible eighth stage. August 22 a portion of this cage was thoroughly examined and some twenty larvæ removed; but none were larger than those taken earlier. A close watch was kept on a smaller lot of larvæ until September 11, but no later stage was discovered. It would, therefore, appear that the seventh stage might be the limit of growth. As the larvæ reached

* Obtained by dividing the difference by actual width.

this stage, they became less active, and not rarely portions of the head and thorax became incrustated with a thin layer of very fine particles of sand. Several thus incrustated died, but not so many as to convince one that this incrustation was the cause. Unfortunately all perished at this time.

Habits of the Larvæ.

Throughout their different stages, the larvæ usually harmonize with their surroundings so closely that it is difficult to detect them. Frequently a slight motion of the earth is the first indication of their presence. They burrow in the earth, and remain underground much of the time. Many burrows ran less than one inch below the surface, although a few extended to a depth of three or four inches. The larvæ may be fed readily upon raw meat placed upon the surface of the ground. Some time after placing the meat in the cage, they may be found under it, frequently in a more or less cell-like depression. When in such a position they rarely try to escape, but trust to their protective resemblances, and remain motionless. Around the edge of the piece of meat and also under it, the mouths of burrows may be seen and in them the heads of larvæ; when in such positions they dodge back quickly at the least disturbance. Unless the meat is moved very cautiously the burrows will appear empty; but if quiet is maintained for a few moments, the heads will soon be seen. The burrows opening under the meat frequently come to the surface a little distance away, and it is quite easy to drive a larva out of its back-door. Not infrequently they have been observed to emerge from a burrow for their feeding. This usually occurred in the afternoon. On one of these occasions a little fellow was watched through a simple lens. It was interesting to see him bite off a piece of meat and swallow it with every evidence of satisfaction. The antennæ were moved back and forth in a most appreciative way. As the larvæ increase in size, more burrows open upon the surface and they are seen lying at their mouths. One time two were seen out of adjacent burrows. The larger seized the smaller in the back and tried to drag it down into its burrow. The smaller was unable to escape, and when it was pulled away with forceps, the body-wall was ruptured. At another time a smaller active larva was seen to attack a larger inactive one, which, unable to resist, was bitten so severely that the segment swelled considerably, but was not ruptured. In a day or two the larger died and was fed upon by its former persecutor. In several cages there was a marked decrease in the number of larvæ. The foregoing incidents throw light on the mystery. The weaker probably fell a prey to the rapacity of the stronger. The

larvæ will feed readily upon recently killed caterpillars. Packard (*loc. cit.*, p. 162) states that the food of the larva is dead animals.

On another occasion a larva was seen moving particles of earth from the mouth of its burrow, seizing them with its mandibles and placing them on one side. The larvæ burrow slowly; they do not excavate the earth but compress it by a series of muscular contractions. They cannot travel readily over moist sand, because particles adhere to the legs and interfere with their movement. This is especially true of the anal-fork, which frequently becomes filled with a mass of sand. If the larvæ have a firm surface as a piece of paper or glass their rate of locomotion will compare favorably with that of many caterpillars. The method of progression sometimes resembles that of a geometer. The thoracic legs and the anal-fork are the principal organs of locomotion, the latter being capable of supporting the entire body, and upon a hard surface it is used in much the same way as the anal prolegs of a caterpillar. The rudimentary prolegs seem of little use. When seized the larva opens its tiny jaws in a very suggestive way. If dropped into water it quickly sinks and straightens out apparently dead, but soon revives when removed.

As the larvæ were kept under nearly natural conditions, it is quite likely that they live in much the same way in nature. They burrow in the ground or wander over the surface and live upon what they can find. The special sense organ on the antenna probably enables them to locate the coveted food readily. One afternoon the haunts of *Panorpa* were visited. Several vials were sunk with their mouths just at the surface of the ground, and bits of meat were placed in them. Later in the day a *Panorpa* larva was found in one of the vials. Not only do they wander in search of food, but it is also quite likely that they lie in wait at the mouths of their burrows and capture whatever may fall within their power.

Length of Larval Existence.

For the remainder of the life-history of this species I can do no better than quote McLachlan's translation of Brauer's observations upon an European species:*

"They are full grown in thirty days, and then burrow deeper into the ground, excavate an oval cell in a small lump of earth, and remain as larvæ for several months before assuming the pupa state. In this condition they shrivel to one-half of their previous length, the under-side increases in thickness, and the end of the body is somewhat curved

* *In Trans. Lond. Ent. Soc.*, 1868, p. 213.

against the back. If taken out they move slowly and have no power to walk. The bristles on the last three segments are then partly broken off."

It is probable that *P. rufescens* completes its round of life in nearly the same manner, though, as shown in the preceding, its growth is more rapid.

Pupa of European Species.

The pupa of an European species of *Punorpa*, as figured and described by Westwood,* is inactive. The limbs are laid along the breast and the antennæ along the sides. The head is less elongated than in the imago. The pupa was found an inch below the surface in moist earth at the foot of an alder stump.

Bittacus strigosus Hagen.

The general appearance of this insect is quite different from that of *Punorpa*. Its body is more slender and the sides more flattened. Were it not for the long beak, which is much more pointed and especially adapted for piercing, the relationship between the two genera would scarcely be suspected. Upon closer examination, however, the affinity becomes clearer. For example, the venation of the wings in the two

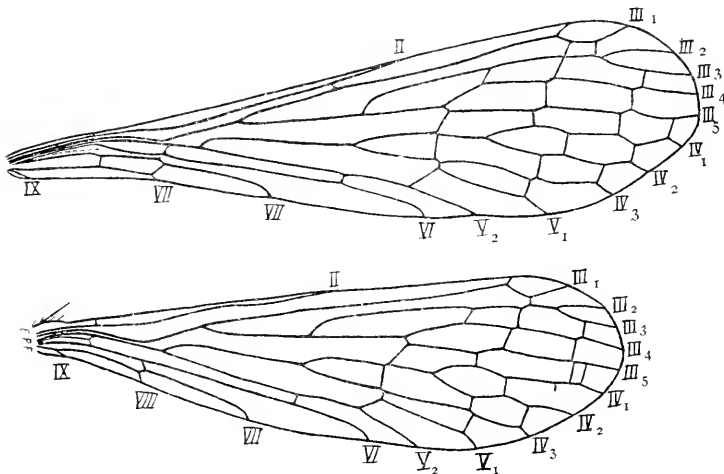


FIG. 24.—VENATION OF BITTACUS STRIGOSUS. The homology of the veins was determined by Prof. J. H. Comstock.

genera is very similar (Fig. 24). The minute mouth-parts and other organs also show the relationship existing between them.

* *Introduct. Class. Insects*, vol. ii, pp. 52, 53, figs. 65, 18. 1840.

Habitat and Appearance.

The moist shady swamps are the delight of this insect. In such places they may be seen flitting from branch to branch, during July and early August, rarely retaining one position more than ten minutes. Their manner of flight and general appearance resembles that of the *Tipulæ* which abound in the same places, but they never alight upon a leaf or branch of any kind; they suspend themselves by the long slender fore limbs (Pl. iv, fig. 1), not infrequently using the middle pair of limbs also.* The limbs of *Bittacus* are totally unfitted for supporting the owner in the position most insects assume when at rest. On a flat surface it is nearly helpless; its long legs become entangled, or if several are in a bottle, a snarled mass of legs with here and there a body is the result—it cannot even stand on its legs. In their suspended position the fore limbs are bent so as to elevate the head above the fore femora, thus affording an uninterrupted view. The head is extended forward, while the slender beak inclines a little from the horizontal. The diverging antennæ curve gracefully backwards. The wings droop beside the body and cover the abdomen. One leg or the two of the middle pair not used in supporting the insect, extend at an oblique angle from the body. The hind femora are nearly vertical, the tibiæ incline forward, while the tarsi hang in a peculiar drooping curve. The general appearance of the insect in this position is not very unlike a bit of dried, dangling foliage.

Method of Capturing Prey.

The position appears restful and one might almost think the insect asleep. It is very far from that, as many a small insect could testify, were it still alive. The small fly that ventures within reach of the long, dangling legs imperils its life. In a second those well-armed tarsi (Pl. iv, fig. 2) seize the unfortunate, the fourth and fifth segments of the tarsus shutting together like the jaws of a trap (shown at *a*)—the teeth upon their apposing surfaces (shown at *b* and *c*); and also the large spines on the second and third segments, especially of the hind leg (shown in outline at *d* and *e*). The struggle is usually short; two, three, or four of those long legs lay hold of the captive and soon bring it within reach of the sharp beak. It is only a minute's work to pierce a soft part of the body and suck the victim's blood, when the lifeless remains are dropped to the ground and the insatiate insect is ready for the next. If a large

* Baron Osten-Sacken has contributed an interesting observation upon the habits of *B. apterus*. The insect is not rare in open grassy places in parts of California and it "replaces the want of wings by a great dexterity in climbing, swinging itself, monkey-like, from halm to halm, often suspended only by the front tarsi." One was observed devouring a *Tipula*.—C. V. RILEY, in *Am. Nat.*, July, 1882, pp. 596-597.

fly is seized, *Bittacus* would sooner be torn from its support than relinquish its hold upon the prey. One was seen in the field just after she had seized a rather large fly; twice she was torn from the supporting stem and forced to fly a short distance, still holding her prey. After quite a struggle the fly was killed. *Bittacus* will touch nothing but living insects, so far as known. One female killed four house-flies in a day; on another she killed three. In nature they undoubtedly destroy large numbers of insects; flies seemed to be preferred, though some small Capsidæ, Coleoptera, and Hymenoptera were killed by confined individuals. As they are such voracious feeders and by no means rare, since hundreds were seen flitting in the woods inhabited by them, the genus may be ranked among the beneficial insects. It appears to be rather local and, therefore, of little importance in an economic way. In the woods where they abounded the conditions seemed favorable for the multiplication of mosquitoes, yet they were not abundant; possibly their numbers were reduced by the blood-thirsty *Bittacus*.

Habits of European Species.

The following is Dr. Packard's (*loc. cit.*, p. 162) rendering of Brauer's account of an European species: "The imagines, or adult flies, live in a sort of a chamber covered in by leaves, grasses, nettles, etc., forming an airy abode or vivarium. Here they feed upon such flies as enter their habitation. The flies die after laying their eggs in the soil, and the earth at the bottom of the chamber dries up, but in the following April, when the soil is again wet by the spring rains, the larvæ hatch out. And now a remarkable fact has been noticed by Brauer. He has observed that if the marshy or wet ground where the female *Bittaci* customarily lay their eggs does not dry up, no females appear until the second year following; so that the eggs lie over unhatched two years. The first condition of their hatching is a complete drying of the earth in which the eggs lie; the second condition is a succeeding thorough wetting of the ground in spring. If the ground remains dry from want of snow in the winter or of rain in the spring, and there follows in the next summer a very thorough wetting of the soil, then the time of appearance of the adult will be retarded three or four months."

In this country no vivarium or chamber has been found as yet. The insects were observed for hours in their native haunts, where they were seen to rise in numbers from low bushes and ferns upon the approach of an intruder, yet they were rarely seen within three inches of the ground. In this connection it would be interesting

to learn how this airy chamber or vivarium was constructed. On the ground, as before stated, the insects appear nearly helpless. When suspended from the branches they could easily pull leaves, etc., together, but they appear to have no means of fastening them in place. This interesting habit does not seem to be common to any American species yet observed.

A Remarkable Organ.

Arising between the large appendages of the tenth abdominal segment of the male there is a most remarkable median organ; it is a long, slender filament of chitine coiled up like the proboscis of a butterfly (Pl. iii, fig. 14 *f*). It is also represented partly extended in figure 15 *f*. When stretched out it would quickly spring back to its original position upon being released. This was observed upon males that had been dead some forty hours and also upon alcoholic specimens. The insect can uncoil this filament. It appears like the rudiment of a once important organ.

Egg-laying Habits.

The perfect state lasts a number of days and possibly a month or more. Owing to their requiring living food, it was difficult to keep the insects alive when in confinement. A female of *B. pilicornis* Westw was kept five days; during that period she killed eight house-flies, and there were times when she would have been glad of more. The first day of confinement she laid one egg and several each day thereafter; before dying, thirty were deposited. This species was less abundant at Ithaca and appeared much less vigorous than *B. strigosus*. Several examples of *B. strigosus* with well-distended abdomens were dissected; they were found to contain fourteen, sixteen, and nineteen eggs, respectively, yet the abdomens were apparently as large as that of *B. pilicornis*, which laid thirty eggs. From the above it would seem that the eggs develop and are produced a few at a time during the greater part of the adult existence. These insects die very soon if deprived of food, most of them living but a day after capture unless well supplied with small insects. So far as observed, oviposition consists simply of extruding the egg and allowing it to drop at random. It has a hard shell and a tough inner membrane, differing in this respect from that of *Panorpa*.

The egg.—Subcuboidal; long diameter, .8125 mm.: short diameter, .6875 mm. Color, dark brown. Shell hard, tuberculate. It appears like the "frass" of a caterpillar (Pl. iv., fig. 9).

Larval and Pupal Stages of European Species.

In all probability our American species winter in the egg state. The larvæ have not been seen by me. The following is abridged from Packard's (*loc. cit.*, pp. 163, 164) rendering of Brauer's observations upon European species. The larvæ of *Bittacus* do not burrow in the ground as do those of *Panorpa*, but remain on the surface and secrete themselves under leaves, etc.; like *Panorpa*, the larvæ feed readily upon meat. They differ from that of *Panorpa* in the possession of "two rows of dorsal spiny tubercles which end in long stiff filaments, and which extend from behind the head to the tail." They are reddish-gray in color and their hairs resemble particles of earth or bits of vegetation and thus aid in concealing the possessor. "At the least disturbance they assume an erect position, throwing the body into the shape of an S, or they roll up spirally like a saw-fly larva and fall into the cracks in the ground." They pupate in a cell one or two inches below the surface, in which the larvæ remain ten days before pupation. The pupa state lasts fourteen days.

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EXPLANATION OF PLATE III.

Panorpa rufescens.

Larva.

- Fig. 1.—Lateral aspect of first stage: 1*a*, rudimentary annulated spine of 7th abdominal segment in 2d stage; 1*b*, the annulated spine of 8th abdominal segment in do; 1*c*, abnormal bifurcate spine of 10th abdominal segment.
- Fig. 2.—Ventral aspect of head: *e*, eye; *p*, maxillary palpus.
- Fig. 3.—Dorsal aspect of head: *a*, antenna; *e*, eye.
- Fig. 4.—One of the eyes, showing distribution of ocelli.
- Fig. 5.—Antenna, showing special sense organ at *s*.
- Fig. 6.—Mandible.
- Fig. 7.—Thoracic spiracle in first stage.
- Fig. 10.—Arrangement of setae on 3d thoracic segment; diagrammatic.
- Fig. 11.—The same of the 1st abdominal segment.
- Fig. 19.—Anal-fork extended, latero-caudal aspect.
- Fig. 21.—Portion of the maxilla: *p*, palpus.

Imago.

- Fig. 8.—Lateral aspect of 9th abdominal segment of male: *v*, valve.
- Fig. 12.—Ventral aspect of 10th abdominal segment of male: *h*, harpe; *u*, uncus; *l*, lower limb of uncus; *i*, inner harpe.
- Fig. 9.—Internal aspect of ventral portion of 9th abdominal segment of female.
- Fig. 16.—Dorsal aspect of 9th and 10th segments of female abdomen: *a*, segmented appendage.
- Fig. 17.—Lateral aspect of 8th, 9th, and 10th segments of female abdomen: *a*, segmented appendage.

Bittacus strigosus.

Imago.

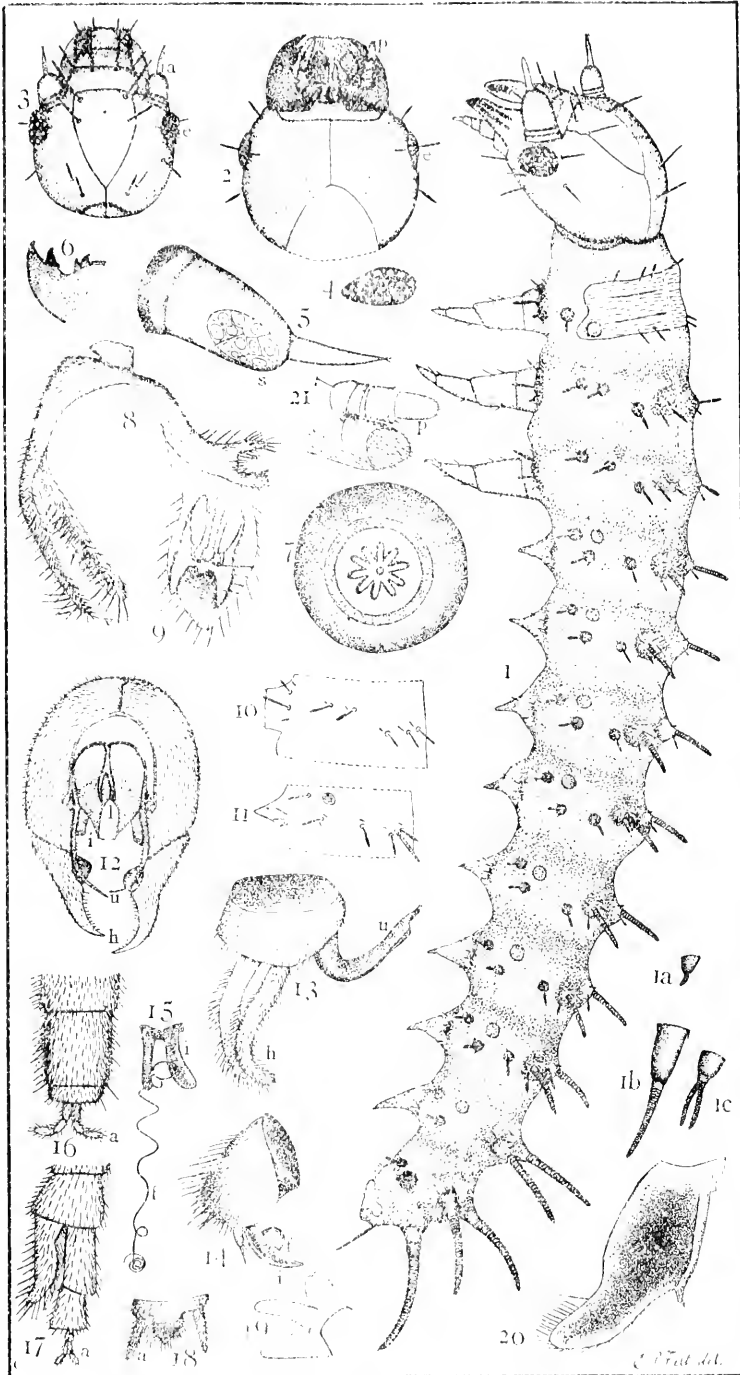
- Fig. 20.—Internal aspect of right valve.
- Fig. 13.—Cephalo-lateral aspect of 9th abdominal segment: *h*, harpe; *u*, uncus.
- Fig. 14.—The same of 10th abdominal segment: *i*, inner harpe; *f*, chitinous filament.
- Fig. 15.—Chitinous filament partially uncoiled: *i*, inner harpe; *f*, filament.
- Fig. 18.—Dorsal aspect of 9th and 10th abdominal segments of female: *a*, unsegmented appendage.

All the drawings, except figures 19 and 21, were made with the aid of the camera lucida. All the figures are greatly enlarged.

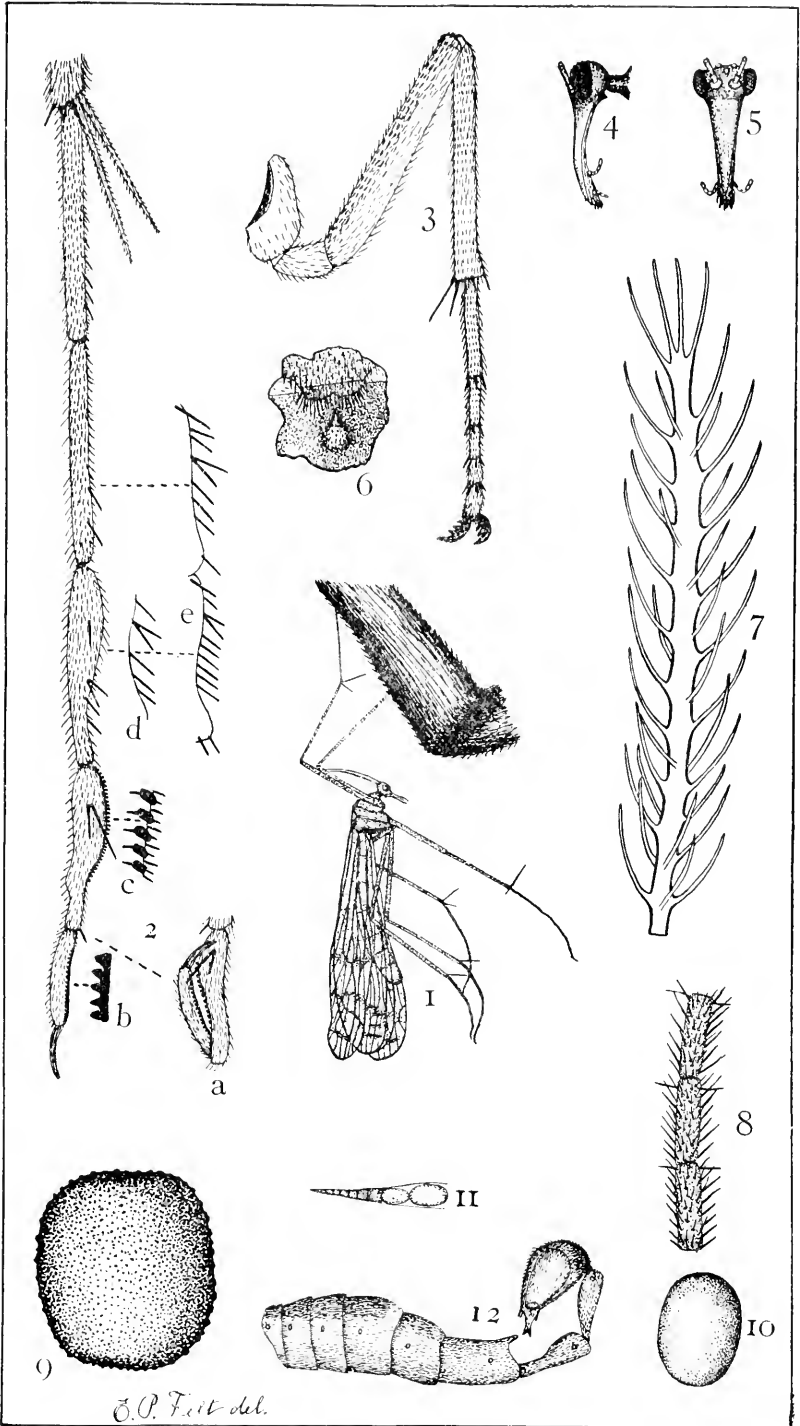
EXPLANATION OF PLATE IV.

- Fig. 1.—Natural position of *Bittacus strigosus*. Drawn from a photograph of the living insect (enlarged).
- Fig. 2.—Fore tarsus of *B. strigosus*: *a*, 4th and 5th segments apposed; *b*, teeth of 5th enlarged; *c*, do. of 4th; *d*, armature of 3d on middle legs; *e*, the same of 2d and 3d segments of hind legs.
- Fig. 3.—Fore leg of *Panorpa rufescens*.
- Fig. 4.—Lateral aspect of the head of *P. rufescens*.
- Fig. 5.—Front of same.
- Fig. 6.—Portions of the fourth and fifth abdominal segments of *P. rufescens*, showing the dorsal abdominal organ of the male.
- Fig. 7.—Terminal antennal segment of *B. strigosus*.
- Fig. 8.—Three antennal segments, 8th, 9th and 10th, of *P. rufescens*.
- Fig. 9.—Egg of *B. strigosus*.
- Fig. 10.—Egg of *P. rufescens*.
- Fig. 11.—A single ovarian tube of *P. rufescens*.
- Fig. 12.—Lateral aspect of male abdomen of *P. rufescens*.

Figures 4, 5, 9, 10, 12 were drawn by aid of the camera lucida; the others, to scale. Figures 2, 3, 6, 7, 8, 9, 10, 11 greatly enlarged; figures 4, 5, 12 moderately enlarged.



SCORPION-FLIES.



J.P. Felt del.

SCORPION-FLIES.

(B)

LIST OF DATES OF COLLECTIONS OF LEPIDOPTERA
(HETEROCERA).

The time of appearance of insects in their perfect stage is an important and essential part of their life-history. It is of special importance in the injurious species, in enabling us often to guard against the deposit of their eggs, or to destroy the larvæ at their earliest appearance before serious injury has been committed by them.

The following list is from unpublished memoranda made in the year 1874 of species taken either in Albany or Schenectady, New York. Similar lists for the years 1869, 1870, 1872 and 1875 may be found in Nos. 1, 2, 3 and 4 of my "Entomological Contributions."

SPHINGIDÆ

Philampelus Pandorus (<i>Hübner</i>)	August 18.
Philampelus Achemon (<i>Drury</i>)	August 25.
Ampelophaga Myron (<i>Cramer</i>)	June 24.
Ceratomia Amyntor (<i>Hübner</i>)	July 10; Sept. 22.

BOMBYCIDÆ

Alypia octomaculata (<i>Fabr.</i>)	June 9.
Eudryas grata (<i>Fabr.</i>)	June 27.
Euphannya mendica (<i>Walk.</i>)	July 7, 8, 12, 13, 17, 21.
Arctia parthenice (<i>Kirby</i>)	August 23.
Pyrharctia isabella (<i>Sm.-Abb.</i>)	June 28.
Spilosoma virginica (<i>Fabr.</i>)	June 12.
Euchaetes egle (<i>Drury</i>)	June 24.
Halisidota tessellaris (<i>Sm.-Abb.</i>)	July 21.
Orgyia leucostigma (<i>Sm.-Abb.</i>)	July 9, 15.
Heterocampa marthesia (<i>Cramer</i>)	July 14.
Attacus Cecropia (<i>Linn.</i>)	June 26.
Actias luna (<i>Linn.</i>)	June 18.
Telea Polyphemus (<i>Cramer</i>)	June 26.
Hyperchiria Io (<i>Fabr.</i>)	July 1, 3.
Eacles imperialis (<i>Drury</i>)	July 8; August 24.
Clisiocampa Americana <i>Harris</i>	June 30.

NOCTUIDÆ

Pseudothyatira expultrix <i>Grote</i>	July 1, 5.
Acronycta morula <i>Gr.-Rob.</i>	June 30.

<i>Acronycta funeralis Gr.-Rob.</i>	August 8.
<i>Acronycta hamamelis Guen.</i>	June 14.
<i>Acronycta dissecta Gr.-Rob.</i>	June 24.
<i>Agrotis badicollis Grote</i>	August 24.
<i>Agrotis prasina (Fabr.)</i>	August 22.
<i>Agrotis c-nigrum (Linn.)</i>	July 5, 8.
<i>Agrotis plecta (Linn.)</i>	June 6, 30.
<i>Agrotis haruspica Grote</i>	July 21.
<i>Agrotis clandestina (Harris)</i>	June 24.
<i>Agrotis subgothica (Haw.)</i>	August 22, 31.
<i>Agrotis tricolor Lintn.</i>	August 11, 29, 31.
<i>Agrotis herilis Grote</i>	July 3, 12.
<i>Mamestra meditata Grote</i>	September 30.
<i>Mamestra grandis (Boisd.)</i>	June 15.
<i>Mamestra trifolii (Rott.)</i>	June 6.
<i>Mamestra adjuncta (Boisd.)</i>	June 3; July 17.
<i>Mamestra renigera (Steph.)</i>	August 20.
<i>Hadena passer (Guen.)</i>	June 17; July 1.
<i>Hadena finitima (Guen.)</i>	June 13.
<i>Hadena lateritia (Hufn.)</i>	August 22, 25.
<i>Hadena devastatrix (Braee)</i>	August 28.
<i>Hadena arctica (Boisd.)</i>	June 13; July 1, 5, 21.
<i>Hadena fractilinea Grote</i>	August 22; Sept. 20.
<i>Hyppa xylinoides (Guen.)</i>	June 7; August 22.
<i>Euplexia lucipara (Linn.)</i>	July 17.
<i>Nephelodes violans Guen</i>	August 29.
<i>Helotropha reniformis Grote</i>	August 10, 25.
<i>Hydræcia sera Gr.-Rob.</i>	July 6, 17.
<i>Hydræcia nictitans (Linn.)</i>	July 21.
<i>Leucania albilinea (Hüb.)</i>	August 10, 17, 21.
<i>Leucania unipuncta (Haw.)</i>	July 5, 8.
<i>Leucania pseudargyria Guen</i>	June 13, 21, 31.
<i>Ufeus satyricus Grote</i>	April 25.
<i>Adipsophanes miscellus Grote</i>	August 9.
<i>Crambodes talidiformis Guen</i>	June 22; July 20.
<i>Caradrina miranda Grote</i>	August 16.
<i>Caradrina multifera Walk.</i>	September 5.
<i>Orthosia bicolorago (Guen.)</i>	October 14, 18.
<i>Morrisonia confusor (Hüb.)</i>	May 13.
<i>Cucullia asteroides Guen.</i>	August 23.
<i>Plusia ærea (Hüb.)</i>	July 21; August 23.
<i>Plusia æroides Grote</i>	July 21.
<i>Plusia precatiosis Guen.</i>	July 26.
<i>Erastria synochitis Gr.-Rob</i>	July 9.
<i>Erastria muscosula Guen.</i>	July 10.
<i>Erastria apicosa (Haw.)</i>	July 17.
<i>Catocala nubilis (Hüb.)</i>	July 14.
<i>Parallelia bistriaris (Hüb.)</i>	June 26, 30.
<i>Pityolita pedipalalis (Guen.)</i>	June 21.
<i>Renia discoloralis Guen</i>	Aug. 3.

GEOMETRIDÆ

<i>Prochoerodes transversata</i> (Drury).....	Aug. 6, 7, 11.
<i>Tetracis crocallata</i> Guen.....	June 13.
<i>Tetracis lorata</i> (Grote).....	June 13.
<i>Angerona crocatoria</i> (Fabr.).....	July 10.
<i>Acidalia enucleata</i> Guen.....	July 20.
<i>Stegania pustularia</i> Guen.....	July 7.
<i>Hæmatopis grataria</i> (Fabr.).....	June 22.
<i>Hemerophila unitaria</i> Her.-Sch.....	July 3.
<i>Heterophleps triguttata</i> Her.-Sch.....	June 22; July 21; Aug. 23
<i>Petrophora diversilineata</i> Hübn.....	July 1.
<i>Plemyria fluviata</i> Hübn.....	July 21.

PYRALIDÆ

<i>Desmia maculalis</i> Westw.....	Aug. 1, 9.
<i>Botis marculenta</i> Gr.-Rob.....	July 21.
<i>Botis acutella</i> Walker.....	June 11.
<i>Botis ferrugalis</i> Hübn.....	Aug. 7.
<i>Botis unifascialis</i> Pack.....	June 1, 3.
<i>Botis theseusalis</i> Walk.....	June 27, 28.
<i>Botis adipaloides</i> Gr.-Rob.....	July 12.
<i>Evergestis straminealis</i> Hübn.....	Aug. 20, 22, 23.
<i>Cordylopeza nigrinodes</i> Zeller.....	July 21.
<i>Pyralis farinalis</i> Linn.....	June 3, 4; July 5, 8.
<i>Pyralis costalis</i> Fabr.....	July 7, 8.

TORTRICIDÆ

<i>Cacoecia purpurana</i> (Clem.).....	July 10.
<i>Cacoecia cerasivorana</i> (Fitch).....	July 19.
<i>Cacoecia argyrospila</i> (Walk.).....	June 2, 22, 26.
<i>Lozotania afflictana</i> (Walk.).....	May 21.
<i>Ptycholoma per-sicana</i> (Clem.).....	June 9.
<i>Pandemis limitata</i> (Rob.).....	July 10.
<i>Tortrix fumiferana</i> Clem.....	July 7.
<i>Cenopis reticulatana</i> (Clem.).....	July 22.
<i>Cenopis Pettittana</i> (Rob.).....	July 1.
<i>Amphisa discopunctana</i> (Clem.).....	June 30.
<i>Exartema permundana</i> Clem.....	July 10.
<i>Exartema exoleta</i> Zeller.....	July 14.
<i>Penthina nimbatana</i> (Clem.).....	June 23.
<i>Penthina chionosema</i> Zeller.....	June 18.
<i>Sericoris instrutana</i> Clem.....	June 22.
<i>Sericoris campestrana</i> Zeller.....	June 19.
<i>Tmetocera ocellana</i> (Schiff.).....	June 26.
<i>Phoxopteris semiovana</i> Zeller.....	May 29.
<i>Carpocapsa pomonella</i> (Linn.).....	May 28.

(C)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the years 1893 and 1894 (100), giving title, place, and date, and a summary of contents of each.

How to Prevent the Ravages of the Cabbage-Maggot. (Gardening, for February 1, 1893, i, p. 155, figs. 1-3 — 92 cm.)

As the effectiveness of remedies are often influenced by soil and other conditions, the following are noticed and commended: Tobacco; lime; burdock decoction; tansy decoction; kerosene emulsion; night-soil; soot; hellebore; liquid manure. More effective than any of these as a preventive — the tarred-paper protectors designed by Prof. E. S. Goff are described and illustrated, with method of making, and mention of results obtained from their use.

A Destructive Elm-Tree Bark-Borer. (Garden and Forest, for February 15, 1893, vi, p. 76 — 29 cm.)

The white elm, *Ulmus Americana*, in New York and other Northern States is being injured and killed by the burrowing in the inner bark and sap-wood of the longicorn beetle, *Saperda tridentata* Oliv. A coating, containing carbolic acid and Paris green to deter from oviposition and to kill the larvæ in entering the bark, is recommended. A better remedy would be to remove the outer bark until the burrows are reached, and then apply kerosene emulsion to kill the grubs or pupæ. The experiment of M. Robert, in France, is related, of killing the Scolytus in elms by removing all of the outer bark in two thousand elms, and in removing strips of the bark two inches wide from the ground to the boughs. The four insects operating on our elms and threatening their destruction are noticed. Fears expressed lest the elm is a doomed tree.

Plant-Lice. (Country Gentleman, for March 9, 1893, lviii, p. 186, c. 3 — 12 cm.)

Inquiry is made, from Nas-au, N. Y., of means for destroying lice on roots of vegetables in gardens. But few species of plant-lice are known to operate in the above manner. Only five are recalled (named with their food-plants). Several of the flowering plants are subject to root attack. For remedies tobacco water is thought the best; others that may be experimented with are hot water, kerosene emulsion, common soapsuds, whale-oil soapsuds, pyrethrum water, hellebore tea, alum water, and lime water. Lime or wood ashes washed into the soil may serve as preventives.

The Angoumois-Moth, *Sitotroga cerealella*. (Country Gentleman, for March 9, 1893, lviii, pp. 188-9, cols. 4, 1, 2 — 68 cm.)

Replying to inquiry of the insect infesting wheat in York county, Penn., is given: its operations in Europe; its history in the United States; is a southern species, and rare in the State of New York; notice of the few occasions in which it has been observed in this State, in museums at Albany and Geneva, and in grain stores — probably not attacking grain in the field; a *Catolaccus* parasite reared from infested corn; number of broods varying with the latitude and temperature, from two to eight; broods in Pennsylvania; the grain heated by the gnawing of the larvæ; the flour produced from infested wheat unwholesome and producing disease; bisulphide of carbon remedy for the insect when within the grain.

[Extended in pp. 377-386, of this Report (x).]

Report of the Committee on Entomology. (Proceedings of the Western New York Horticultural Society, for January, 1893, pp. 28-43. Also, separate, with cover and title, March 21, 1893, 16 pp.) Read before the society at its annual meeting, January 26, 1893.

Notices as follows: Remarkable exemption from insect injuries during the year. Various pests of the year (twelve species remarked upon). The Gypsy-moth. *Oeneria dispar*, in Massachusetts — work done for its extermination. A destructive shade-tree pest, *Zeuzera pyrina* — its spread and injuries. An elm-tree bark-borer, *Saperda tridentata* — its work and remedies for it. Experiment Station publications — insects attacks discovered by them — ten noted. Spraying and insecticides — results during the year and new insecticides introduced. Bounties for insect pests — offered in Newton, Mass., and what may be done in like manner elsewhere.

[Published in the Ninth Report on the Insects of New York, 1893, pp. 422-437.]

The Periodical Cicada. (Country Gentleman, for March 23, 1893, lviii, p. 226, col. 3 — 20 cm.)

Replying to inquiries from Plainfield, N. J. — This will not be a locust year in New Jersey or in New York. Next year an extensive brood will appear along the Hudson river valley, and in parts of Connecticut, New Jersey, Pennsylvania, Maryland, and Virginia. It probably will not be abundant in the vicinity of Plainfield, N. J. Fruit-trees are often injured by it, nurseries and young orchards especially. Its injuries through oviposition cannot be prevented by applications to the trees. It may be more easily killed before it becomes winged; and the mature insect may be driven from orchards by taking advantage of high winds.

Mites Attacking Mushrooms. (Country Gentleman, for March 23, 1893, lviii, pp. 228-9, cols. 4, 1 — 27 cm.)

"Some small reddish crawling lice," reported from Newburgh, N. Y., as infesting "by millions," a large mushroom bed in a steam-heated cellar, are doubtless mites. Examples should have been sent for name. Mention of a mushroom cellar on the imperial farm at Vincennes, France, infested with immense numbers of mites of a gray color. *Tyroglyphus rostroerratus* infests mushroom beds in the vicinity of Paris—also of a gray color. A new species of *Rhizoglyphus* occurring in pits in mushrooms was lately received from Suffolk county, L. I. The Newburgh species may be *Bryobia pratensis* which often enters buildings. Sulphur commended for killing the mites, and how used; bisulphide of carbon might also be tried, in manner directed.

[See pages 449, 450 of this Report (x).]

Flower Crickets and Apple Twigs. (Country Gentleman, for March 30, 1893, lviii, p. 246, col. 2 — 17 cm.)

Eggs in apple twig from Fremont county, Colorado, are those of one of the flower crickets, but of which species cannot be determined. Mr. Allis, of Adrian, Mich., is of the opinion that *Ecanthus nireus* is confined to the apple and other hard wood, while the oviposition usually referred to this species as found in canes and grapevines belongs to *Ecanthus fasciatus*. The oviposition of these crickets needs further observation and study.

But little harm can result to apple-trees from these egg deposits. The harm is more than counterbalanced by the good done in the large number of plant-lice eaten by *Ecanthus* in its early stages.

The Onion-Fly — *Phorbia ceparum*. (Country Gentleman, for March 30, 1893, lviii, p. 246, c. 2, 3 — 20 cm.)

The onion-fly [replying to inquiry] is distinct from the cabbage-fly, *Anthomyia brassicæ* Bouché, although so similar that the same preventives and remedies may be used for each.

A strongly-recommended remedy is the burdock infusion, of which the method of making is given. Other remedies are kerosene emulsion, tansy decoction, whale-oil soap solution, soot and water, and liquid manures.

As a preventive, is given—the preparation of the soil by deep working, manuring, and rolling. Also, directions for removing infested plants from the ground and for their disposal.

Miss Ormerod's Report. (Country Gentleman, for April 13, 1893, lviii, p. 289, c. 2 — 35 cm.)

Miss Ormerod's work in economic entomology commended; the value of her reports enhanced by their prompt publication: their satisfactory appearance; convenient arrangement of their material; contents of the 16th report; an interesting notice of "club-root." Nearly half the infestations noticed occur also in the United States. Credit due the author for her successful introduction in England of spraying with Paris green and water for insect pests.

Myriapods and Mites in "Scabby" Potatoes. (Country Gentleman, for April 27, 1893, lviii, p. 329, cols. 1, 2 — 37 cm.)

Potatoes from Scarsdale, N. Y., show numerous deep cavities which contain many "thousand-legged" worms, of the species known as *Julus cæruleocinctus* Wood, which is at times quite injurious to potatoes. Neither they nor wire-worms nor earth-worms or mites cause the "scab" with which they are often associated, but are drawn to it as an attractive feeding ground. The "scab" is caused by the fungus *Oospora scabies* Thaxter; bacteria presence sometimes accompanies it. Five of the best preventives of the scab are named. Thousand-legged worms are difficult to contend with; perhaps gas-lime or kainit may arrest their injuries. Mites also occupied the cavities with the *Julidae*, perhaps referable to *Rhizoglyphus phyllovereæ*. Another instance of its occurrence cited, as also of other species of mites at another time.

[Extended in pages 445-449 of this Report (x).]

Spraying for Codling-Moth. (Country Gentleman, for April 27, 1893, lviii, p. 329, c. 2, 3 — 19 cm.)

In reply to questions — spray soon after the blossoms fall; a second spraying may be made a week or two thereafter; is hardly necessary to spray for the second brood of moths; the arsenites are preferable for the purpose to other insecticides; ordinary soapsuds would not suffice -- a strong soap solution might answer; tobacco solution could not be depended upon, but it might repel oviposition.

[Insects on Lettuce and Cabbage.] (Gardening, for May 1, 1893, i, p. 264, c. 2 — 14 cm.)

Replying to inquiries from Medical Lake, Washington: The caterpillar injuring lettuce was probably *Plusia simplex*; the one burrowing into the heads of summer cabbage and causing wilting and rot, was probably *Plusia brassicæ*. The *Plusias* may be killed by air-slaked lime, or by pyrethrum powder, or by hot water.

The plant-lice on cabbage, *Aphis brassicæ*, should be sprayed from the under side of the leaves with soapsuds.

The Clover-Hay Worm — *Pyralis Costalis* (Fabr.). (Country Gentleman, for May 4, 1893, lviii, p. 349, c. 1-3 — 70 cm.)

Appearance of the cocoons; diversity in its scientific designation; features of the *Pyralidæ*; description of the moth and of the caterpillar; injuries not reported from the insect in Europe; injuries recorded in the United States by Walsh; life-history as given by Riley; additional information by Prof. Webster; extent of its injuries to hay; feeds on timothy and possibly straw; preventives and remedies; farther study needed.

When to Spray. (Country Gentleman, for May 11, 1893, lviii, p. 368, c. 2 — 15 cm.)

In answer to inquiries from Brockport, N. Y.: Spray for the canker-worm with Paris green when the apple-tree buds are opening, again before blossoming. For the codling-moth, after the blossoms have fallen, and again a week or ten days later. For preventive of apple scab, spray with a solution of copper sulphate before growth starts, or with ammoniacal solution of copper carbonate. For pear-tree blight, spray with the last-named solution as the leaves begin to open, and repeat two or three times at intervals of two weeks. For quince-tree blight, same as preceding. A formula is given for an insecticide and fungicide combined.

Clover-Leaf Weevil. (Country Gentleman, for May 18, 1893, lviii, p. 386, c. 4 — 29 cm.)

Clover fields in Hillsboro, Va., injured by the clover-leaf weevil, *Phytonomus punctatus*. Imported from Europe; when first noticed; distribution; ravages arrested by fungus attack; indication of attack; habits, life-history and figures in the *Country Gentleman*, for May 29, 1889, in the Annual Report of the Department of Agriculture for 1881, and in the First Report on the Insects of New York. Two remedies: Plowing the field before the larvæ have matured; crushing the larvæ by going over the field after dark with a heavy roller.

Apple-Tree Borer. (Country Gentleman, for May 18, 1893, lviii, p. 387, c. 1 — 17 cm.)

Two pupæ sent from Fairlee, Md., found in the trunk of an apple-tree are those of the apple-tree borer, *Saperda candida* Fabr. *Chrysobothris femorata* (Fabr.) — also an apple-tree borer, is referred to. Probing the *Saperda* burrow with a wire is the remedy usually employed. A newspaper arranged according to directions given, around the base of the tree, is claimed to be an effectual preventive.

The Bud-Worm. (Country Gentleman, for May 18, 1893, lviii, p. 387, c. 1 — 14 cm.)

The best remedy known for the bud-moth [*Tmetocera ocellana*] is spraying with Paris green just as the buds begin to open. Paris green may be used in a stronger solution without injuring the opening buds, if combined with Bordeaux mixture, than if used alone. Bordeaux mixture would also ward off the very prevalent apple-scab.

A Danger to Apple Buds. (The New York Homestead, for May 25, 1893, xxvii, p. 236, c. 4 — 18 cm.)

The insect eating into the apple buds at Lancaster, N. Y., is the "bud-worm" of *Tmetocera ocellana*. Its injuries, appearance, and habits are given. Its rapid increase necessitates effort for its arrest. How and when the Paris green spray should be applied.

The Pear-Midge. (Albany Evening Journal, for May 30, 1893, p. 6, c. 5 — 8 cm.)

The pear-midge has made its appearance in Columbia and Greene counties in this State. When first observed; an introduced insect; nature of its injuries; preference for the Lawrence pear.

The Invasion of Plant-Lice in New York. (American Farmer, lxxiv, for June 1, 1893, p. 1, c. 4 — 28 cm.)

The apple-tree aphid, *Aphis mali*, is unusually abundant, apparently throughout the State. Importance of reducing it by spraying. The early rains do not seem to have materially diminished it. Anxiety of the hop-growers lest the conditions favorable to aphid multiplication this year should so increase the hop-vine aphid that its injuries of 1886 shall be repeated; they are urged to watch for its first appearance and at once spray for it. The "hop-washings" in England.

[See pages 426-429 of this Report (x).]

The Apple-Tree Aphid. (Country Gentleman, for June 8, 1893, lviii, p. 449, c. 2 — 15 cm.)

Replying to an inquiry from Seneca county, N. Y.: The aphid may occur on the opening buds without blighting the blossoms. Young aphides are destroyed by heavy rainfalls. Their multiplication may seriously impair fruit crops. Young apple trees may be killed by aphid attack. Importance of spraying to prevent injury just after the aphides have hatched.

Some Potato Pests. (Country Gentleman, for June 8, 1893, lviii, p. 449, c. 2, 3 — 18 cm.)

A "small black flea" perforating the leaves of potatoes in Scarsdale, N. Y., is the cucumber flea-beetle, *Crepidodera cucumeris*. Its food-plants and remedies.

Wire-worms and thousand-legged worm, *Julus ceruleocinctus*, referred to as operating on field potatoes. *J. ceruleocinctus* not the cause of the scab.—See *Country Gentleman*, for April 27, 1893, p. 329. Kainit given as a remedy for the thousand-legged worm. Wire-worms would not be killed by kainit unless applied in too expensive quantities.

A Greenhouse Pest. (Gardening, for June 15, 1893, i, p. 313, c. 1-3 — 61 cm.)

Reply made to a communication from Boise, Idaho, of flies injuring plants in a greenhouse:—The fly seems to be an undescribed species. It is one of the "midges" and belongs to the genus *Sciara*, and according to Mr. R. H. Meade, near to the European *S. nervosa*. Some of the flies, received in 1889 from a gentleman in Albany as injuring mushrooms, were sent to Mr. William Falconer. He states that "he had never regarded them as injurious to mushrooms, although there were thousands of them in the

mushroom cellars." Remedy, pyrethrum powder. The *Sciaræ* are numerous in species, both in this country and in Europe. Little careful study has been given them. Two species of *Sciara* — "the yellow-fever fly" and "the snake-worm" — are referred to.

[Extended in pages 397-399 of this Report (x).]

The Apple-Tree Aphis. (American Farmer, for June 15, 1893, lxxiv, p. 8, c. 6 — 41 cm.)

Whether the unusual abundance of aphides this year will prove destructive to fruit crops will depend largely on meteorological and other conditions that can not be foretold. Recent protracted rains have destroyed large numbers. Nursery trees are frequently killed by them. The apple-tree aphis is vulnerable to proper spraying during a few days of its life, just after hatching. The eggs can not be killed by the winter spraying formerly recommended. Kerosene emulsion, tobacco water, and soapsuds are the best insecticides for the apple aphis. How to kill the bud-worm of *Tmetocera ocellana*.

Immense Swarms of a Butterfly. (New York Homestead, for June 22, 1893, xxvii, p. 273, c. 1, 2 — 19 cm.)

Butterflies sent from Kansas, occurring in immense companies, are the milk-weed butterfly, *Danais Archippus* (Fabr.). It is noted for its congregating in millions for southern migration in September. Accounts by Thaxter, Dr. Hamilton, and Scudder of such assemblies. Its observation at Schoharie. Necessity for its migration southward. From its food-plants it is a harmless species.

A New Peach Insect. (Country Gentleman, for June 29, 1893, lviii, p. 508, c. 2 — 8 cm.)

A plant-bug sent from Brockport, N. Y., as having last year nearly destroyed a crop of peaches by making them rough and pithy, is *Pentatoma juniperina* (Linn.). It has not been previously reported as injurious to peaches, nor has anything been recorded of its habits by our writers.

[Extended in pages 430-432 of this Report (x).]

Caterpillar on Rye. (Country Gentleman, for June 29, 1893, lviii, p. 508, c. 2 — 10 cm.)

A caterpillar feeding on the heads of rye in several localities near Stone Ridge, N. Y., is that of one of the Noctuid moths, *Leucania albilinea* Hübner. In former years it has been destructive to wheat, rye and heads of timothy in Pennsylvania, Maryland, and Kansas. It has been called the "wheat-head army-worm." from its resemblance to the army-worm, *Leucania unipuncta*.

The Hellgrammite Fly. (Country Gentleman, for June 29, 1893, lviii, p. 508, c. 3 — 8 cm.)

Identification is made of the pupa of the hellgrammite fly, *Corydalus cornuta* (Linn.) from Cos Cob, Conn. Its transformations and some of its habits are given, with its principal features.

Ants on Fruit-Trees. (Country Gentleman, for July 6, 1893, lviii, p. 523, c. 1 — 19 cm.)

Ants occurring on fruit-trees are believed not to be injurious to the tree or fruit, but are attracted to feed on the "honey-dew" secreted by the infesting plant-lice or aphides. Two species often met with are *Camponotus herculeanus* (Linn.) and *Cremastogaster cerasi* (Fitch). The aphides cause the injury to the foliage; they may be killed by spraying the first that appear, before they find shelter in the curled leaves, with tobacco water, soapsuds, or kerosene emulsion.

[Extended in pages 365-369 of this Report (x).]

A New Grapevine Pest. (Country Gentleman, for July 6, 1893, lviii, p. 523, c. 1, 2 — 11 cm.)

In reply to a correspondent from North Carolina who writes of the habits and ravages of *Anomola marginata*, for the first time, on his grapevines, answer is made, that although the beetle is widely distributed over the southern part of the United States, it has not been recorded as injurious to the grape, except in a single instance, in Louisiana. Shaking them from the vines into a collector such as recommended by Prof. Smith for the collection of the rose-bug, is, perhaps, the best that can be done to reduce their number. Paris green might safely be used before the grapes begin to ripen.

[Extended on pages 411-413 of this Report (x).]

Ants on Peonies. (Country Gentleman, for July 6, 1893, lviii, p. 524, c. 1, 2 — 12 cm.)

Peonies in Albany thickly populated with black ants fail to give perfect blossoms. The ants are probably merely drawn to them to feed on the sweet secretion of the buds, or on the small insects that visit them — possibly an aphid, but no species is recorded as occurring on the peony. Ants have been seen to carry away small insect visitors of the peony which may have been injuring the blossoms. In Florida they are serviceable in preying on some of the smaller insect pests of the orange.

[See pages 368-369 of this Report (x).]

Three-lined Leaf-Beetle. (Country Gentleman, for July 6, 1893, lviii, p. 524, c. 2 — 9 cm.)

An insect destructive in gardens in Buffalo, N. Y., is identified as *Lema trilineata*, conspicuously marked with three black lines on its wing-covers, and belonging to the destructive family of *Chrysomelidae*. It is, at times, abundant, and often injurious to the potato crop. Remedies are, beating from the plant into water and kerosene, or spraying with Paris green.

A Useful Beetle. (Country Gentleman, for July 6, 1893, lviii, p. 524, c. 3 — 10 cm.)

A beetle (described) found in Albany in a box of Sicily lemons when opened, is the *Calosoma sycophanta*, of Europe, closely resembling our beautiful *Calosoma scrutator*. These *Carabidae* are serviceable in their

hunting for and feeding on injurious insects, coursing over the ground or climbing trees for their capture, whence they are known as "caterpillar hunters."

[The Angoumois Moth.] (Orange County Farmer, for July 6, 1893, xii, p. 4, c. 5—10 cm.)

Corn received from Dr. Collier of the New York State Agricultural Station—the seed from which it was grown said to have been received from Port Jervis, N. Y., and thought to have been infested, shows the work of the above-named insect, *Sitotroga cerealella* (Olivier). From the statement, it can not be determined where the corn became infested.

The remedy for the insect is the vapor of bisulphide of carbon in a close bin or vessel.

[The Wheat-Midge in Central New York.] (Albany Evening Journal, for July 10, 1893, p. 8, c. 9—9 cm.)

The wheat-midge is reported from Onondaga county, but not in numbers that threaten much harm, now that the wheat is already hardening. Attacks by the insect in 1884 and in 1854 in New York State are referred to, and also the injury it has been causing for several years in Nova Scotia.

The Wheat-Head Army-Worm. (Country Gentleman, for July 13, 1893, lviii, p. 539, c. 2—20 cm.)

Caterpillars which were sent from Chelton Hills, Pa., as being destructive to fields of timothy, are those of *Leucania albilinea*, noticed in the *Country Gentleman*, for June 28, p. 508, as "A Caterpillar on Rye." Also occurs on wheat. Abundant in the Western States. Not unusual in New York (*Fourth Report on the Insects of New York*, p. 56). Habits little known. Infested fields should be thoroughly plowed and raked over in the autumn.

The Zebra Caterpillar. (Country Gentleman, for July 13, 1893, lviii, p. 539, c. 2, 3—18 cm.)

The caterpillar feeding on the leaves and pods of pease in Albany, N. Y., is *Mamestra picta*. It is a general feeder on garden plants, preferring those of the *Cruciferae* and *Leguminosae*. The mature caterpillar is briefly described. It would be unsafe to apply arsenical poisons if the caterpillars eat into the pods. Picking them off by hand or shaking them from the vines would be a safer method.

Wheat-Weevil. (Country Gentleman, for July 13, 1893, lviii, p. 540, c. 2—6 cm.)

A wheat-bin infested with weevil the preceding year, might be fumigated, if tight, with sulphur. When attacking the wheat, the weevil may be killed with the vapor of bisulphide of carbon.

Ground-Beetle. (Country Gentleman, for July 13, 1893, lviii, p. 540, c. 2 — 8 cm.)

The grubs supposed to be killing watermelon plants by feeding on their roots, at Cheviot, N. Y., are one of the *Carabidae*, possibly a *Pterostichus*. It is quite improbable that their presence among the roots could have caused the death of the vines, as they are carnivorous—living on other insects. *Amara obesa*, also a carnivorous species, referred to.

Although "worms" were sent in the bottle, only one larva was contained in it when received.

Insect on Wistaria. (Country Gentleman, for July 20, 1893, lviii, p. 557, c. 2 — 17 cm.)

An insect occurring in abundance on Wistaria, in Cheviot-on-Hudson, is the two spotted tree-hopper, *Euchenopa binotata* (Say). It is described and the appearance of its egg-covering given. Spraying the young larvæ in May or early June with kerosene emulsion would arrest the attack. References to articles on it.

Maple-Tree Borer. (Country Gentleman, for July 20, 1893, lviii, p. 557, c. 1, 2 — 15 cm.)

Glycobius speciosus is identified, from Adams, N. Y., and its principal features and its serious injuries to maples given. A preventive is coating the trunk of the tree with soft soap and carbolic acid to prevent deposit of the eggs, and a remedy, cutting out the young larvæ.

Elm-leaf Beetle. (Country Gentleman for July 20, 1893, lviii, p. 558, c. 1 — 8 cm.)

The beetle is identified from New Britain, Conn., and references given to the principal articles upon it in the *Country Gentleman* for the past few years.

Water-Beetle. (Country Gentleman, for July 20, 1893, lviii, p. 558, c. 2 — 9 cm.)

Replying to inquiries from Geneva, N. Y., *Dytiscus Harrisii* (Kirby) is identified, and its marked features given and its habits. The insect may be harmful in feeding on the spawn of fishes and young fish. Its generic name refers to its facility in diving.

A Silk-Worm Moth. (Country Gentleman, for July 20, 1893, lviii, p. 558, c. 2, 3 — 12 cm.)

A moth drawn to an electric light in Albany is *Telea Polyphemus* (Cramer). From its large size it was named after the one-eyed giant, Cyclops, of mythology. Its cocoon is made of strong silk, but can not be reeled. Notice of the unsuccessful experiment of M. Trouvelot in cultivating the caterpillar at Medford, Mass., for utilizing the silk. In the notice of this experiment it was named the "American silk-worm."

Woolly Plant Louse. (Country Gentleman, for July 20, 1893, lviii, p. 558, c. 3—8 cm.)

An aphid infesting maple leaves in Red Bank, N. J., is *Pemphigus acerifolii* Riley—a rather rare species usually. From the downy secretion enveloping it, it is difficult to reach it with insecticides. A strong solution of whale-oil soap should be effectual in destroying it.

The Walnut Span-Worm. (Gardening, for August 15, 1893, i, p. 377, c. 2—8 cm.)

A "brown worm" infesting and injuring black walnut trees in Kansas City is probably *Boarmia plumigeraria* Hnslt—one of the Geometridæ. It has recently come into notice as a walnut-tree pest in some localities in the Western States. As yet no better remedy is known than spraying with Paris green or London purple in water.

How to Control the Squash-bug. (Gardening, for August 15, 1893, i, p. 377-8, c. 3, 1—16 cm.)

To inquiry from Lowell, Mass., answer is made that this pest may best be controlled by trapping and killing the hibernating individuals when they come abroad for oviposition, for which directions are given. Additional remedies are, destroying the eggs and newly-hatched bugs and protecting the stalks with a mixture of ashes and salt. A preventive is said to be ashes or dry earth with a few drops of spirits of turpentine, sprinkled over the plants.

Humming-Bird Moth. (Country Gentleman, for August 17, 1893, lviii, p. 634, c. 1—10 cm.)

Moths, the characteristic features of which are given, are identified as the *Sesia uniformis* of former authors. How they resemble humming-birds in their flight and manner of taking their food, is stated. [The species is now listed as *Hemaris Thysbe* var. *ruficaudus*.]

Bag-Worm. (Country Gentleman, for August 17, 1893, lviii, p. 634, c. 2—8 cm.)

A "cocoon" taken from a locust in Buckland, Va., is the case of the bag-worm or basket-worm, *Thyridopteryx ephemeræformis*—a common insect in the Southern States. Its case serves for larval protection, for pupation and oviposition—the female never leaving it. When injurious from abundance the caterpillars may be destroyed by hand-picking and burning or by spraying with Paris green and water.

Grain-Weevil. (Country Gentleman, for August 31, 1893, lviii, p. 674, c. 3—10 cm.)

For killing the weevil infesting bins of wheat of one thousand bushels each, in Williamsport, Ind., bisulphide of carbon is recommended for evaporation in open vessels on the top of the grain, using a pound and a half to each ton of grain if the bins are tight at sides and bottom. The operation of the "Tracy House," used for killing the bean-weevil, is described and suggested for use when large amounts of grain are to be treated for the weevil or other stored grain pests.

The Insects of the Past Year and Progress in Insect Studies. [Read before the Albany Institute April 15, 1890.] (Transactions of the Albany Institute, xii [August], 1893, pp. 227-240.)

Pages 227-229 treat of the injuries from the grain aphid (*Siphonophora avenae*) and of the hop aphid (*Phorodon humuli*), the prevalence of the apple-tree tent-caterpillar (*Clisiocampa Americana*) and the white-marked tussock-moth (*Orgyia leucostigma*), the unusual abundance of the forest tent-caterpillar (*Clisiocampa sylvatica*), *Otiiorhynchus ovalus*, and *Silvanus surinamensis* — which, together with several foot-notes, are in addition to the paper as published in the 7th *Report on the Insects of New York*, 1891, pp. 331-342.

The Cabbage Aphid. (Country Gentleman, for September 14, 1893, lviii, p. 717, c. 1, 2 — 29 cm.)

Aphis brassicae Linn. is one of the most difficult of the aphids to control by insecticides. Its mealy or powdery coating renders kerosene emulsion only partially effective. It has, however, been highly recommended for it by Prof. J. B. Smith and satisfactorily tested by him, as was also fish-oil soap — 1 lb. to 8 gallons of water, and also ground tobacco dust. How a liquid insecticide should be used against it. Soapsuds said to be efficient. Pyrethrum powder, also hot water recommended. If the eggs survive the winter on the leaves, destroying the stripped leaves ordinarily left in the fields would be very serviceable.

A Beetle Destroying Strawberry Plants. (Albany Evening Journal, for September 27, 1893, p. 1, c. 6 — 11 cm.)

A beetle eating innumerable holes in the leaves of strawberry plants, in Connecticut, is the *Paria aterrima*. The grub feeds on the roots and has been known as the strawberry-root worm. Its injury is new to the Eastern States. The remedy for it is the application of Paris green to the plants in August and September.

Plugging Trees with Sulphur. (Country Gentleman, for September 28, 1893, lviii, p. 753, c. 3, 4 — 35 cm.)

There is no virtue in sulphur placed in holes bored in trees and plugged, in preventing insects feeding on the foliage. It has proved valueless in experiments made for testing it. Where it has seemed to be successful, the apparent success may be otherwise explained. Sulphur is not soluble in sap, and even if it were it would be beyond the reach of the sap at the depth at which it is usually placed. Experiments made by Dr. Fitch apparently showed that sulphur, if it could be taken in the circulation, promoted the growth and health of the apple-tree tent-caterpillar. An Iowa fruit-grower testifies to the worthlessness of the "sulphur cure."

Black Blister Beetle Attack on Asters. (Gardening, for October 1, 1893, ii, p. 28, c. 3 — 16 cm.)

Insects sent from Illinois as destructive to asters, are *Epicauta Pennsylvanica* DeGeer. The method employed by the correspondent for killing them which proved so successful, viz., sprinkling the beetles with a fine spray and then applying pyrethrum powder, is probably as good a one as can be used, as this species is known to be readily affected by pyrethrum, and the wetting would cause the powder to adhere. Pyrethrum is only a contact insecticide. Some insects, as the rose-bug, are not killed by it.

The Clover-Seed Caterpillar. (Country Gentleman, for October 5, 1893, lviii, p. 773, c. 1, 2 — 20 cm.)

Clover-seed submitted from Miami county, Ind., much of which "has been hulled out like beans eaten by bugs" and left so light as "to blow away from the huller in cleaning," shows the work of the clover-seed caterpillar, *Grapholitha interstinctana* Clemens. Characters of the caterpillar and moth and life-history are given. Its limited literature and its known distribution. Cutting the clover in June will check its injuries.

Grasshopper Plague in New York. (Country Gentleman, for October 12, 1893, lviii, p. 793, c. 1-4 — 107 cm.)

New York State is exempt from the Rocky Mountain locust, *Melanoplus spretus*; *M. femur rubrum* and *M. atlantis* are the two destructive species of the Eastern States; injuries from them in New Hampshire, Maine, etc.; comparison of appearance and habits of the two; their operations in western counties of New York the present year; other associated species; present condition of the plague; will the insects abound next year? how to prevent their ravages, through destruction of eggs, plowing under, use of the hopperdozer and the bran-mash poison.

[See pages 439-445 of this Report (x).]

A Potato-Beetle Killer. (Orange County Farmer, for October 19, 1893, xiii, p. 1, c. 7 — 15 cm.)

A beetle sent as "the new potato-bug killer," of which sensational stories have appeared in many papers this year, is identified as *Lebia grandis*, one of the Carabidæ, and long known as an efficient destroyer of the potato-beetle. The instantaneous death resulting from its bite and its ferocity as narrated are, of course, imaginative.

Insect Pests. (Gardening, for November 15, 1893, ii, p. 77 — 14 cm.)

Of three species of insect larvæ sent for name from Medical Lake, Washington, and received in poor condition, only one—said to occur in great number on apple-trees—can be doubtfully identified, as *Sphinx drupiferarum*. Of one of the larvæ, feeding on rutabagas, the features are given.

On Arsenical Spraying of Fruit-Trees While in Blossom. (Insect Life, vi, 1893, pp. 181-185.)

It is still a question if the observed mortality of bees visiting sprayed blossoms is the result of the arsenic or some other cause or causes. The experiments of Professors Webster and Cook are cited. A satisfactory test would be the examination of the stomachs of bees believed to have been poisoned by the arsenic. Legislation in Ontario against spraying fruit-trees while in blossom. My arsenic blight the blossoms? Until the harmlessness of spraying at this time can be established it should be discontinued, but if harmless it should not be intermitted during the blossoming season, when several pests can be better controlled than at any other time. Seventeen species are named which are operating destructively at this time.

Eighth Report on the Injurious and Other Insects of the State of New York for the Year 1891. Albany, 1893. [Issued February 7, 1894.] Pages 218, figures 53. (Forty-fifth Annual Report on the New York State Museum for the Year 1891. Albany, 1892 [issued in February, 1894], pp. 103-320, figs. 53.)

The contents are: INTRODUCTORY. INJURIOUS INSECTS: *Synchlora glaucaria*, the Raspberry Geometer. *Bucculatrix Canadensisella*, the Birch-leaf *Bucculatrix*. *Diplosis pyrivora*, the Pear-midge. *Clastoptera obtusa*, the Obtuse *Clastoptera*. *Clastoptera pini*, the Pine *Clastoptera*. *Chauliodes pectinicornis*, the Comb-horned Fish-fly. *Corydalis cornuta*, the Horned *Corydalis*. NOTES ON VARIOUS INSECTS. *Thalassa lunator*, the Lunate Long-sting. ? *Janus flaviventris*, the Currant-stem Girdler. *Nematus Erichsonii*, the Larch Saw-fly. *Feniseca Tarquinius*, the little Orange Butterfly. *Eudryas grata*, the Beautiful Wood-nymph. *Scoliopteryx libatrix*, the Scallop-wing. *Exechia* species? a Fungus Gnat. *Telephorus?* *bilineatus*, occurring on snow. *Lachnosterna fusca*, the White-grub of the May-beetle. *Cyllene pictus*, the Hickory Borer. *Tenebrio molitor*, the Meal-worm. *Pulvinaria innumerabilis*, the Maple-tree Scale Insect. *Gryllus luctuosus*, the Common Black Cricket. *Trombidium locustarum*, the Locust Mite. INSECT ATTACKS -- THEIR REMEDIES AND PREVENTIVES. Remedies for the Peach tree Borer. An Ichneumonized Caterpillar. Interesting case of Parasitism. A New Onion Pest, *Agrotis ypsilon*. The Stalk-borer, *Gortyna nitela*, as an External Feeder. The Cow-horn Fly in New York. Wire-worms and Remedies for them. The Rose-bug and How to Kill it. The Maple-tree Borer, *Glycobius speciosus*. The Squash-bug, *Anasa tristis*. The Hop-vine *Aphis* and Remedies. The Melon *Aphis*, *Aphis cucumeris*. Melon and Strawberry Pests: *Aphis cucumeris* and *Corimelaena pulicaria*. Scale Insects on *Camellia* and *Oleander*. A Grapevine Scale Insect, *Lecanium* sp.? Apple-tree Insects of Early Spring. Some Injurious Insects of 1890. APPENDIX: (A) ENTOMOLOGICAL ADDRESSES. Some Injurious Insects of Massachusetts. Our Insect Enemies and How to Meet them. (B) PUBLICATIONS OF THE ENTOMOLOGIST DURING

1891. (C) PUBLICATIONS OF THE ENTOMOLOGIST FOR 1875 AND 1876. (D) Contributions to the Department. (E) CLASSIFIED LIST OF INSECTS NOTICED IN THIS REPORT. GENERAL INDEX.

Ninth Report on the Injurious and Other Insects of the State of New York, for the year 1892. Albany, 1893. [Issued March 2, 1894.] Pages 211, figures 34. (Forty-sixth Report on the New York State Museum, for the year 1892. Albany, 1892 [issued in March, 1894], pp. 289-495, figs. 34.)

The contents are: TRANSMITTAL. INJURIOUS INSECTS: *Anthrenus scrophulariæ* and *Attagenus piceus*, two Carpet Beetles. *Tenebrio obscurus*, the American Meal-worm. *Pollenia rudis*, the Cluster-fly. *Murgantia histrionica*, the Harlequin Cabbage-bug. *Psylla pyricola*, the Pear-tree *Psylla*. *Chortophaga viridifasciata*, the Green-striped Locust. NOTES ON VARIOUS INSECTS, etc. *Eriocampa cerasi*, the Cherry-tree or Pear-tree slug. *Papilio Cresphontes*, the Yellow-banded Swallow-tail. *Podosesia syringæ*, the Syringa Borer. *Carpocapsa pomonella*, the Codling-moth. *Dynastes Tityus*, as a Fruit-eater. *Crioceris asparagi*, the Asparagus Beetle. *Systema frontalis*, injuring Gooseberry Foliage. *Chauliognathus Pennsylvanicus*, the Pennsylvania Soldier-Beetle. *Pissodes strobi*, the White-pine Weevil. *Myzus cerasi*, the Cherry-tree Aphis. *Pemphigus tessellata*, the Alder-blight Aphis. *Phylloxera vitifoliæ*, the Grapevine *Phylloxera*. *Crangonyx mucronatus*, a Blind Shrimp in Wells. Insectivorous Birds for Protection. INSECT ATTACKS: Resistance of Fleas to Insecticides. White Grubs Injuring Nursery Stock. The White Grub Eaten by the Robin. A Maple-tree Pruner, *Elaphidion parallelum*. The Striped Cucumber Beetle, *Diabrotica vittata*. The Grape Curculio, *Craponius inæqualis*. The Peach-bark *Scolytus*, *Phlæotribus liminaris*. An unrecognized Attack on Pease. The Plum-tree Aphis, and the Brown Rot. The Currant Aphis, *Myzus ribis*. Aphides and Myriapods as Aster and Lily Pests. Some Apple-tree Insects. Beet Insects. Diseased Austrian Pines. APPENDIX. (A) CATALOGUE OF THE KNOWN HOMOPTERA OF THE STATE OF NEW YORK IN 1851. (B) ENTOMOLOGICAL ADDRESSES. (C) LIST OF PUBLICATIONS OF THE ENTOMOLOGIST. (D) PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1870-1874. (E) CONTRIBUTIONS TO THE DEPARTMENT. (F) CLASSIFIED LIST OF INSECTS NOTICED IN THIS REPORT. GENERAL INDEX.

Grubs Destroying Mermet Roses. (The Florist's Exchange, for February 10, 1894, vi, p. 176, c. 1 — 7 cm.)

Grubs working at the roots of Mermet roses belong to the "white grubs" and probably to the genus of *Lachnosterna*, the larvæ of which can not be specifically determined. When attacking single plants the roots may be partly uncovered and the grubs taken and destroyed. When this is not practicable, kerosene emulsion may be poured over the roots and followed by an application of water to carry it into the ground and reach the grubs.

A Maple-Tree Scale Insect. (Gardening, for March 15, 1894, ii, p. 206 — 18 cm.)

Silver maples in Maryland, brought three years ago from an eastern nursery and now seriously affected with a scale insect (no examples sent), are probably infested with the "maple-tree scale insect," *Pulvinaria innumerabilis* (Rathvon). The characters and habits of this species are given and the means of destroying it with kerosene emulsion at its hatching time. If it be some other species it could be destroyed by the same means, but would require examination with a magnifier to discover the vulnerable egg-hatching period. Mr. Wm. Falconer's experience with scale insects quoted.

The Rose Slug. (Gardening, for April 1, 1894, ii, p. 230 — 27 cm.)

A remedy is asked for destruction of roses by the rose slug, for the past two years in Tracy City, Tenn. The most simple remedy is dusting with heliobore or spraying with one ounce of the powder in one gallon of water, preferably after dark, when the slugs are feeding on the upper surface of the leaves. Mr. Howard's "spraying with cold water remedy" is given. Brief account of the common rose slug, *Monostegia roseæ*, and of two other species (sawflies) recently introduced from Europe, viz., the bristly rose worm, *Cladius pectinicornis* Four., and the curled rose worm, *Emphytus cinctus* (Linn.)

White Worms at the Roots of House-plants. (Gardening, for April 15, 1894, ii, p. 257, c. 2 — 7 cm.)

Strong mustard water applied will bring the worms to the surface of the ground where [they may be readily killed. Tobacco water or pyrethrum water will probably kill the worms. One ounce of corrosive sublimate to thirty gallons of water has been recommended, but it is too poisonous a substance for general use.

Apple Maggot — *Trypeta Pomonella*. (Country Gentleman, for May 3, 1894, lix, p. 349, c. 1, 2 — 40 cm.)

The small larvæ which destroy apples by tunneling them in every direction as described in an inquiry of name and remedy, from New Salem, N. Y., are the "apple maggot" of *Trypeta pomonella* Walsh. Figures of the insect in its different stages are given, as also its habits, etc. It is known to infest seventy varieties of apples. It can not be reached by spraying with insecticides. The best remedies are, destroying the infested fruit, and searching for and destroying the pupæ in bins and barrels. Where a valuable study and extended account of the insect may be found.

The Foe of Shade-Trees. (Albany Evening Journal, for May 7, 1894.)

Notice of the elm-tree bark-borer [*Saperda tridentata*] infesting shade-trees in Albany. How the borer works, and the best remedies to be employed for repelling egg-deposit or destroying the grubs.

The Cottonwood Beetle. (Syracuse Union, for May 9, 1894, p. 2, c. 1 — 44 cm.)

A beetle sent for determination, etc., as destroying acre after acre of basket-willows in the vicinity of Syracuse, is identified as *Lina scripta* (Fabr.). Has been destructive to cotton-woods in Western States, but not in the State of New York. Observed in Keene Valley feeding on willows. Description of the larva and beetle given. Nature of its injuries. May be controlled by spraying with Paris green. Force pumps that may be used.

[Extended in Ms. of Report (xi).]

The Insect that Kills the Pine-Tree Borers. (Gardening, for May 15, 1894, ii, p. 292, c. 2 — 8 cm.)

Clerus formicarius was brought over from Germany, by A. D. Hopkins, Entomologist of West Virginia Agricultural Experiment Station, at Morgantown, W. Va., and introduced into the pine forests of that State, to prey upon *Dendroctonus frontalis* and other Scolytid bark-borers that were rapidly destroying the pines and rendering them unfit for timber.

Probably White Grubs. (Country Gentleman, for May 17, 1894, lix, p. 386, c. 2 — 22 cm.)

“White worms about as large as a man’s little finger,” reported as destroying a lawn, from Oceanic, N. Y., are in all probability white grubs of the May beetle. It is difficult to stop their ravages in lawns and grass lands. The best method known to us is a liberal application of kerosene emulsion, to be followed by heavy waterings to carry the kerosene into the ground to reach and kill the grubs.

Grubs of the size above stated should mature and stop their injuries about the middle of the following month, preparatory to their pupation and change to beetles during the summer.—Benefit may be derived by placing lanterns over tubs of water and kerosene on the lawn, to attract and drown the beetles.

The Periodical Cicada, or the Seventeen-year Locust. Issued as a Circular of 4 pages, Albany, June 19, 1894.

Remarks on the interest attaching to this insect; the two races of *C. septendecim* and *C. tredecim*; the six broods in the State of New York, and particularly the Hudson river valley brood; transformations of the insect; remarkable above-ground chambers built by the pupæ in a locality at New Baltimore, N. Y., for purposes unknown. Figures of the chambers, and of the transformations and egg-laying referred to, given. Request made for replies to twenty questions proposed, relating to the present occurrence of the Cicada.

[See pages 420-425 of this Report (x).]

Pear-Leaf Blister Mite. (Country Gentleman, for June 21, 1894, lix, p. 468, c. 4 — 28 cm.)

Leaves of Kieffer pear-trees (other varieties not affected) sent from Hadonfield, N. J., show the attack of the above-named insect, *Phytoptus pyri*. The development of the gall is given, and features of the microscopic mite that causes it. The attack is rapidly spreading in New York and elsewhere. Picking off and destroying affected leaves in May is serviceable. The proper remedy is spraying with a strong kerosene emulsion (1 to 7) in winter. It can be controlled by this means.

[See pages 453-459 of this Report (x).]

Chestnut Weevil. (Country Gentleman, for July 5, 1894, lix, p. 504, c. 1 — 4 cm.)

From Westchester, Pa., a remedy is asked for the "chestnut worm." *Balaninus caryatrypes* is probably referred to. No remedy is known, unless perhaps one has been discovered by Mr. Gerald McCarthy of the N. C. Agricultural Experiment Station, who has been making special study of the insect.

Rose-Bugs. (Country Gentleman, for July 5, 1894, lix, p. 504, c. 1, 2 — 12 cm.)

The formula for the ammoniacal solution of copper is given in response to request, it having been represented as a remedy for the rose-bug. It will not be effective for this purpose if we may judge from experiments made by Dr. J. B. Smith. The mechanical devices recommended by Dr. Smith for collecting and destroying this insect should be used when it occurs in immense numbers, as in New Jersey.

Friendly Insects. (Country Gentleman, for July 5, 1894, lix, p. 504, c. 2 — 7 cm.)

Specimens from Nassau, N. Y., are identified as pupæ of the "twice-stabbed lady-bird," *Chilocorus bivulnerus* Muls. They are not injurious, but beneficial from their feeding on plant-lice or scale insects, and should, therefore, be protected.

Hellgrammite Fly. (Country Gentleman, for July 12, 1894, lix, p. 520, c. 2 — 3 cm.)

The insect, from Cornwall, N. Y., is identified as *Corydalis cornuta*, and its features given. Its larva is known to fishermen as "the dobson."

Plant-Lice at the Roots of Asters, etc. (Gardening, for July 15, 1894, ii, p. 358, c. 1 — 12 cm.)

Root-lice attacking asters, chrysanthemums and other plants at Dayton, Ohio, are probably *Aphis Middletonii* Thomas. For destroying them, drawing away the earth and applying soapsuds, tobacco water, pyrethrum water or hot water is recommended. The ants that attend them are harmless to the plants.

Ants in Strawberry Beds. (Country Gentleman, for August 2, 1894, lix, p. 568, c. 1 — 9 cm.)

The ants may be destroyed by the use of bisulphide of carbon as directed, if their nests or hills can be found; or, if occurring abundantly upon the plants, pyrethrum water or the dry powder may be used.

Grapevine Caterpillar. (Country Gentleman, for August 2, 1894, lix, p. 568, c. 1 — 8 cm.)

The caterpillar is that of *Thyreus Abbotii*; its distinguishing features are given, and its comparative abundance stated. The other caterpillar noticed on the grape — “looking like a snake, with the head of a frog” — is probably one of the long-bodied and sharp-headed “measuring worms” of the Geometridæ.

Enemies of the Potato Beetle. (Country Gentleman, for August 2, 1894, lix, p. 568, c. 2 — 6 cm.)

Replying to the question — what are the enemies of the potato beetle — the insect enemies alone are so many that a simple list of them would require much space. Papers on them may be found in the publications of Dr. Riley and Dr. Packard, and elsewhere.

Elm-Leaf Beetle. (Country Gentleman, for August 16, 1894, lix, p. 600, c. 2 — 6 cm.)

For the insect [elm-leaf beetle] killing the elm trees in Montclair, N. J., spraying the foliage with Paris green or London purple is recommended, and reference made to previous articles on the insect in the *Country Gentleman*, to be found in the indexes of the volumes.

The Above-Ground Buildings of the Seventeen Year Cicada. (New York Daily Tribune, for August 21, 1894, p. 12, c. 2 — 4 cm.)

Brief abstract of a paper read before the American Association for the Advancement of Science, at Brooklyn, N. Y., in which an account of the structures is given, and the mystery connected with their exceptional occurrence in localities in New York and New Jersey and the purpose that they served, noticed.

Worms destroying Canna Leaves. (Florist's Exchange, for September 8, 1894, vi, p. 788 — 12 cm.)

Caterpillars sent from Charleston, S. C., as destroying the foliage of cannas, are of two species. One has completed its transformations and given out the Hesperid butterfly, *Pamphila Ethlius* after a pupation of eleven days. The other, an Arctian, has spun up in cocoon and may be the common *Spilosophoma isabella*.

Sumac Galls. (Country Gentleman, for September 20, 1894, lix, p. 686, c. 1 — 13 cm.)

Galls (described) from Clinton, N. Y., result from the operations of an aphid, *Melaphis rhois* (Fitch). Its life-history is briefly given. The galls occur on *Rhus glabra* and *R. typhina*. Its former rarity in New York is noticed, and its occurrence also in some Western States.

The Box-Elder Plant-Bug. (Country Gentleman, for September 27, 1894, lix, p. 699, c. 2, 3 — 17 cm.)

An insect observed in abundance on the city sidewalks of Shenandoah, Iowa, judging from the description given of it, is the box-elder plant-bug, *Leptocoris trivittatus* (Say). It is a western insect long known as destructive to foliage and blossoms, which has lately developed a fondness for fruit. Means for its destruction are mentioned, and the principal features from which it can be recognized.

[See page 434 of this Report (x).]

A Beetle Feeding on Green Corn. (Country Gentleman, for September 27, 1894, lix, p. 701, c. 2 — 18 cm.)

A beetle sent from Hartford, Conn., found feeding in the tips of standing sweet corn during the month of August, is one of the Scarabæidæ, *Euphoria Inda* (Linn.). It has on different occasions been recorded as injurious to sweet corn while in the milk. It is not known if it commences the attack, or if it merely follows that of birds. Its injuries committed on ripe fruit, are referred to.

Muskmelon Borers at the South. (Country Gentleman, for October 4, 1894, lix, p. 721, c. 2-4 — 55 cm.)

Correspondents from Pendleton, S. C., and Asheville, N. C., are answered: there are two melon-boring caterpillars in the Southern States, destructive to crops—the one, *Eudiotis nitidalis* (Cramer), the other, *Eudiotis hyalinata* (Linn.). Their larval features are given, so far as known, and their feeding habits. To what extent each species operates in the Southern States, is not known. Remedies are suggested for their injuries, the efficiency of which must depend on a farther acquaintance with their life-histories. Some of the literature upon them is cited.

Pear Rust. (Country Gentleman, for October 4, 1894, lix, p. 722, c. 1, 2 — 16 cm.)

A pear received from Genesee county, N. Y., shows a "rust" upon its surface which is not a fungus. It nearly comports with the described features of the "orange rust" of Florida, caused by attack of the orange mite, *Typhlodromus oleivorus* Ashmead; and it is not improbable that this pear rust may be produced by a Phytoptus mite, which may prove to be, upon further observations and the detection of the mite, *Phytoptus pyri*, overflowing from the foliage upon the fruit.

“Pear Rust”—Cause Unknown. (Country Gentleman, for October 25, 1894, lix, p. 773, c. 3 — 12 cm.)

Further examination of a rusted pear submitted to Prof. Galloway, chief of the Division of Vegetable Pathology at Washington, renders it probable that the peculiar appearance of the fruit is but an unusual development of its natural rust — the cause of which is unknown.

The Indian Cetonia. (Gardening, for November 1, 1894, iii, pp. 55, 56, c. 3, 1 — 23 cm.)

Beetles which are thought to be killing a young pear-tree in White Plains, N. Y., by piercing the bark and extracting the sap, are the Indian Cetonia, *Euryomia* [*Euphoria*] *Inda*. The beetle is known to injure ripe fruits by eating into them and to be fond of the sap of the sugar-maple. The above report lends confirmation to a statement made many years ago, but questioned, that it gnawed the bark of young apple-trees for the sake of the sap.

The beetle also injures corn while in the milk by burrowing beneath the husks and eating the kernels. Little can be done to prevent its injuries, except “hand picking.” It is apparently local, and has its years of abundance.

Injurious Beetles. (Gardening, for November 1, 1894, iii, p. 56, c. 1, 2 — 22 cm.)

Of the two beetles sent from Detroit, Mich., for name, the one that occurs “in clusters on the trunks of the Norway maple” is thought by the sender to be destructive in the larval state by boring in the trunk of maple, beech, and birch. It is *Euryomia* [*Euphoria*] *Inda*, of which the early history is unknown. If it can be shown to be a borer of these trees, it would be an interesting discovery.

The other beetle seen “coming out of holes in the common maple” is the locust-borer, *Cyllene robinice* (Forster). It has no connection with the maple, and probably, from their resemblance, it has been confounded by the person sending it with the maple-tree borer, *Glycobius* [*Plagionotus*] *speciosus* (Say).

A Maple-Tree Borer. (Gardening, for November 1, 1894, iii, p. 56, c. 2 — 12 cm.)

A pupal-case from Millville, N. J., projecting from a maple-tree, is that of *Aegeria acerni* Clemens. In some localities in the Western States, it is very destructive to soft maples. Its egg-deposit may be prevented by white-washing the trunk, or by an occasional wash of soft soap.

The Squash-Bug. (Gardening, for November 1, 1894, iii, p. 56, c. 2, 3 — 11 cm.)

Remedies for the squash-bug, *Anasa tristis* (DeGeer), is asked for, from Convent Station, N. J.

The best remedies are believed to be, placing “traps” of bark, chips, etc., on the ground near the hills, and collecting the bugs that take shelter beneath them; and searching for and crushing the egg-clusters to be found on the under-side of the leaves.

Report of the State Entomologist to the Regents of the University of the State of New York, for the Year 1893. Albany, November, 1894. 26 pp.

Contains—Transmittal: Increasing Interest in the Work of the Department; Publications of the Entomologist: Additions to the State Collection: Collections Made in the Adirondack Mountains: Operations Against the Gypsy Moth in Massachusetts: The Destructive Wheat-midge in Western New York: Remarkable Appearance of Aphids or Plant-Lice: A Grasshopper Plague in Western New York: Insect Defoliators of Shade and Forest-Trees: APPENDIX: Index to Report for 1886.

[Included in part in this Report (x).]

The San José Scale. (Albany Evening Journal, for November 7, 1894, p. 6, c. 5 — 20 cm.)

The San José Scale, *Aspidiotus perniciosus*, is found in a pear orchard at Kinderhook, N. Y., where it had been introduced in nursery stock purchased in New Jersey two years ago. As soon as it was detected, the trees were taken up and burned, and it was hoped that it had been exterminated, but, unfortunately, other trees from the same source, received previously, were also infested. It is now found in abundance on these: they will also at once be taken up and burned.

This scale — seen in San José twenty years ago, — has also been introduced into Maryland and Virginia, and exists at least in one other locality in New York, viz., in nurseries on Long Island. Its successive broods, and fruit-trees on which it occurs, are stated.

“North Dakota’s New Bug.” (Country Gentleman, for November 22, 1894, lix, p. 841, c. 2, 3 — 32 cm.)

An insect, the appearance and habits of which are given in the Minneapolis Journal by a correspondent from Jamestown, North Dakota, is undoubtedly the box-elder plant-bug, *Leptocoris trivittatus* (Say) — the same as noticed in the *Country Gentleman* of September 29th. It has never before been recorded as appearing in such number. The object of these gatherings can not be accounted for. Its distribution throughout the western part of the United States is stated. That it has not extended eastward of the Mississippi River is strange, since its favorite food-plant on which it breeds, *Negundo aceroides*, is widely distributed throughout the eastern half of the United States. Reference is made to other notices of the insect.

[See page 435 of this Report (x).]

Experiment Station Work on Long Island. (American Agriculturist, for December 1, 1894, liv, p. 404, c. 1 — 3 cm.)

Letter in relation to the value of the work being done on Long Island through the Geneva Agricultural Experiment Station, as shown in the discovery of the San José scale in nurseries on the Island: the great importance of arresting its spread and accomplishing its extermination in its eastern occurrence.

Grubs in Manure. (Country Gentleman, for December 27, 1894, lix, p. 931, c. 4 — 18 cm.)

The "white grubs" found in manure, are not those of "the tumble-bug" as stated by a correspondent, nor of the May-beetle, but of another species allied to the latter, viz., *Ligyrrus relictus*. The food-habits of the two will distinguish *L. relictus* when found in manure. There need be no fear of using manure in which "white grubs" are found for field crops, as they can not be injurious to vegetation.

(D)

ENTOMOLOGICAL PUBLICATIONS OF J. A. LINTNER, 1862-1869.

Metamorphoses of *Ceratonia quadricornis* HARRIS. (Proceedings of the Entomological Society of Philadelphia, i, 1862, pp. 285-293) Also, separate, with cover and half-title page, December, 1862.

Oviposition; description of the egg; the larva in its first stage; the molting operation described; the second, third and fourth stages; time of molting; the fifth stage after the fourth molt; the mature larva; preparation for pupation; the pupal cell and its construction described; the final molt to the pupa; the pupa described; length of the seven stages; when the moth emerges; larval liability to being parasitized; features of the imago.

Notes on Some of the Diurnal Lepidoptera of the State of New York, with Descriptions of their Larvæ and Chrysalides. (Proceedings of the Entomological Society of Philadelphia, iii, 1864, pp. 50-64.) Also, separate, with cover and title page, May, 1864.

The following species are noticed: *Papilio Turnus* Linn., *Papilio Asterias* Fabr., *Papilio Troilus* Linn., *Pieris oleracea* (Harris), its three broods, *Colias Philodice* Godt., *Grapta comma* (Harris), *Grapta Faunus* Edw., *Grapta Progne* (Fabr.), *Grapta j-album* (Godt.), *Vanessa Antiopa* (Linn.), *Vanessa Milbertii* (Godt.), *Limenitis Arthemis* (Drury), *Limenitis disippus* (Godt.), *Pyrameis huntera* (Sm.-Abb.). Also, notes of capture of some of the Diurnals, with notes of comparative abundance.

Description of the Larva of *Dryocampa rubicunda* (Fabr.). (Proceedings of the Entomological Society of Philadelphia, iii, 1864, pp. 426, 427.)

The mature larvæ taken from sugar-maple is described.

Notes on some Sphingidæ of New York, with Descriptions of their Larvæ and Pupæ. (Proceedings of the Entomological Society of Philadelphia, iii, 1864, pp. 645-672.) Also, separate, with cover and title page, December, 1864.

Importance of the knowledge of the early stages of the Sphingidæ; *Sesia Thysbe* Fabr., its larva and pupa, with features of the several segments; *Sphinx quinquemaculata* Stephens, three varieties of the larva, and the pupa; *Sphinx cingulata*, the three larval varieties, and the pupa; *Sphinx* — ?

[*eremitus* (*Hüb.*)], larva and pupa; *Sphinx cinerea Harris*, larva, food-plants, pupa, imagoes and "assembling;" *Sphinx Kalmia Sm.-Abb.*; *Sphinx drupiferarum Sm.-Abb.*, larva, food-plants and pupa; *Philampelus satellitia* [P. *Pandorus (Hüb.)*], larva and pupa; *Philampelus Achemon (Drury)*, larva, pupa, and imago; *Deilephila Chamænerii Harris*, larva, pupa, imago; *Deilephila lineata (Fabr.)*, larva; *Darapsa Myron (Cramer)*, larva, pupa, imago; *Ceratomia quadricornis Harris* [*C. Amyntor (Hüb.)*], pupa; *Smerinthus excæcatus (Sm.-Abb.)*, larva, pupa; *Smerinthus* —? [*excæcatus*], larva, care of *Smerinthus* pupæ; *Smerinthus juglandis (Sm.-Abb.)*, larva, pupa; *Ellema Harrisii Clemens*, larva, pupa; *Sphinx larvæ* on poplar (*Notodonta dictæa (Linn.) = Pheosia rimosa Pack.*]; list of undescribed larvæ of N. Y. State Sphingidæ.]

A Hundred-fold Return for a Trifling Expenditure. (*Utica Morning Herald*, for May 11, 1866, 48 cm.)

The study of entomology in its utilitarian aspects commended; notices the growing appreciation of entomological investigations, and commending to the patronage of the public the *Practical Entomologist*, published at a nominal price by the Entomological Society of Philadelphia, with special reference to an article in it on a remedy for the Black-knot of plum and cherry-trees.

Description of a New Species of *Grapta*, and Notes on *G. interrogationis*. (*Transactions of the American Entomological Society*, ii, 1869, pp. 313-319.) Also, separate, May, 1869.

Description of *Grapta umbrosa*, and difference from *G. interrogationis*; compared, also, with *G. c-aureum* Fabr., of Europe.

[Subsequently shown, by breeding, to be a seasonal variety of *G. interrogationis* Fabr.]

(E)

CONTRIBUTIONS TO THE DEPARTMENT IN 1893.

The following are the contributions that have been made to the Department during the year 1893.

HYMENOPTERA.

Cluster of cocoons of *Apanteles congregatus* (Say) from a plum-tree. From JAMES WYNKOOP, Catskill, N. Y.

Thalessa atrata (Fabr.). From W. McALLISTER, Albany, N. Y. The same, taken from numbers ovipositing in a maple stump, June 29th; from G. R. HITT, Albany, N. Y. The same, July 10th; from P. F. MATTIMORE, Menands, N. Y.

LEPIDOPTERA.

Larva of *Thyreus Abbotii* Swainson, June 27th. From JAMES A. VAN HORN, Albany, N. Y. The same insect, from Mrs. E. B. SMITH, Coeymans, N. Y.

Larva of *Ampelophaga Myron* (Cramer), ichneumonized, September 4th. From JOHN T. ROBERTS, Syracuse, N. Y.

Ceratonia Amyntor (Hübner), imago, July 1st. From H. GUYER, Albany, N. Y.

The bag-worm, *Thyridopteryx ephemera-formis* (Haworth). From F. STRAUB, Burton, Texas.

Actias Luna (Linn.). From P. F. MATTIMORE, Menands, N. Y.

Larvæ of *Hadena turbulenta* (Hübner) feeding on catbrier (*Smilax*). From H. G. DYAR, New York city.

Larva of *Gortyna cataphracta* Grote, boring in raspberry cane, June 19th. From Prof. C. H. PECK, Menands, N. Y.

Larva of *Gortyna nitela* Guen., in dahlia stalk, July 17th. From PRICE & REED, Albany, N. Y.

Larvæ of *Leucania albilinea* Hübner, on heads of rye, June 18th. From C. C. HARDENBERGH, Stone Ridge, N. Y. The same, June 29th; from A. PARDEE, Jr., Chelton Hills, Pa.

Ephestia interpunctella Zeller. Moths emerging in a warm room, April 12th. From J. F. ROSE, South Byron, N. Y.

Larvæ of *Tmetocera ocellana* Schiff., nearly mature; and *Coleophora* sp. (probably *Fletcherella* — imago not yet obtained), from pear-trees, June 3d. From DAVID K. BALL, West Brighton, N. Y.

Cloverseed injured by larvæ of *Grapholitha interstinctana* Clemens, September 7th. From JOHN M. JENKINS, Miami Co., Ind.

The Angoumois moth, *Sitotroga cerealella* (Olivier), in wheat; from J. E. WITTMER, Montgomery Co., Pa. The same, in corn stored in a commission house; from H. R. WRIGHT, Albany, N. Y.

Cocoons of *Antispila nyssæfoliella* Clemens, within cuttings of leaves of *Nyssa multiflora* — the sour gum, together with some of the cut leaves. From H. G. DYAR, New York city.

Cocoons of *Bucculatrix pomifoliella* Clem., on apple twigs; from E. RUMLEY, Clyde, N. Y. The same, with numerous puparia of *Derostenus* sp. ?; from F. A. FITCH, Randolph, N. Y.

Cocoons of *Micropteryx pomivorella* Packard, from apple. From JAMES FLETCHER, Ottawa, Canada.

DIPTERA.

Galls of *Lasioptera vitis* O. S., on grapevine, June 27th. From GEORGE UHRIG, Hudson, N. Y.

Pears infested with the pear-midge, *Diplosis pyrivora* Riley, May 22d. From THEO. A. COLE, Catskill, N. Y.

Examples of *Sciara ca'daria* n. sp. infesting a greenhouse. From Mrs. G. Seaman, Boise, Idaho.

Larva of *Scenopinus fenestralis* (Linn.), from underneath a carpet, January 24th. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

Parasitized larvæ of *Eristalis tenax* (Linn.), August 31st; from J. F. ROSE, South Byron, N. Y. The same, from J. B. NAMES, Phœnix, N. Y.

The cluster-fly, *Pollenia rudis* (Fabr.), infesting a dwelling-house, August 31st. From WIRT D. WALKER, Pittsfield, Mass. Also, the same, from Mrs. E. B. SMITH, Coeymans, N. Y.

The chrysanthemum-fly, *Phytomyza chrysanthemi* Kowarz, mining leaves of Cinerarias in greenhouses of St. Vincent's Male Orphan Asylum, Albany, N. Y., February 13th. From JAMES O. FANNING, Albany, N. Y.

COLEOPTERA.

Dytiscus Harrisii Kirby, July 9th. From R. E. TAYLOR, Geneva, N. Y.

Examples of *Megilla maculata* (De Geer), April 19th, from a large hibernating colony underneath a wood-sorrel. From Mrs. C. H. WHEELER, Boston, Mass.

Epilachna borealis Thunb., July 17th. From O. W. SMITH, Meriden, Conn.

The rose-beetle, *Macroductylus subspinosus* (Fabr.), from apples, July 1st. From Hon. JAMES A. PLACE, Oswego, N. Y.

Euphoria melancholica (Gory), *Neoclytus erythrocephalus* (Fabr.), and *Donacia piscatrix* Lac. From L. N. GILLIS, Alexandria, Va.

Plagionotus speciosus (Say) — living imago, July 7th. From D. F. HARRIS, Delano, N. Y.

Monohammus confusor (Kirby), living imago, from 4th floor of the Capitol. From M. CASSIDY, Albany.

Pupæ of *Saperda candida* Fabr., May 8th. From J. R. MORDECAI, Fairlee, Md.

The strawberry weevil, *Paria aterrima* (Oliv.) — 7 examples of imago, feeding on strawberry leaves, September 13th. From S. B. HILL, Waterbury, Conn.

The elm-leaf beetle, *Galerucella xanthomelena* (Schrank) in egg, larva, and imago, July 12th. From THEO. A. STANLEY, New Britain, Conn.

Larvæ of the plantain flea-beetle, *Dibolia borealis* Chev., mining plantain leaves, June 19th. From C. L. SHEAR, Alcove, N. Y.

Bruchus obtectus Say, from beans stored in the pod in 1891. From Prof. F. L. HARVEY, State College, Orono, Me.

The oil-beetle, *Meloe angusticollis* Say, August 30th. From Mrs. H. D. GRAVES, Ausable Forks, N. Y. The same, from Mrs. E. B. SMITH.

Macrobasis unicolor (Kirby), feeding on egg-plant and potatoes, July 17th. From W. H. BENTLEY, Bull's Head, N. Y.

Otiorrhynchus ovatus (Linn.) — several examples from cabbage, August 17th. From R. J. DIMON, Hastings, N. Y., per Dr. P. COLLIER.

Larvæ of the punctured clover-leaf weevil, *Phytonomus punctatus* (Fabr.), from an infested clover field. From J. R. NEER, Hillsboro, Va. Same, from Mrs. E. B. SMITH, Coeymans, N. Y.

Larvæ of the quince curculio, *Conotrachelus cratægi* Walsh, and 3 of the imagos, October 8th. From T. C. MAXWELL BROS., Geneva, N. Y.

Lixus concavus Say. From Mrs. E. B. SMITH, Coeymans, N. Y.

The rice-weevil, *Calandra oryze* (Linn.) — the larva and imago in corn, September 11th. From E. C. BROWN & Co., Rochester, N. Y.

HEMIPTERA.

Pentatoma juniperina (Linn.), injuring peaches, June 14th. From GEORGE A. RICH, Brockport, N. Y.

The four-lined leaf-bug, *Pecilocapsus lineatus* (Fabr.), June 27th. From N. POMROY, Lockport, N. Y.; from Mr. HUNTING, Gallupville, N. Y.

The giant water-bug, *Belostoma Americanum* Leidy, taken from beneath ice in running water, January 18th. From ALLEN D. WADSWORTH, East Chatham, N. Y.

Enchenopa binotata (Say), from Wistaria, July 3d. From R. R. LIVINGSTON, Cheviot-on-Hudson.

Siphonophora sp.? on *Celastrus scandens*. From Miss J. A. LANSING, Albany, N. Y.

The apple-tree aphid, *Aphis mali* (Fabr.), abounding on apple-buds, May 8th. From J. J. BULLEN, Lincoln, N. Y.

Migrant from plum of hop-vine aphid, *Phorodon humuli* (Schränk), June 8th. From A. RICKARD, Middleburgh, N. Y.

Phorodon humuli (Schränk) — migrants and their first brood, from Otsego county; also a small hop-vine leaf of about one-fourth inch area, containing 25 migrants, from Munnsville, N. Y. From C. C. RISLEY, Chairman Hop-Growers' Association, Waterville, N. Y.

Larvæ, pupæ, and imago of pear-tree aphid: the same of quince-tree aphid, May 8th. From Prof. C. H. PECK, Menands, N. Y.

Pulvinaria innumerabilis Rathvon with its egg-masses, June 5th. From SYLVESTER GRIDLEY, Waterville, N. Y.

Lecanium hesperidum Linn., on fern; and *Mytilaspis pomorum* Bouché on *Cratægus oxyacantha*. From C. S. SHIELDS, State Normal School, Oswego, N. Y.

ORTHOPTERA.

The walking-stick, *Diaperomera femorata* (Say), October 8th. From ERNEST KUEHN, Albany, N. Y. The same, from THOMAS GRAYLES, Albany, N. Y.

Egg deposit in apple-twigs of probably *Ecanthus niveus* (DeGeer). From D. F. WOODRUFF, Fremont county, Colorado.

Amblycorypha oblongifolia (DeGeer). From Mrs. E. B. SMITH, Coeymans, N. Y.

NEUROPTERA.

Pupa of *Corydalis cornuta* (Linn.), June 16th. From J. C. LEONARD, Cos Cob, Conn. Living imago of the same, June 22, from HERBERT BOTHWELL, Albany, N. Y.

THYSANURA.

Lepisma sp. ? from papers in the Capitol. From Miss J. S. HOAG, Albany, N. Y.

ARACHNIDA.

Trichodectes sphaerocephalus Nitzsch, on wool of sheep. From J. B. NICHOLS & SON, Liberty, N. Y.

MYRIAPODA.

Julus caeruleocinctus Wood, from flower-beds. From WM. LETCHWORTH, Portage, N. Y.

(F)

CONTRIBUTIONS TO THE DEPARTMENT IN 1894.

HYMENOPTERA.

The large digger-wasp, *Sphecius speciosus* (Drury). From J. A. PAINE, Tarrytown, N. Y.

Pelecinus polyturator (Drury), Sept. 7th. From JOHN G. LINSLEY, Oswego, N. Y.; also from GEORGE R. HOWELL, Albany, N. Y.

Numerous larvæ of *Lophyrus Lecontei* Fitch, feeding on white pine, August 21st. From J. H. TEN EYCK BURR, Cazenovia, N. Y.

Examples of the wheat saw-fly, *Cephus pygmaeus* (Linn.). From Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y.

LEPIDOPTERA.

Larvæ (10) of *Papilio Asterius* Fabr., feeding on parsley. From WM. FALCONER, Glen Cove, L. I., N. Y.

Papilio Cresphontes Cramer — crippled examples and puparia, and *Sphinx kalmie* Sm.-Abb. From Miss J. A. LANSING, Albany, N. Y.

Amphion Nessus (Cramer) — imago, July 23d. From J. BYRNE, Cambridge, N. Y.

Ampelophaga Myron (Cramer), August 5th, parasitized by *Apanteles congregatus* (Say). From JULIUS S. LINSLEY, Oswego, N. Y.

Cocoons of *Orygia leucostigma* (Sm.-Abb.), abounding on apple-trees — one hundred on some trees in an orchard. From J. F. ROSE, South Byron, N. Y.

Actias Luna (Linn.) attracted to light, June 21st. From C. E. RIDER, Albany, N. Y. The same, from M. MANDLEBAUM, Albany, N. Y.

Telea Polyphemus (Linn.), June 14th. From P. M. VAN EPPS, Glenville, N. Y.

Many larvæ of the Pyralid, *Mecyna reversalis* Guenée, September 20th, feeding on *Genista* in a conservatory. From WM. FALCONER, Glen Cove, L. I., N. Y.

Larvæ and cases of *Phycis indiginella* Zeller, from apple, March 24th. From W. C. BRASS, Carlisle, Ark.

Larvæ of *Oxyptilus periscelidactylus* (Fitch) from tips of grapevine, May 24th. From WALTER F. TABER, Poughkeepsie, N. Y.

Larvæ of a Tortricid? (imago not yet obtained) feeding on pease in the pod, in Canada. From N. B. KEENE & SON, Leroy, N. Y.

Larvæ of *Caræcia rosana* (Linn.) in tied-up leaves of the strawberry, *Symphoricarpon racemosus*. From Miss J. A. LANSING, Albany, N. Y.

Larvæ of *Coleophora* sp. and *Tmetocera ocellana* (Schiff.) on apple twigs, May 29th. From W. A. LEFLER, Albion, N. Y.

DIPTERA.

Eggs of the pear-midge, *Diplosis pyrivora* Riley, in pear blossoms, May 10th. From Dr. JOHN B. SMITH, New Brunswick, N. J.

Many larvæ of *Phora agarici* n. sp., infesting "the new mushroom," *Agaricus subrufescens* Peck, October 5th. From WM. FALCONER, Glen Cove, L. I., N. Y.

The cluster-fly, *Pollenia rudis* (Fabr.), September 1st. From WIRT D. WALKER, Pittsfield, Mass.

Larvæ and pupæ of *Phorbia cilicrura* Rondani, July 12th, in seed potatoes. From JAMES D. McCANN, Elmira, N. Y.

COLEOPTERA.

Calosoma scrutator (Fabr.) and *Calosoma calidum* (Fabr.) and *Chelymorpha Argus* Licht. From Mrs. JORDAN, Greenbush, N. Y.

Buprestis fasciata Fabr., July 31st. From Mrs. E. C. ANTHONY, Gouverneur, N. Y.

The raspberry gouty gall-beetle, *Agrilus ruficollis* (Fabr.). From M. BROOKS, Athens, N. Y.

Copris anaglypticus Say, June 20th. From Prof. JAMES HALL, Albany, N. Y.

Examples of *Dichelonycha elongata* (Fabr.), June 14th, from mountain ash, *Pyrus Americana*. From RICHARD H. LAWRENCE, South Salem, N. Y.

Allorhina nitida (Linn.)—14 examples. From WM. FALCONER, Glen Cove, L. I., N. Y.

Euphoria Inda (Linn.), feeding on corn in the field, in August. From FRED STURGIS, Hartford, Conn. The same, feeding on the sap of trees: from E. BAYLEY, White Plains, N. Y.

Oak branches cut by *Elaphidion parallelum* (Newm.) From Mrs. G. W. RAINS, Newburgh, N. Y.

Branches of apple-tree, $\frac{3}{4}$ in. diameter, cut off by *Elaphidion* sp.
From M. BROOKS, Athens, N. Y.

Cyllene robinia (Foerst.), reported as emerging from the common maple — probably sent instead of *Plagionotus speciosus*. From Mrs. M. F. MENDELL, Detroit, Mich.

Plagionotus speciosus (Say). From W. S. EGGLESTON, Mt. Riga, N. Y.

Monohammus confusor Kirby, June 25th. From FRANCIS STARR, Albany, N. Y.

Monohammus scutellatus (Say). From ROBERT LENOX BANKS, Albany, N. Y.

Lema trilineata (Olivier). From W. H. HARRISON.

Crioceris asparagi (Linn.) and *Crioceris 12-punctata* (Linn.), May 2d, from asparagus beds at Brighton. From SILAS J. ROBBINS, Brighton, Monroe Co., N. Y.

Examples of the cottonwood leaf-beetle, *Lina scripta* (Fabr.), devastating osier willows near Syracuse, N. Y., May 4th. From A. LANDBERG, Syracuse, N. Y.

Galerucella xanthomelena (Schrank), from the garret of a dwelling-house on Long Island, May 7th. From Dr. J. W. HALL, New York city.

Chelymorpha Argus Licht., June 6th, from a mangel-wurzel field. From JOHN PIGEON, Saugerties, N. Y.

The oil-beetle, *Meloe angusticollis* Say, October 8th. From JESSE PARKER, Albany, N. Y.

Macrops indistinctus Dietz, September 13th, reared from a larva in root of celery. From F. A. SIRRIE, Jamaica, L. I., N. Y.

A strawberry-weevil, *Anthonomus* sp., July 15th. From H. STEWART, Highlands, N. C.

Larvæ of the chestnut-weevil, *Balaninus ?caryatrypes* Bohe., September 30th. From J. A. LOCHNER & Co., Albany, N. Y.

The grain-weevil, *Calandra granaria* Linn. From Mrs. S. A. LITTLE, Malcom, N. Y.

HEMIPTERA.

Eggs, pupa, and imagos of *Anasa tristis* (DeGeer), August 14th. From Dr. H. C. COON, Alfred, N. Y.

Acholla multispinosa DeGeer, occurring on peach-trees, May 8th. From MALCOM LITTLE, Malcom, N. Y.

Belostoma Americanum Leidy and *Cicada tibicen* Linn., July 30th. From N. POMROY, Lockport, N. Y.

Above-ground chambers of the 17-year Cicada, *Cicada septendecim* Linn. From H. VAN SLYKE, New Baltimore, N. Y. The same (3) from near Poughkeepsie; from HENRY S. CURTIS, Poughkeepsie, N. Y. The same, from Bath-on-Hudson, near the rifle range; from W. H. COLEMAN, Albany, N. Y. The same (37), from New Baltimore, N. Y., from W. W. BYINGTON, Albany, N. Y. The same (9), from South Mountain, near Nyack; from BENJAMIN LANDER, Nyack, N. Y.

Above-ground chamber of *Cicada septendecim* L., collected by Prof. J. S. NEWBERRY from a cellar in Rahway, N. J., in 1877. From Prof. DANIEL S. MARTIN, Rutgers Female College, New York.

Above-ground chambers (2) of *Cicada septendecim* race *tredecim*, Brood xviii, 1894, from the valley of the North Fakens, Knox Co., Missouri. From JASPER BLINE, per W. H. Coleman.

Many pupa cases of *Cicada septendecim* L., from the Rural Cemetery at Menands, in May. From W. H. COLEMAN, Albany, N. Y.

Pupæ and imagos of *Cicada septendecim* L. From M. BROOKS, Athens, N. Y.

Cicada tibicen Linn. From D. F. HARRIS, Adams, N. Y.

Eggs of pear-tree Psylla, *Psylla pyricola* on Bartlett pear twigs, April 23d, and pupæ in May. From M. BROOKS, Athens, N. Y.

The pine-leaf scale-insect, *Chionaspis pinifoliae* Fitch. From B. KEMPER, Muscatine, Iowa.

The scurfy bark-louse, *Chionaspis furfurus* (Fitch), encrusting twigs of *Cydonia Japonica*, in Arlington, N. J. From A. H. STRATTON, New York city.

Mytilaspis pomorum Bouché, on crab apple; from J. T. ROSE, South Byron, N. Y. The same, on an apple, September 13th; from ROMEYN B. HOUGH, Lowville, N. Y. The same, on lilac; from Miss MARY L. VAN ORDEN, Catskill, N. Y. The same, on apple, from P. D. COOKINGHAM, Pleasant Plains, N. Y.

The gloomy scale, *Aspidiotus tenebrosus* Comstock, occurring on maple. From C. R. MORE, Bird's Nest, Va.

The pernicious scale, *Aspidiotus perniciosus* Comstock, from pear-tree. From L. L. MORRELL, Kinderhook, N. Y.

Lecanium juglandis Bouché, occurring on plum twigs in May. From W. C. BARRY, Rochester, N. Y.; from C. M. HOOKER, Rochester, N. Y., and from Prof. C. H. PECK, Menands, Albany county, N. Y.

Lecanium Fitchii Signoret, occurring in clusters on blackberry canes, June 1st. From Prof. C. H. PECK, Menands, N. Y.

The magnolia scale, *Lecanium tulipifera* Cook. From J. W. ALLIS, Rochester, N. Y.

Lecanium sp.? on oak. From ELLWANGER & BARRY, Rochester, N. Y.

Asterolecanium quercicola Bouché, on oak. From Mrs. GEORGE W. RAINS, Newburg, N. Y.

Gossyparia ulmi Geoff., in abundance on elm twigs. From GEORGE T. POWELL, Ghent, N. Y.

ORTHOPTERA.

Egg deposit of white flower cricket, *Æcanthus niveus* (DeGeer) in raspberry cane. From Dr. H. C. COONS, Alfred, N. Y.

The walking stick, *Diaperomera femorata* (Say). From JESSE PARKER, Albany, N. Y. The same, from C. R. HELLER, Albany, N. Y.

Larva of the mole cricket, *Gryllotalpa borealis* Burm., with a fungus growing from its middle. From Mrs. M. W. WELCH, Lake Comfort, N. C.

THYSANURA.

Examples of *Schoturus nivicola* (Fitch), from myriads occurring on trunks of pear-trees, April 13th. From EDWIN C. POWELL, Ghent, N. Y.

Therinobia furnorum (Prov.), (= *Lepisma domestica* Packard) from flour barrels. From JOHN FONDA, Albany, N. Y.

MYRIAPODA.

Juvidæ — species not determined, injurious to tobacco plants. From J. R. LOWE, Big Flats, N. Y.

CRUSTACEA.

Crangonyx mucronatus Forbes — an eyeless shrimp drawn from a driven well. From FRANK M. SIMONS, Ingleside, N. Y.

MISCELLANEA.

Vespa vulgaris Linn., *Pelecinus polyturator* Drury, *Papilio Turnus* Linn., *Deilephila lineata* (Fabr.), *Agrotis herilis* Grote, *Agrois subgothica* Haw., *Leucania unipuncta* (Haw.), *Hematopis grataria* (Fabr.), *Eristalis tenax* (Linn.), *Anasa tristis* (DeGeer), *Euschistus fissilis* Uhler, *Cicada tibicen* Linn., *Cicada septenlecim* Linn., *Gastroidea polygoni* (Linn.), *Lachnosterna fusca* (Frohl.), *Amblycorypha oblongifolia* (DeGeer). From Mrs. EMILY B. SMITH, Coeymans, N. Y.

(G)

CLASSIFIED LIST OF INSECTS NOTICED IN
REPORTS I-X.

HYMENOPTERA.

- Cladius viminalis* *Fallen*, the poplar saw-fly.
Nematus Erichsonii *Hartig*, the larch saw-fly.
Nematus salicis-pomum *Walsh*, the willow-apple gall saw-fly.
Monostegia ignota (*Norton*), the strawberry slug.
Eriocampa cerasi (*Peck*), the cherry-tree or pear-tree slug.
Cephus pygmæus (*Linn.*), the wheat saw-fly.
Phyllæcus flaviventris (*Fitch*), the currant stem girdler.
Urocerus Cressoni *Norton*, Cresson's horn-tail.
Tremex columba (*Linn.*), the pigeon Tremex.
Amphibolips prunus (*Walsh*), the oak-plum gall Cynips.
Cryptus mundus *Provancher*.
Hemiteles thyriderigis *Riley*.
Limneria fugitiva (*Say*).
Rhyssa persuasoria (*Linn.*), an European long-sting.
Thalessa atrata (*Fabr.*), the black long-sting.
Thalessa lunator (*Fabr.*), the lunated long-sting.
Thalessa Nortoni *Cresson*, Cresson's *Thalessa*.
Pimpla conquisitor (*Say*).
Pimpla inquisitor (*Say*).
Lampronota frigida *Cresson*, a parasite on the vagabond Crambus.
Sigalphus curculionis *Fitch*, a curculio parasite.
Apanteles congregatus (*Say*).
Microgaster gelechiæ (*Riley*).
Alysia manducator *Panzer*.
Chalcis flavipes *Fabr.*
Catolaccus species, an Angoumois moth parasite.
Perilampus violaceus *Dalm.*
Isosoma captivum *Riley* MS.
Isosoma grande *Riley*, the large joint-worm fly.

- Isosoma hordei* (*Harris*), the joint-worm fly.
Isosoma tritici *Riley*, the wheat *Isosoma*.
Isosoma vitis *Saunders*, the grape-seed midge.
Torymus species, parasitic on *Cecidomyia betulæ*.
Encyrtus bucculatricis *Howard*.
Semiotellus chalcidiphagus *Walsh*.
Pteromalus gelechiæ *Webster*, parasitic on the Angoumois moth.
Pteromalus sp? from bag-worms.
Tridymus species, parasitic on *Lasioptera vitis*.
Cirrospilus flavicinctus *Riley*.
Entodon species, parasitic on *Cecidomyia betulæ*.
Derostenus sp.? parasitic on the apple-leaf *Bucculatrix*.
Tetrastichus species, parasitic on *Cecidomyia betulæ*.
Trichogramma pretiosa *Riley*, egg-parasite of currant saw-fly.
Camponotus herculeaneus (*Linn.*), the large black ant.
Formica nigra *Linn.*, the black ant.
Monomorium carbonarium *Smith*.
Monomorium molestum (*Say*), the little yellow ant.
Cremastogaster cerasi (*Fitch*), the cherry-tree ant.
Solenopsis geminata (*Fabr.*).
Pemphredon concolor *Say*, a wood wasp.
Eumenes fraternus *Say*, the fraternal potter wasp.

LEPIDOPTERA.

- Danais Archippus* (*Fabr.*), the milkweed butterfly.
Heliconia Charitonia (*Linn.*).
Pyrameis Atalanta *Linn.*, the red admiral.
Thecla strigosa *Harris*, the striped *Thecla*.
Feniseca Tarquinius (*Fabr.*), the little orange butterfly.
Pieris rapæ *Linn.*, the cabbage butterfly.
Papilio Cresphontes *Cramer*, the yellow-banded swallow-tail.
Nisoniades Icelus *Lintn.*
Nisoniades Somnus *Lintn.*
Nisoniades Persius *Scudd.*
Nisoniades Petronius *Lintn.*
Nisoniades Propertius *Scudd-Burg.*
Nisoniades Nævius *Lintn.*
Eudamus Electra *Lintn.*
Eudamus Nevada *Scudd.*
Eudamus Proteus (*Linn.*).

- Thyreus Abbotii Swains.*
Ampelophaga Myron (Cramer), the green grapevine Sphinx.
Protoparce celeus Hubn., the five-spotted Sphinx.
Sphinx Canadensis Boisd. the Canadian Sphinx.
Smerinthus geminatus Say, the twin-spotted Sphinx.
Melittia ceto Westw., the squash-vine borer.
Podosesia syringæ (Harris), the Syringa borer.
Sannina exitiosa (Say), the peach-tree borer.
Alypia octomaculata (Fabr.), the eight-spotted forester.
Eudryas grata (Fabr.), the beautiful wood-nymph.
Pyrrharetia isabella (Sm.-Abb.), the black-and-red woolly-bear.
Halisidota caryæ (Harris), the hickory tussock caterpillar.
Ocneria dispar (Linn.), the gypsy-moth.
Orgyia leucostigma (Sm.-Abb.), the white marked tussock-moth.
Lagoa opercularis (Sm.-Abb.), the rabbit-moth.
Phobetron pithecium (Sm.-Abb.), the hag-moth.
Thyridopteryx ephemeraformis Haworth, the bag or basket-worm.
Ædemasia concinna (Sm.-Abb.), the red-humped apple caterpillar.
Actias Luna (Linn.), the Luna moth
Eacles imperialis (Drury), the pine emperor moth.
Anisota senatoria (Sm.-Abb.), the senatorial oak-moth.
Dryocampa rubicunda (Fabr.), the rosy Dryocampa.
Hemileuca Maia (Drury), the Maia moth.
Clisiocampa Americana Harris, the apple-tree tent-caterpillar.
Clisiocampa sylvatica Harris, the forest tent-caterpillar.
Tolyte laricis (Fitch), the larch lappet.
Heteropacha Rileyana Harvey.
Cossus centerensis Lintn., the poplar Cossus.
Cossus querciperda Fitch, the oak Cossus.
Zeuzera pyrina (Fabr.), the leopard-moth.
Agrotis clandestina (Harris), the W-marked cut-worm.
Agrotis saucia (Hübner), the variegated cut-worm.
Agrotis ypsilon (Rott.), the black cut-worm.
Agrotis species, cut-worms.
Mamestra grandis (Boisd.), a poplar feeding cut-worm.
Mamestra picta Harris, the zebra cabbage caterpillar.
Hyppa xylinoides Guenée.
Nephelodes violans Guenée, the bronze-colored cut-worm.
Gortyna cataphracta Grote, the raspberry-cane borer.
Gortyna immanis (Guen.), the hop-vine grub.

- Gortyna nebris* *Guenée*.
Gortyna nitela *Guenée*, the stalk-borer.
Leucania unipuncta (*Haw.*), the army worm.
Scoliopteryx libatrix (*Linn.*), the scallop-wing.
Aletia agillacea *Hüb.*, the cotton-worm.
Plusia cultus *Lintn.*
Plusia dyaus *Grote*.
Plusia brassicæ *Riley*, the cabbage *Plusia*.
Heliothis armiger *Hüb.*, the corn-worm.
Catocala nubilis (*Hüb.*).
Erebus odora (*Linn.*).
Homoptera lunata (*Drury*).
Nematocampa limbaria (*Walk.*).
Synchlora glaucaria (*Guenée*), the raspberry Geometer.
Zerene catenaria *Cramer*.
Eubyia cognataria (*Guenée*).
Anisopteryx vernata (*Pech*), the spring canker-worm.
Anisopteryx pometaria *Harris*, the fall canker-worm.
Eudiotis hyalinata (*Linn.*), the melon-worm.
Eudiotis nitidalis (*Cramer*), the pickle-worm.
Crambus vulgivagellus *Clemens*, the vagabond *Crambus*.
Crambus exsiccatus *Zeller*, the dried *Crambus*.
Cacœcia rosaceana *Harris*, the oblique-banded leaf-roller.
Cacœcia argyrospila (*Walker*), the V-shaped Tortrix.
Tortrix fumiferana *Clem.*, the spruce-bud worm.
Penthina nimbatana (*Clemens*), the rose-leaf tyer.
Tmetocera ocellana (*Schiff.*), the eye-spotted bud-moth
Phoxopteris nubeculana (*Clem.*), the apple-leaf sewer.
Carpocapsa pomonella (*Linn.*), the codling-moth.
Carpocapsa saltitans *Westw.*, the jumping-seed moth.
Mellisopus latiferreana *Wlsm.*
Tinea pellionella (*Linn.*), the clothes-moth.
Incurvaria acerfoliella (*Fitch*), the maple-leaf cutter.
Pronuba yuccasella *Riley*, the *Yucca* moth.
Sitotroga cerealella (*Olivier*), the Angoumois moth.
Anarsia lineatella *Zeller*, the peach-twig moth.
Coleophora Fletcherella *Fern.*, the apple case-bearer.
Coleophora malivorella *Riley*, the apple-tree case-bearer.
Tischeria malifoliella *Clem.*, the apple-leaf miner.
Bucculatrix Canadensisella *Chamb.*, the Canadian *Bucculatrix*.
Bucculatrix pomifoliella *Clemens*, the apple-leaf *Bucculatrix*.

DIPTERA.

- Pulex irritans* *Linn.*, the common flea.
Cecidomyia balsamicola *Lintn.*, the balsam *Cecidomyia*.
Cecidomyia destructor *Say*, the Hessian-fly.
Cecidomyia leguminicola *Lintn.*, the clover-seed midge.
Cecidomyia sp.?, within a jumping gall.
Diplosis pyrivora *Riley*, the pear midge.
Diplosis tritici (*Kirby*), the wheat midge.
Lasioptera vitis *O. S.*, the grapevine gall midge.
Sciara caldaria *Lintn.*, the green-house *Sciara*.
Sciara coprophila *Lintn.*, the manure-fly.
Sciara mali (*Fitch*), the apple midge.
Sciara militaris *Now*, the "snake-worm."?
Sciara Thomæ (*Linn.*), the "snake-worm."?
Sciara species, the fungus gnats.
Epidapus scabies *Hopkins*, the potato-scab gnat.
Exechia sp., a fungus gnat.
Simulium molestum *Harris* MS., the black-fly.
Bibio albipennis *Say*, the white-winged *Bibio*.
Anopheles quadrimaculatus *Say*, the winter mosquito.
Chironomus nivoriundus *Fitch*, the snow-born midge.
Trichocera brumalis *Fitch*, the mid-winter *Trichocera*.
Scenopinus fenestralis (*Linn.*).
Promachus Fitchii *Ost.-Sack*.
Erax rufibarbis *Macq.*
Microdon globosus (*Fabr.*).
Helophilus latifrons (*Loew*).
Mallota posticata (*Fabr.*).
Spilomyia fusca *Loew*.
Hypoderma bovis (*De Geer*), the ox warble-fly.
Cutereba emasculator *Fitch*, the emasculating bot-fly.
Hæmatobia serrata *R. Desv.*, the cow-horn fly.
Pollenia rudis (*Fabr.*), the cluster-fly.
Lucilia macellaria *Fabr.*, the "screw-worm."
Hylemyia deceptiva *Fitch*, the deceptive wheat-fly.
Phorbia ceparum (*Meigen*), the onion-fly.
Phorbia cilicrura (*Rondani*), the locust-egg *Anthomyian*.
Phorbia floccosa (*Macq.*).
Anthomyia brassicæ *Bouché*, the cabbage-fly.
Anthomyia radicum *Linn.*, the root-fly.
Anthomyia raphani *Harris*, the radish-fly.

- Anthomyia similis* *Fitch*, the similar wheat-fly.
Anthomyia zææ *Riley*, the seed-corn fly.
Pegomyia betarum (*Linln.*), the beet-fly.
Pegomyia vicina *Linln.*, a beat-leaf miner.
Trypeta longipennis *Wied.*
Trypeta pomonella *Walsh*, the apple-maggot
Drosophila ampelophila *Loew*, the pickled-fruit fly.
Drosophila sp., a flour-paste fly.
Meromyza Americana *Fitch*, the wheat-stem maggot.
Chloropisca prolifica *Osten-Sacken*, the prolific Chlorops.
Phytomyza chrysanthemi *Kowarz*, the marguerite-fly.
Phytomyza nigricornis *Macq.*
Phora agarici *Linln.*, the mushroom *Phora*.

COLEOPTERA.

- Calosoma calidum* (*Fabr.*), the fiery caterpillar hunter.
Bembidium quadrimaculatum (*Linn.*).
Harpalus caliginosus (*Fabr.*).
Aleochara anthomyiæ *Sprague*.
Phalacrus politus *Mels.*, in wheat.
Megilla maculata *De Geer*, the spotted lady-bird.
Hippodamia convergens *Guer.*, the convergent lady-bird.
Adalia bipunctata (*Linn.*), the two-spotted lady-bird.
Harmonia picta *Rand.*, the painted lady-bird.
Anatis ocellata (*Linn.*), the fifteen spotted lady-bird.
Chilocorus bivulnerus *Muls.*, the twice-stabbed lady-bird.
Epilachna borealis (*Fabr.*), the northern lady-bird.
Vedalia cardinalis *Muls.*
Læmophlæus alternans *Erich.*
Dermestes lardarius *Linn.*, the bacon-beetle.
Dermestes vulpinus *Fabr.*, a leather-beetle.
Attagenus piceus (*Oliv.*), the black carpet-beetle.
Anthrenus scrophulariæ (*Fabr.*), the carpet-beetle.
Lathridius ruficollis *Marsh.*
Elateridæ species, wire-worms.
Alaus ocellatus (*Linn.*), the owl-beetle.
Agriotes mancus *Say*, the wheat wire-worm.
Melanotus communis (*Gyll.*).
Limonius confusus *Le Conte*.
Cebrio bicolor (*Fabr.*).

- Agrilus anxius* Gory, the willow *Agrilus*.
Agrilus ruficollis (Fabr.), the raspberry gouty-gall beetle.
Chauliognathus Pennsylvanicus (De Geer), Pennsylvania soldier-beetle.
Chauliognathus marginatus (Fabr.), the margined soldier-beetle.
Telephorus bilineatus (Say), the two lined soldier-beetle.
Trichodes Nuttalli Kirby.
Thanasimus dubius (Fabr.).
Ptinus brunneus Duftsch.
Ptinus quadrimaculatus Mels.
Sitodrepa panicea (Linn.), a leather-beetle.
Sinoxylon basulare Say, the red-shouldered *Sinoxylon*.
Amphicerus bicaudatus (Say), the apple-twig borer.
Polycaon confertus Lec.
Lyctus opaculus Lec.
Aphodius fimetarius (Linn.), a dung-beetle.
Aphodius inquinatus (Herbst.), a dung-beetle.
Macroductylus subspinosus (Fabr.), the rose-bug.
Lachnosterna fusca (Fröhl.) and congeners, the white grubs.
Lachnosterna tristis (Fabr.).
Anomala lucicola (Fabr.), the light-loving grapevine beetle.
Anomala marginata (Fabr.), the margined *Anomala*.
Dynastes Hyllus Chev.
Dynastes Tityus (Linn.), the Rhinoceros beetle.
Allorhina nitida (Linn.), the fig eater.
Euphoria Inda (Linn.), the Indian Cetonia.
Orthosoma brunneum Forst.
Hylotrupes bajulus (Linn.)
Chion cinctus (Drury), the banded *Chion*.
Elaphidion parallelum Newm., the oak-pruner.
Cyllene robiniae (Foerst.), the locust borer.
Cyllene pictus (Drury), the hickory borer
Plagionotus speciosus (Say), the maple-tree borer.
Xylotrechus colonus (Fabr.).
Psenocerus supernotatus (Say).
Monohammus confusor (Kirby), the long-horned pine-borer.
Saperda candida Fabr., the round-headed apple-tree borer.
Saperda tridentata Oliv., the common elm-tree borer.
Oberea bimaculata (Oliv.), the raspberry-cane girdler.
Lema trilineata (Olivier), the three-lined leaf-beetle.
Crioceris asparagi (Linn.), the asparagus beetle.

- Crioceris 12-punctata* *Linn.*, the 12-spotted asparagus beetle.
Chrysochus auratus (*Fabr.*), the golden Chrysochus.
Typophorus canellus (*Fabr.*).
Doryphora decemlineata (*Say*), the Colorado potato-beetle.
Diabrotica 12-punctata (*Oliv.*), the 12-spotted Diabrotica.
Diabrotica vittata (*Fabr.*), the striped cucumber beetle.
Trirhabda Canadensis (*Kirby*).
Galerucella luteola (*Mull.*), the elm-leaf beetle.
Haltica bimarginata (*Say*), the alder flea-beetle.
Haltica chalybea *Illig.*, the grapevine flea-beetle.
Crepidodera rufipes (*Linn.*), the red-footed flea-beetle.
Orthaltica copalina (*Fabr.*).
Phyllotreta vittata (*Fabr.*), the striped flea-beetle.
Systema frontalis (*Fabr.*).
Systema tæniata (*Say*), the broad-striped flea-beetle.
Dibolia borealis *Chev.*, a plantain leaf miner.
Odontata dorsalis *Thunb.*
Coptocycla bicolor *Fabr.*, the golden tortoise beetle.
Coptocycla clavata (*Fabr.*), the clubbed tortoise beetle.
Bruchus Chinensis *Linn.*, a southern pea weevil.
Bruchus lentis *Boheman*, the lentil weevil.
Bruchus obtectus *Say*, the bean weevil.
Bruchus rufimanus (*Boheman*), the European bean weevil.
Tenebrio obscurus *Fabr.*, the American meal-worm.
Tenebrio molitor (*Linn.*), the meal-worm.
Tribolium ferrugineum (*Fabr.*).
Hymenorus obscurus (*Say*).
Meloe angusticollis *Say*, the oil-beetle.
Macrobasis unicolor (*Kirby*), the ash-gray blister-beetle.
Epicauta vittata (*Fabr.*), the striped blister-beetle.
Epicauta cinerea (*Forst.*), the margined blister-beetle.
Epicauta Pennsylvanica (*De Geer*), the black blister-beetle.
Pomphopœa Sayi *Le Conte*, Say's blister-beetle.
Otiorhynchus ovatus (*Linn.*), the ovate snout-beetle.
Otiorhynchus singularis *Linn.*
Otiorhynchus sulcatus (*Fabr.*).
Aramigus Fulleri (*Horn*), Fuller's rose-beetle.
Phytonomus punctatus (*Fabr.*), the punctured clover-leaf weevil.
Pissodes strobi (*Peck*), the white-pine weevil.
Pachylobius picivorus (*Germ.*).
Lixus concavus *Say*.

- Tachypterus quadrigibbus* (*Say*), the apple curculio.
Coccotorus scutellaris *Lec.*, the plum gouger.
Anthonomus signatus *Say*, the strawberry weevil.
Conotrachelus nenuphar (*Herbst*), the plum curculio.
Conotrachelus crataegi *Walsh*, the quince curculio.
Craponius inæqualis (*Say*), the grape curculio.
Trichobaris trinotata (*Say*), the potato-stalk weevil.
Sphenophorus caryosus (*Oliv.*).
Sphenophorus robustus *Horn*.
Sphenophorus sculptilis *Uhler*, the sculptured corn curculio.
Calandra oryzae (*Linn.*), the rice weevil.
Calandra granaria (*Linn.*), the grain weevil.
Monarthrum mali (*Fitch*), the apple-tree bark-beetle.
Xyleborus dispar (*Fabr.*), the pear-blight beetle.
Tomicus sp? a balsam-fir bark beetle.
Tomicus typographus (*Linn.*).
Scolytus rugulosus (*Ratz.*), the wrinkled Scolytus.
Polygraphus rufipennis (*Kirby*), the spruce-bark beetle.
Phloeotribus liminaris (*Harr.*), the peach-bark Scolytus.
Hylesinus opaculus *Lec.*, the elm-bark beetle.
Dendroctonus rufipennis (*Kirby*).
Crypturgus pusillus *Gyll.*
Brachytarsus variegatus (*Say*).

HEMIPTERA.

- Corimelaena pulicaria* *Germ.*, the flea-like negro-bug.
Podisus cynicus (*Say*).
Podisus modestus *Dallas*.
Podisus spinosus (*Dallas*), the spined soldier-beetle.
Cosmopepla carnifex (*Fabr.*).
Lioderma ligata (*Stall*).
Pentatoma juniperina (*Linn.*), the juniper plant-bug.
Murgantia histrionica (*Hahn.*), the Harlequin cabbage-bug.
Leptoglossus oppositus (*Say*).
Anasa tristis (*De Geer*), the squash-bug.
Leptocoris trivittatus (*Say*), the box-elder plant-bug.
Blissus leucopterus (*Say*), the chinch-bug.
Pyrrhocoris californiensis *Falle* v.
Largus succinctus (*Linn.*), the margined Largus.
Dysdercus suturellus *Her.-Sch.*, the cotton-stainer.

- Lygus invitus* (*Say*), the contrary plant bug.
Lygus pratensis (*Linn.*), the tarnished plant-bug.
Pæcilocapsus lineatus (*Fabr.*), the four lined leaf-bug.
Acanthia lectularia (*Linn.*), the bed-bug.
Corythuca arcuata (*Say*).
Corythuca ciliata (*Say*), the ciliated Tingis.
Phymata Wolfii *Stal.*, "an ugly bee-slayer."
Prionidus cristatus (*Linn.*), the nine-pronged wheel-bug.
Sirthenia carinata (*Fabr.*).
Rasahus biguttatus (*Say*).
Melanolestes abdominalis (*Her.-Sch.*).
Melanolestes picipes (*Her.-Sch.*), the black cor-air.
Conorhinus sanguisugus *Le Conte*, the "blood-sucking cone-nose."
Opsicætus personatus (*Linn.*), the bed-bug hunter.
Belostoma Americanum *Leidy*, the giant water-bug.
Cicada septendecim *Linn.*, the seventeen-year Cicada.
Cicada tredecim *Riley*, the thirteen-year Cicada.
Cicada tibicen (*Linn.*), the harvest-fly.
Ceresa bubalus (*Fabr.*), the buffalo tree-hopper.
Ptyelus lineatus (*Linn.*), the lined spittle-hopper.
Clastoptera obtusa (*Say*), the alder spittle-insect.
Clastoptera pini *Fitch*, the pine *Clastoptera*.
Enchenopa hinotata (*Say*), the two-marked tree-hopper.
Typhlocyba rosæ (*Harris*), the rose-leaf hopper.
Typhlocyba vitis (*Harris*), the grapevine leaf-hopper.
Psylla buxi *Linn.*, the box *Psylla*.
Psylla pyricola *Foerster*, the pear-tree *Psylla*.
Chermes pinicorticis (*Fitch*), the pine-bark *Chermes*.
Pemphigus imbricator (*Fitch*), the beech-tree blight aphid.
Pemphigus tessellata (*Fitch*), the alder-blight aphid.
Colopha ulmicola (*Fitch*), the cockscomb elm-gall aphid.
Aphis brassicæ *Linn.*, the cabbage aphid.
Aphis cucumeris *Forbes*, the melon aphid.
Aphis mali *Fabr.*, the apple-tree aphid.
Aphis Middletonii *Thomas*, the aster-root aphid.
Aphis prunifoliæ *Fitch*, the plum-tree aphid.
Siphocoryne pastinacæ (*Linn.*), the parsnip aphid.
Myzus cerasi (*Fabr.*), the cherry-tree aphid.
Myzus ribis (*Linn.*), the currant aphid.
Megoura solani *Thomas*, the potato aphid.
Phorodon humuli (*Schrank*), the hop-vine aphid

- Siphonophora granaria* (*Kirby*), the grain aphid.
Phylloxera vitifoliae (*Fitch*), the grapevine *Phylloxera*.
Icerya Purchasi *Maskell*, the cottony-cushion scale.
Dactylopius destructor *Coms.*, the destructive mealy-bug.
Dactylopius longifilis *Coms.*, the long-threaded mealy-bug.
Pulvinaria innumerabilis (*Rathv.*), the maple-tree scale-insect.
Lecanium sp., a grapevine scale-insect.
Aspidiotus nerii *Bouché*, the white scale.
Chionaspis furfurus (*Fitch*), the scurfy bark-louse.
Chionaspis pinifoliae (*Fitch*), the pine leaf scale-insect.
Mytilaspis pomorum (*Bouché*), the apple-tree bark-louse.

PHYSOPODA.

- Heliothrips hæmorrhoidalis* *Bouché*
 Thrips species.

ORTHOPTERA.

- Grylotalpa borealis* *Burm.*, the mole cricket.
Gryllus luctuosus *Serv.*, the doleful cricket.
Cecanthus niveus *Harris*, the white-flower cricket.
Microcentrum retinervis (*Burm*), the angular-winged katydid.
Melanoplus atlantis (*Riley*), the lesser migratory locust.
Melanoplus femur-rubrum (*De Geer*), the red-legged grasshopper.
Melanoplus spretus (*Uhler*), the Rocky Mountain locust.
Chortophaga viridifasciata (*De Geer*), the green-striped grasshopper.
Mantis Carolina *Linn.*, the Carolina Mantis.
Mantis religiosus *Linn.*, the *Prie-Dieu*.
Diapheromera femorata (*Say*), the walking-stick.
 Blattidæ, cockroaches.
Ectobia Germanica (*Fabr.*), the Croton-bug.

NEUROPTERA.

- Chauliodes pectinicornis* (*Linn.*), the comb-horned fish-fly.
Chauliodes rasticornis *Ramb.*, the tooth-horned fish-fly.
Chauliodes serricornis *Say*, the saw-horned fish-fly.
Corydalis cornuta (*Linn*), the horned *Corydalis*.
 Chrysopa species, lace-winged flies
Dendroleon obsoletum (*Say*), a climbing ant-lion.
Myrmeleon immaculatus (*De Geer*), the spotless *Myrmeleon*.
Bittacus pilicornis *Westw.*, the hairy-horned scorpion-fly.
Bittacus strigosus *Hagen*, the striped scorpion-fly.

- Panorpa communis* *Linn.*, the common scorpion-fly.
Panorpa maculosa *Hagen*, the spotted scorpion-fly.
Panorpa nematogaster *McLachl.*, a Java scorpion-fly.
Panorpa rufescens *Ramb.*, the rufescent scorpion-fly.
Boreus brumalis *Fitch*, the mid-winter Boreus.
Boreus nivoriundus *Fitch*, the snow-born Boreus.

PSEUDONEUROPTERA.

- Capnia pygmæa* (*Burm.*), the small snow-fly.
Nemoura nivalis *Fitch*, the large snow-fly. The shad-fly.
Clothilia pulsatoria *Linn.*, the death-watch.
Atropos divinatoria (*O. Fabr.*), the divining Atropos.
Psocus sp? from *Bucculatrix*.
Psocus venosus *Burm.*
Hexagenia bilineata (*Say*).
Ephemera natata *Walker*.
Ephemera sp?, a May-fly.
Cænis nigra *Hagen* MS.

THYSANURA.

- Campodea fragilis* *Meinert*.
Smynthurus hortensis *Fitch*, the garden-flea.
Achorutes purpurescens (*Lubbock*).
Schoturus nivicola (*Fitch*), "the snow-flea."
Aphorura armata *Tullberg*.
Anurida maritima *Guerin*.

ARACHNIDA.

- Tetranychus telarius* (*Linn.*), the red-spider.
Trombidium locustarum *Riley*, the locust mite.
Bryobia pratensis *Garman*, the clover mite.
Dermanyssus avium *Dugès*, the chicken-louse.
Gamasus obovatus *Lintner*, associated with *Julus* in potatoes.
Uropoda Americana *Riley*, the Colorado potato beetle mite.
Ixodes bovis *Riley*, the cattle tick.
Tyroglyphus Lintneri *Osborn*, a tomato-infesting mite.
Tyroglyphus longior (*Gervais*), a mite in smoked meat.
Tyroglyphus phylloxerae (*Plan.-Riley*), the phylloxera mite.
Tyroglyphus siro (*Linn.*), the cheese mite.
Rhizoglyphus rostroerratus (*Mégnin*), a mushroom mite.
Heteropus ventricosus *Newport*, the ventricose mite.

Phytoptus ?persicæ, a peach-tree Phytoptus.

Phytoptus phlæocoptes *Nalepa*, a plum-tree Phytoptus.

Phytoptus pyri (*Scheuten*), the pear-leaf blister mite.

MYRIAPODA.

Julus cæruleocinctus *Wood*, the blue-banded Julus.

Polydesmus complanatus (*Linn.*).

Thousand-legged worms.

Cermatia forceps (*Raf.*), a household centipede.

CRUSTACEA.

Crangonyx mucronatus *Forbes*, an eyeless fresh-water shrimp.

VERMES.

Anguillulidæ, eel-worms.

Gordius linearis,	} hair-worms or hair-snakes.
Gordius robustus,	
Gordius varius,	

Syngamus trachealis, the gape-worm.

(H)

ERRATA (ADDITIONAL) IN PRECEDING REPORTS.*

Additional Errata in First Report.

- Page 40, line 14, for *Sylvanus* read *Silvanus*.
Page 42, line 23, for Tenthredinidæ read Tenthredinidæ.
Page 156, line 4 from bottom, for *pinifolice* read *pinifoliella*.
Page 227, lines 15 and 16 from bottom, for p. 682 *et seq.*, read pp. 477-484.
Page 264, line 5, for 183 read 1834.
Page 263-269, for *Pentatomoide* read *Pentatomoidea*.
Page 272, line 2, for *ribes* read *ribis*.
Page 297, line 5 from bottom, for *togata* read *tergata*.
Page 300, line 14, for *Telamone* read *Telamona*.
Page 302, line 4, for 264 read 254.
Page 314, last line, for *Cyniphidæ* read *Cynipidæ*.
Page 330, line 11, for *fuscata* read *fuscatus*.
Page 330, line 2 from bottom, for ix read x.
Page 331, line 2, for *aculifer* read *aculiferus*.
Page 343, line 14 from bottom, for *marcellaria* read *macellaria*.

Additional Errata in Second Report.

- Page 23, line 13 from bottom, for *Ampelophila* read *Drosophila*.
Page 57, line 19, for 487 read 497.
Page 125, line 11, for *Sciari* read *Sciara*.
Page 146, line 23, for *Euschistes* read *Euschistus*.
Page 152, line 32, for *Cimex lectularia* read *C. lectularius*.
Page 166, line 14 from bottom, for *Euchetes* read *Euchætes*.
Page 180, line 1, for Fitch read (Fitch).
Page 207, lines 19 (and under figures), for *purpurascens* read *purpurescens*.
Page 213, line 5 from bottom, for *Corydalis* read *Corydalis*.
Page 241, line 2 from bottom, for *Anophales* read *Anopheles*.

Errata in Third Report.

- Page 116, line 5, for *Anaitis* read *Anatis*.
Page 138, line 16 from bottom, for NUTTALI read NUTTALLI.
Page 140, line 9, for chalcid *Copodosoma truncatella* read chalcid *Copidosoma truncatellum*.
Page 140, line 17, for *Irus* read *strigosa*.
Page 141, line 7, for *fusciventris* read *fasciventris*.
Page 144, line 6, for *picivorous* read *picivorus*.
Page 153, line 23, for *Euschistes* read *Euschistus*.
Page 153, line 24, for *Phyllira* read *Phyllira*.

* If desired, the errata may be inserted as slips in the respective Reports.

Additional Errata in Fourth Report.

- Page 50, lines 3, 8, 12, 13, 20, for *definata* read *definita*.
 Page 67, line 23, for Daniels read Daniell.
 Page 71, lines 19 and 20, for auxiliary read first.
 Page 72, lines 17 and 40, for Wager read Waga.
 Page 73, line 6, after p. 152 add (of Synop. Br. Ins.).
 Page 104, bottom line, for oack read bark.
 Page 137, line 6, for *hypophleas* read *hypophleas*.
 Page 139, line 9, for *Cramer* read (*Cramer*).
 Page 151, line 9, for 41, 44 read 41-44.
 Page 180, line 18 from bottom, for *Periplanata* read *Periplaneta*.
 Page 197, line 14 from bottom, for *Tenthridine* read *Tenthredine*.
 Page 206, line 2, for *crocataria* read *crocataria*.
 Page 207, line 16 from bottom, for *vestata* read *vestita*.
 Page 208, line 8 from bottom, for *obtusa* read *obtrusa*.
 Page 483, line 5, for *crocataria* to *crocataria*.

Additional Errata in Fifth Report.

- Page 193, line 2, for *Adolecephala* read *Adelocephala*.
 Page 199, line 7 from bottom, for *Ceratocampade* read *Ceratocampide*.
 Page 245, line 25, for *quadrinota* read *quadrinotata*.
 Page 266, line 15, for *pinifolii* read *pinifolie*.
 Page 268, line 22, for *fraterna* read *fraternus*.
 Page 271, line 4 from bottom, for *Blaphar-* read *Blephar-*.
 Page 300, line 9 from bottom, for *Chrysomelide* read *Bruchide*.
 Page 303, line 17, for *Tachus* read *Tachys*.
 Page 303, line 18, for *Homolota* read *Homalota*.
 Page 320, last line, for *hyalinatalis* read *hyalinata*.

Additional Errata in Sixth Report.

- Page 120, line 2 from bottom, for Henshaw read Dimmock.
 Page 146, line 22, precede with — it and.
 Page 151, lines 11 and 15, *longipennis* and *Columbia* are the same.
 Page 170, line 25, for *Anthomonus* read *Anchomonus*.
 Page 188, line 19, for *confusor* read *confusus*.

Additional Errata in Seventh Report.

- Page 229, line 24, for *abbreviatella* read *abbreviata*.
 Page 325, line 10 from bottom, for *Periplanata* read *Periplaneta*.
 Page 334, line 12, for *pygmeus* read *pygmeus*.
 Page 360, line 12 from bottom, for Oliv. read (Oliv.).
 Page 367, lines 28 and 29, for *Cuterabra* read *Cuterebra*.
 Page 69, line 10, for *Amblycomorpha* read *Amblycorypha*.
 Page 382, line 24, for *Cuterabra* read *Cuterebra*.
 Page 334, line 18, for *Amblycomorpha* read *Amblycorypha*.

Additional Errata in Eighth Report.

- Page 106, line 29, for *C. pyrivora* read *D. pyrivora*.
Page 163, dele last line.
Page 167, line 12, for *pygmeus* read *pygmæus*.
Page 238, line 8 from bottom, for *Masicora* read *Masicera*.
Page 275, line 12, for *Chalciddie* read *Chalcidide*.
Page 289, line 3, for *definata* read *definita*.
Page 291, lines 3 and 8 from bottom, for *Deshaiziana* read *Deshaisiana*.
Page 298, line 6, for *Helophilus* read *Hydrophilus*.
Page 300, line 12 from bottom, for *Chlosops* read *Chlorops*.

Additional Errata in Ninth Report.

- Page 296, line 7, for *pelargium* read *pelargonium*.
Page 296, line 14, for *Garpocapsa* read *Carpocapsa*.
Page 313, line 14, for *Chlorops* read *Chloropisca*.
Page 450, line 11, for *Gonopteryx* read *Gonoptera*.
Page 455, line 4 from bottom, for *Lecontii* read *Lecointei*.
Page 461, line 13, for *Xylocapa* read *Xylocopa*.

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ERRATA FOR REPORT X.

- Page 349, line 27, for gasoline read gas-line.
Page 436, line 2 from bottom, after Dakota, insert South Dakota, Idaho.
Page 480, line 10, for fourth and fifth read third and fourth.
Page 483, line 5, for crocatoria read crocataria.
Page 494, line 18 from bottom, for *ruficaudus* read *ruficaudis*.
Page 515, line 8, for *Lecontii* read *Lecontei*.
Page 524, line 6, for cultus read culta.
Page 529, line 8 from bottom, for histronica read histrionica.
Page 537, line 16, dele the line.
Page 542, line 3, c. 2, for maizil read maizi [tessellata].
Page 544, line 25 from bottom, c. 2, for [variegatus] read , of Europa.
Page 545, line 16 from bottom, c. 2, for persicæ-nigra read persicæ-niger.
Page 546, c. 2, dele lines 10, 11, 27, and in line 34, fasciatus, x, 486.
Page 558, line 23, c. 2, for viii, 187 read viii, 298.
Page 562, line 25 from bottom, c. 1, for [Kermes] read [Chermes].
Page 564, line 9, c. 2, for Systera read Systema.
Page 567, line 4, c. 1, for Daimia read Daimio.
Page 567, line 31, c. 1, dele Ip. on hickory.
Page 568, line 27 from bottom, c. 2, for Therluobia read Thermobia.
Page 569, line 8, c. 2, for 141-150, read 141, 150.
Page 570, bottom line, for Entodon read Entedon.
Page 574, line 24, c. 2, dele [Evoxycoma].
Page 577, line 18 from bottom, c. 2, for Therinobia read Thermobia.
Page 578, line 24, c. 2, before 493 insert x.
Page 602, line 14, for pastinacæ read pastinacæ.
Page 604, line 8 from bottom, c. 2, for pilisicollis read pilosicollis.
Page 607, line 6 from bottom, for leucostigmia read leucostigma.
Page 622, line 23 from bottom, c. 2, before 497 insert x.
Page 632, line 30, for Sitodrepa read Sitodrepa.
Page 632, bottom line, before Phymata insert Wolffil.

ADDITIONAL ERRATA IN PRECEDING REPORTS.

- Report 1, page 57, line 20 from bottom, for tiers read tyers.
Report 1, page 326, line 5, for *Daimia* read *Daimio*.
Report 1, page 351, line 31, for Cockchaffer read Cockchafer.
Report 1, page 362, line 31, c. 2, for marcellaria read macellaria.
Report 2, page 255, line 7 from bottom, c. 2, for 180 read 184.
Report 3, page 138, line 7 from bottom, for DACTOLYPIUS read DACTYLOPIUS.
Report 3, page 194 (of index) line 27, c. 1, dele rubicunda.
Report 3, page 196 (of index) lines 22 and 23 from bottom, read rubicunda, Dryocampa.
Report 4, page 154, line 8 from bottom, for *tamariscis* read *tamarisci*.
Report 4, page 226, line 13, c. 2, for ovinus read bovinus.
Report 4, page 232, line 14 from bottom, for *basilis* read *basalis*.
Report 6, page 176, line 22, and in index, for pilisicollis read pilosicollis.
Report 7, page 371, line 9, and in index, for *Daimia* read *Daimio*.
Report 9, page 426, line 2 from bottom, and in index, for *fulvipes* read *fusciceps*.

Reports of Entomologist of the State of New York.—Continued.

Seventh Report on the Injurious and Other Insects of the State of New York. Made to the Regents of the University, Pursuant to Chapter 355 of the Laws of 1883. Albany: James B. Lyon, State Printer. 1891. Pages 211 (195-405), figures 40. Also as Report of the State Entomologist for the year 1890; in the Forty-fourth Annual Report, New York State Museum, for the year 1890. 1892. Pages 197-405.

Eighth Report on the Injurious and Other Insects of the State of New York, for the Year 1891. Albany, University of the State of New York. 1893. Pages 218 (103-320), figures 53. Also as Report of the State Entomologist for the year 1891; in the New York State Museum Forty-fifth Annual Report, for the year 1891. Albany: James B. Lyon, Printer. 1892. Pages and figures as above.

Ninth Report on the Injurious and Other Insects of the State of New York, for the Year 1892. Albany, University of the State of New York. 1893. Pages 206 (289-494), figures 34. Also as Report of the State Entomologist for the year 1892; in the New York State Museum Forty-sixth Annual Report, for the year 1892. Albany: James B. Lyon, State Printer. 1893. Pages and figures as above.

[Report of the State Entomologist to the Regents of the University of the State of New York, for the Year 1893; in the New York State Museum, Forty-seventh Annual Report for the year 1893. Pages 175-197. Albany: James B. Lyon, State Printer. 1894. Also in separates, with cover and title-page.]

List of Reports of the Entomologist of the State of New York.

First Annual Report on the Injurious and other Insects of the State of New York. Made to the State Legislature, pursuant to Chapter 377 of the Laws of 1881. Albany: Weed, Parsons and Company, Printers. 1882. Pages xxii, 381, figures 84.

Second Report on the Injurious and other Insects of the State of New York. Made to the Legislature, pursuant to Chapter 377 of the Laws of 1881. Albany: Weed, Parsons and Company, Legislative Printers. 1885. Pages xiv, 265, figures 68.

[Reports of the State Entomologist to the Regents of the University of the State of New York, for the years 1884 and 1885, are published (only) in the 38th and 39th Annual Reports of the New York State Museum of Natural History, for the above-named years, pages 67-76, 77-125.]

[Third Report of the State Entomologist.] **Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1886.** Albany: The Argus Company, Printers. 1887. Published in the 40th Annual Report of the New York State Museum of Natural History, 1887, pages 79-154; also in 200 separates, with cover and title-page.

Fourth Report on the Injurious and Other Insects of the State of New York. Made to the Regents of the University, Pursuant to Chapter 355 of the Laws of 1883. Albany: James B. Lyon, Printer. 1888. Pages 237, figures 68. Also as Report of the State Entomologist to the Regents of the University, State of New York, for the year 1887, in the Forty-first Annual Report of the State Museum of Natural History. 1888. Pages 123-358.

Fifth Report on the Injurious and Other Insects of the State of New York. Made to the Regents of the University, Pursuant to Chapter 355 of the Laws of 1883. Albany: The Troy Press Company, Printers. 1889. Pages 205; double-paged as 145-347, figures 50. Also as Report of the State Entomologist to the Regents of the University, State of New York, for the year 1888; in the Forty-second Annual Report of the State Museum of Natural History, for the year 1888. 1889. Pages 145-348.

Sixth Report on the Injurious and Other Insects of the State of New York. Made to the Regents of the University, Pursuant to Chapter 355 of the Laws of 1883. Albany: James B. Lyon, State Printer. 1890. Pages 107 (97-203), figures 25. Also as Report of the State Entomologist to the Regents of the University, State of New York, for the year 1889; in the New York State Museum Forty-third Annual Report, for the year 1889. 1890. Pages 99-205.



