

TWENTY-SEVENTH ANNUAL REPORT
OF THE
ENTOMOLOGICAL SOCIETY
OF
ONTARIO
1896.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE.)

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO.



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TORONTO:
WARWICK BRO'S & RUTTER, PRINTERS & C., 68 AND 70 FRONT ST. WEST
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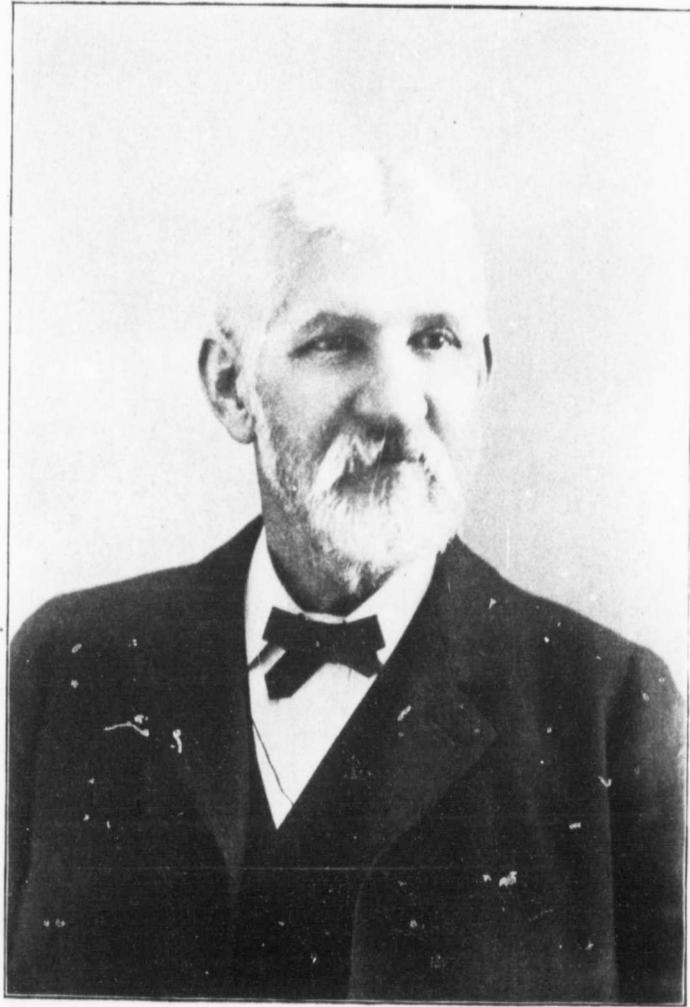
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REV. THOMAS W. FYLES, F. L. S.

Member of the Council of the Entomological Society of Ontario, from 1882 to 1888 ;
delegate to the Royal Society of Canada, in 1890, 1894 and 1895 ; member of the
Editing Committee of the "Canadian Entomologist," since 1889.





J. M. DENTON.

ENTOM

To the Honorable

SIR,—I have the honor to acknowledge the receipt of your paper on the outbreak of the pest of our thirty-fourth year, and 22nd of October, 1900, in connection with the business of the Society. At the meeting, together with the various sections, the outbreak of the pest was discussed, and the work of the "Committee on the Study of Entomology" submitted dealing with the study of Entomology.

The Canadian Entomologist completed its two volumes, and contains papers of a high quality, and is a valuable contribution to this branch of science.

TWENTY-SEVENTH ANNUAL REPORT
OF THE
ENTOMOLOGICAL SOCIETY OF ONTARIO,
1896.

To the Honorable John Dryden, Minister of Agriculture :

SIR,—I have the honor to transmit to you the Twenty-Seventh Annual Report of the Entomological Society of Ontario. It contains a full account of the proceedings at our thirty-fourth annual meeting, which was held in the city of London, on the 21st and 22nd of October last, for the election of officers and the transaction of the general business of the Society. The report includes the addresses delivered and papers read at the meeting, together with the financial statement of the Treasurer and the reports of the various sections and departments of the Society. Considerable attention is given to the outbreak of the "Army Worm" in this Province, last summer, and the destructive work of the "Tussock Moth" to the shade trees in Toronto, and other papers are submitted dealing with matters of economic and scientific interest in connection with the study of Entomology.

The Canadian Entomologist, the monthly magazine issued by the Society, has now completed its twenty-eighth volume, which will be found to contain a large number of papers of a highly scientific character contributed by the most distinguished students of this branch of science in Canada and elsewhere.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,
Editor.

OFFICERS FOR 1897.

<i>President</i>	J. W. DEARNESS	London.
<i>Vice-President</i>	H. H. LYMAN	Montreal.
<i>Secretary</i>	W. E. SAUNDERS	London.
<i>Treasurer</i>	J. A. BALKWILL	do
<i>Directors :</i>		
Division No. 1	JAMES FLETCHER, LL.D.	Ottawa.
“ 2	REV. C. J. S. BETHUNE, D.C.L.	Port Hope.
“ 3	ARTHUR GIBSON	Toronto.
“ 4	A. H. KILMAN	Ridgeway.
“ 5	C. G. ANDERSON	London.
Ontario Agricultural College	PROF. J. H. PANTON	Guelph.
<i>Librarian and Curator</i>	J. A. MOFFAT	London.
<i>Auditors</i>	{ J. H. BOWMAN	do
	{ R. W. RENNIE	do
<i>Editor of the "Canadian Entomologist"</i>	REV. C. J. S. BETHUNE, F.R.S.C.	Port Hope.
<i>Editing Committee</i>	{ DR. J. FLETCHER, F.R.S.C.	Ottawa.
	{ H. H. LYMAN	Montreal.
	{ REV. T. W. FYLES	S. Quebec.
	{ JAMES WHITE	Snelgrove.
	{ W. H. HARRINGTON, F.R.S.C.	Ottawa.
<i>Delegate to the Royal Society</i>	J. D. EVANS	Trenton.
<i>Committee on Field Days</i>	{ DRS. WOOLVERTON AND HOTSON,	
	{ MESSRS. BALKWILL, SAUNDERS,	
	{ ANDERSON, RENNIE, BOWMAN,	
	{ ELLIOTT AND SPENCER	London.

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ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

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The thirty-fourth annual meeting of the Entomological Society of Ontario was held in its rooms, in Victoria Hall, London, on Wednesday and Thursday, October 21st and 22nd, 1896, the President, Mr. J. W. Dearness, of London, occupying the chair.

The meeting was called to order at 3 o'clock p.m., on Wednesday, when the following members were present: Rev. T. W. Fyles, South Quebec; Mr. H. H. Lyman, Montreal; Mr. J. D. Evans, Trenton; Rev. C. J. S. Bethune, Port Hope; Prof. J. H. Panton, Ontario Agricultural College, Guelph; Messrs W. E. Saunders (Secretary), J. A. Balkwill (Treasurer), J. Alston Moffat (Curator), J. H. Bowman, H. P. Bock, B. Green, W. Scarrow, T. Green, W. J. Stevenson, J. S. Pearce, J. B. Spencer, J. Law, W. Lochhead, W. Percival, and Drs. Woolverton and Hotson, London, and Robert Elliott, Plover Mills. Letters of apology were read from Dr. James Fletcher and W. H. Harrington, Ottawa, regretting their inability to attend the meeting.

At the request of the President the report of the Council for the past year was read by Dr. Bethune.

REPORT OF THE COUNCIL.

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The Council of the Entomological Society of Ontario beg to present the following report of their proceedings during the past year:

They have much pleasure in stating that the membership of the Society has been well maintained, and that there has been a gratifying increase in the members from Ontario and an especially large addition in the Montreal branch, from the Province of Quebec.

The twenty-sixth annual report on Economic and General Entomology was presented to the Minister of Agriculture for Ontario, in December last and was printed and distributed at the opening of the session of the Legislature. It contained one hundred and two pages, and was illustrated with thirty-four wood cuts and two full page portraits, one of the late Professor C. V. Riley, the most able and distinguished Entomologist in North America, who had been killed by a fall from his bicycle a few months previously, and the other of Mr. William H. Edwards, author of the "Butterflies of North America," the most valuable and important work of the kind ever published,—both of these gentlemen were honorary members of our Society. In addition to an account of the proceedings at the annual meeting, which included an interesting address on "The New Agriculture," by Mr. C. C. James, Deputy Minister of Agriculture, the volume contains the following valuable papers: "The value of Entomology," by Dr. James Fletcher; "How the Forest in Bedford was swept away," by Rev. T. W. Fyles; "Insect injuries of the year 1895," by Dr. Fletcher; "The growth of the wings of a Luna Moth," "Observations on the Season of 1895," and "Variation, with special reference to Insects," by J. A. Moffat; "Some winter insects from Swamp Moss," by W. H. Harrington; "Birds as protectors of Orchards," by Mr. E. H. Forbush; "The Rocky Mountain Locust and its allies in Canada," by Mr. S. H. Scudder. An abstract was also given of the proceedings of the seventh annual meeting of the Association of Economic Entomologists, together with some of the papers that were of special interest and value to the general reader.

The Canadian Entomologist, the monthly magazine published by the Society, completed its twenty-seventh volume in December last. The numbers of the twenty-eighth volume have been regularly issued at the beginning of each month during the current year; ten numbers, containing 270 pages, have thus far been published, containing a large number of papers of high scientific merit. The series of illustrated articles on the Coleoptera of Canada, by Mr. H. F. Wickham, has been continued and proves of great value to those studying this order of insects.

A fairly complete collection of the important insects of the country is now in the Society's cases. Some new and interesting species have been added during the year.

The most important addition to the library during the year is a complete set of the *Annals of the Entomological Society of France*. Nineteen other new volumes have been added and catalogued, besides the usual large number of scientific periodicals and exchanges.

The Council desires to express its satisfaction with the careful manner in which the Curator, Mr. J. Alston Moffat, continues to look after the collection of specimens, scientific instruments and library of the Society. Visitors have found him in constant attendance even outside of the hours at which he is expected to be present. Any one, whether allied with the Society or not, seriously studying any phase of insect life, has been cheerfully assisted by him. Farmers, horticulturists, and students bringing their specimens to the rooms in open hours, have thus the opportunity to have such compared with authentic specimens and identified.

The present accommodation which has served the Society since 1881 has become inadequate. Arrangements are being made to obtain new and more commodious quarters in the fine new structure in course of erection by the Young Men's Christian Association of this city.

The reports of the Secretaries of the several scientific Sections printed elsewhere show that, with the exception of the Ornithological one, they have held regular meetings at which useful and interesting lists of subjects were discussed.

The report of the Treasurer is highly satisfactory. The balance on hand, about \$530, at the close of the financial year, August 31st, 1896, is larger than usual owing to the fact that some accounts had not then been presented for payment, but the current expenses for the remainder of the year will fully absorb this amount.

The Council desire to place upon record their grateful appreciation of the liberal grant from the Legislature of Ontario, which has enabled the Society to carry on during many years past its scientific and practical work in a manner which would otherwise have been impossible.

The Society was represented by Mr. J. D. Evans, of Trenton, at the annual meeting of the Royal Society of Canada, held in Ottawa, in May last. His report is also presented herewith.

It is with profound regret that the Council record the loss during the past year of two of their colleagues. Mr. John M. Denton, of London, one of the earliest members of the Society, died after an illness of some months on the 24th of March last. He was one of those who originally formed the London branch of the Society, and took a most active interest in it and the parent Society till the close of his life. For five and twenty years he was a member of our Council and did much to maintain the prosperity and usefulness of the Society. His sterling honesty, unflinching courtesy and genial hospitality won for him the respect and affection of all our members. We all deplore his loss as one personal to ourselves, and deeply sympathise with his widow in her bereavement.

On the 3rd of April Captain J. Gamble Geddes, of Toronto, died after a few days' illness, brought on by a severe cold. During several years he took an active part in the London branch and held the offices of Secretary-Treasurer, Vice-President and President in succession. After his removal from London he continued to take a great interest in the Society, contributing valuable papers to its publications and holding the position of

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Director on the Council for many years. He was a diligent and enthusiastic collector in the order Lepidoptera and gathered together large stores of specimens, most of which are now in the museum of the Geological Survey at Ottawa. His untimely death is a source of deep grief to his colleagues and to a large circle of relatives and friends throughout the Dominion.

The Council desire further to tender their respectful sympathy to Miss Eleanor A. Ormerod, of Torrington House, St. Alban's, England, in her bereavement owing to the death of her sister and life-long colleague and companion, Miss Georgiana Elizabeth Ormerod, who died on the 19th of August last, after an illness of several months duration. The deceased lady was remarkable for her many talents and acquirements as a botanist, a conchologist, an artist, and a linguist, and for her great benevolence and generosity. She assisted her sister very greatly by illustrating her publications, helping in her correspondence and by her unflinching encouragement and wise counsels. She is widely known especially by the series of large coloured diagrams of injurious insects that she published under the auspices of the Royal Agricultural Society of England, and which are found to be of great practical use in illustrating lectures and addresses in this country as well as in Great Britain.

All of which is respectfully submitted.

J. W. DEARNESS,
President.

Mr. W. E. Saunders presented and read the report of the Secretary.

REPORT OF THE SECRETARY OF THE ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1895-6.

The year 1895-6 has been one of unusual activity to the local members of the council into whose hands the conduct of affairs at the Society's headquarters is placed, but the labors of the Secretary have been reduced to a minimum by the kind and efficient work done by the Librarian and Curator, who has attended to almost all of the work which might otherwise have fallen upon the Secretary. During the early part of the year the council issued a leaflet setting forth the advantage and usefulness of membership in the Society; the said leaflet being for the purpose of enclosure in the correspondence of the members and it is hoped that the influence of the Society will be widened thereby.

Seven council meetings have been called during the year, and three consultation meetings, to which all the local members were invited; for the conduct of business in general, and more especially for that relating to the change of rooms.

The negotiations which had begun at the time of the last annual meeting with the Young Men's Christian Association of this city, for the lease of a room in their new building, have continued throughout the year and have about reached a favorable conclusion, so that unless a hitch occurs, the Society should be occupying the proposed new room in three or four weeks.

The routine work of the Society has proceeded as usual, the meetings of the sections having been regular, except the Ornithological section which did not meet during the year. Particulars of the work of the other sections will be given in the reports by their Secretaries.

Some correspondence has taken place with those in charge of the meeting in Canada of the British Association in which the Secretary has been authorized to pledge the goodwill and hospitality of the Society to the visiting members, but the matter of representation at the meeting has been left for the general council to settle at the annual meeting.

All of which is respectfully submitted,

W. E. SAUNDERS,
Secretary.

The Treasurer, Mr. J. A. Balkwill, read the following report of receipts and expenditure for the year ending August 31st, 1896 :

REPORT OF THE TREASURER

RECEIPTS, 1895-6.	EXPENDITURE, 1895-6.
Balance on hand Sept. 1st, 1895	Printing
Members' fees	Report and meeting expenses
Sales of Entomologist	Library
" pins, cork, etc.	Expense account, postage, etc.
Government grant	Rent and fuel
Advertisements	Insurance
Interest	Salaries
	Pins, cork, etc.
	Balance on hand, August 31st, 1896
\$1,908 34	\$1,908 34

We the Auditors of the Entomological Society of Ontario hereby certify that we have examined the books and vouchers of the Treasurer, and find them well kept and correct, and that the above is a true statement of the accounts of the Society.

JAS. H. BOWMAN, }
W. T. McCLEMENT, } Auditors.

Mr. Balkwill explained the several items of expenditure and stated that the balance on hand would all be absorbed in printing and other expenses before next year's subscriptions came in. The President in accepting the report, commented on the loss the Society had sustained through the removal of Mr. McClement, who has been appointed Lecturer in Chemistry in the Armour Institute at Chicago.

Mr. J. A. Moffat presented and read his report as follows :

REPORT OF THE LIBRARIAN AND CURATOR

FOR THE YEAR ENDING 31ST OF AUGUST, 1896.

The number of volumes added to the Library during the year was nineteen of which nine were exchanges bound for the Society; the others being received from various sources, already bound.

The most important of these were

The Missouri Botanical Garden.

The Year Book of the U. S. Department of Agriculture.

The Report of the N. Y. State Entomologist: Dr. Lintner.

The Report of the Gypsy Moth Commission.

The Proceedings of the Royal Society of Canada.

The Fifteenth Annual Report of the U. S. Geological Survey.

Acknowledgement is due to John Hamilton, M.D., Allegheny, Pa., for two volumes of his Coleoptera papers.

The whole number of volumes on the Library register is now 1,418.

A full set of the annals of the "Entomological Society of France," was obtained, in exchange for a full set of the publications of the Entomological Society of Ontario.

The number of volumes issued to local members was seventy-three.

But slight addition was made to the Society's native collection during the year; most of the new material obtained being yet undetermined.

Respectfully submitted,

J. ALSTON MOFFAT,
Librarian and Curator.

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Dr. Bethune moved, seconded by the Rev. T. W. Fyles, that the Annals of the Entomological Society of France, and such other volumes as may be decided upon by a committee to be appointed by the President, be bound.—*Carried.*

By instruction of the local members of the council, the Secretary brought up the question of cataloguing the books in the Society's Library by the London Free Library Board as an addendum to their reference list. After some consideration of the subject, it was moved by Mr. W. E. Saunders, seconded by Mr. J. D. Evans, that this Society views with favor the proposition of the Free Library Board to publish a list of the books belonging to the Society in their catalogue.—*Carried*

The Secretary called the attention of the meeting to the importance of having the Society represented at the meeting of the British Association, which is to be held in Toronto next year. It was thereupon moved by the Rev. T. W. Fyles, seconded by Mr. Evans, that the President and Editor be, and are hereby, appointed to represent the Entomological Society of Ontario at the meeting of the British Association for the Advancement of Science, to be held in Toronto in 1897, and that the President be authorized to appoint additional representatives at his discretion.—*Carried.*

Mr. J. D. Evans then read his report as delegate to the Royal Society at its meeting in Ottawa in May, 1896, as follows :

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

As the representative of the Entomological Society of Ontario, I have the honor to submit a brief report of its proceedings and work during the past year.

It gives me much pleasure to be able to report that the membership continues to increase and is now much larger than ever heretofore, and that interest in its work is still unabated.

Valuable additions have been made to the Library and Collection of Insects—the number of volumes thus added being thirty-eight, making the total 1,399 volumes.

The Canadian Entomologist, the official organ of the Society, although not numbering quite so many pages as in the year previous, is yet largely increased beyond former years.

During the year 1895 it completed its twenty-seventh volume of three hundred and fifty-eight pages. There were forty six contributors, of whom twenty-nine were from the United States, three from England, and one from Germany—and of the remaining thirteen (Canadian) it is pleasing to be able to state that five of them were from the newer provinces west of Lake Superior. These contributed in the aggregate 100 articles in which were described 109 new species and seven new genera.

Among the more important papers published during the year may be mentioned the following :

- The Coleoptera of Canada—Mr. H. F. Wickham, which ran through eight numbers.
- Canadian Coccidæ—Mr. T. D. A. Cockerell.
- Preliminary Studies in Siphonaptera—Mr. Carl F. Baker, which appeared in seven numbers.
- Variation in *Nemeophila Petrosa* at Laggan in Western Alberta—Mr. Thos. E. Bean.
- Synopsis of the Dipterous Genus *Phora*—Mr. D. W. Coquillett.
- Mounting Insects without pressure—Mr. R. W. Rennie.
- The Coleoptera collected at Massett, Queen Charlotte Island, B.C.—Rev. J. H. Keen.
- Descriptions of the Larvæ of certain Tenthredinidæ—Mr. Harrison G. Dyar.

Notes upon the North American Saturnina, with List of the Species—A. Radcliffe Grote, A. M.

Butterflies of Southern Manitoba—Mr. E. F. Heath.

The Larvæ of the North American Saw-flies—Mr. Harrison G. Dyar.

The Life-history of Pamphilia Manitoba, Scud—Rev. Thos. W. Fyles.

To the aforementioned articles should be added also the numerous book notices of current publications of entomological literature, correspondence, obituary notices, etc.

In addition to the Monthly Magazine the Society publishes an Annual Report to the Department of Agriculture of the Province of Ontario, the twenty-sixth of which was issued in 1895, which consisted of 102 pages with numerous illustrations; in this is given a very full report of the thirty-third annual meeting of the Society, which was held in their rooms in London, on Wednesday and Thursday, the 27th and 28th of November, 1895. An important feature of the annual meeting was an open meeting on the evening of Wednesday, in the City Hall, at which His Worship the Mayor presided and Prof. C. C. James, Deputy Minister of Agriculture of Ontario, delivered a very exhaustive and interesting address on "The New Agriculture," which was followed by Mr. James Fletcher with a very instructive address on "The Value of Entomology."

The annual report also contains the following papers:

How the forest in the District of Bedford was swept away—Rev. Thos. W. Fyles.

Insect Injuries of the year 1895—Mr. James Fletcher.

The growth of the wings of the Luna Moth—Mr. J. A. Moffat.

Observations on the season of 1895—by the same author.

Variation with special reference to Insects—also by the same author.

Some winter insects from swamp moss—Mr. W. Hague Harrington.

Birds as protectors of orchards—Prof. E. H. Forbush, Ornithologist of the Massachusetts Board of Agriculture.

The Rocky Mountain Locust and its allies in Canada—Mr. Samuel H. Scudder.

The reports of the Botanical, Geological and Microscopical Sections of the Society.

The report of the Montreal Branch.

The report from the Entomological Society of Ontario to the Royal Society of Canada.

And also a very full report of the proceedings of the seventh annual meeting of the Association of Economic Entomologists.

The Botanical Section reported that regular weekly meetings had been held during several months, at which the attendance was much in advance of previous years. Several papers had been read at the different meetings. One public field day was held at which much enthusiasm was manifested.

The Geological Section reported as having had a most prosperous year. The membership had increased, and average attendance at meetings was greater. A number of valuable papers have been contributed, and several very successful trips made to places of geological interest.

The Microscopical Section reported as having a number of very successful meetings at which a number of interesting subjects were presented.

The Montreal Branch presented their twenty-second annual report shewing a number of meetings held at which excellent papers were read, and the membership increased.

J. D. EVANS,
Delegate.

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REPORT OF THE MONTREAL BRANCH.

Mr. H. H. Lyman read the following report :

The twenty-third annual meeting of the Montreal Branch was held in the library of the Natural History Society, on Tuesday evening, 19th May, at 8.15 o'clock.

Members present : Messrs. H. H. Lyman, President; A. F. Winn, Vice-President; G. Kearley, G. C. Dunlop, Dr. Wyatt Johnston, E. A. Norris, J. B. Williams, E. T. Chambers, T. D. Brainerd, H. Brainerd, G. H. Moore, and Lachlan Gibb, Secy.-Treas.

The President presented the following report of the Council :

REPORT OF COUNCIL.

In presenting their twenty-third annual report the Council have much pleasure in referring to the increased prosperity of the Branch, especially in regard to the large number of new members who have joined during the year.

Since our last annual meeting eleven new members have been added to our roll, but we have to deplore the loss by death of Mr. E. M. Gibb, who had only joined the Society during the previous year.

During the year eight meetings have been held, and the following papers and communications were read :—

The Life history of *Pamphila Manitoba*—Rev. T. W. Fyles.

Note on the occurrence of *Ællopos Titan*—A. F. Wynn.

Notes on the season of 1895—H. H. Lyman.

Notes on the life history of *Colias Interior*—H. H. Lyman.

Description of the egg and young larva of *Cerura Borealis*—H. H. Lyman.

Notes on *Trychosis Tunicula-rubra*—Rev. T. W. Fyles.

Notes on the preparatory states of *Erebia Epipsodea*—H. H. Lyman.

The Importance of Entomological Studies to our Agricultural and Fruit Growing communities—Rev. T. W. Fyles.

Prairie and Mountain Plants—James Fletcher.

The larger Species of *Argynnis* and the Mystery of their Life History—H. H. Lyman.

During the season a course of short lectures to young people was inaugurated by the Natural History Society with the active assistance of our Branch. The lectures were delivered in the Society's lecture hall on Saturday afternoons, and it is hoped that they will have some beneficial effect in interesting some of the young people in natural history studies.

The Branch is under great obligations to the Natural History Society for the recognition extended to it as an affiliated society or section, such recognition carrying with it the valuable privilege of the free use of their rooms for our meetings when desired, while we retain unimpaired our connection with the parent Society in London.

The Council would recommend that all books belonging to the Branch should be inscribed with our name and placed in the Natural History Society's library on the understanding that we remain the owners of them, and that our members have free access to them.

The Treasurer's report shews that the finances of the Branch are in a healthy condition, and the Council would recommend to the new Council the advisability of considering how the surplus may be expended for the interest of the Branch.

Respectfully submitted on behalf of the Council.

H. H. LYMAN,
President.

The Treasurer submitted his report, and it was moved by G. C. Dunlop, seconded by G. Kearley, That the reports of the Council and the Secretary-Treasurer be received and adopted. Carried.

The following officers were elected for the ensuing year :

President—H. H. Lyman.

Vice-President—A. F. Winn.

Secretary-Treasurer—Lachlan Gibb.

Council—G. C. Dunlop, G. Kearley.

The President then delivered his annual address in which he dwelt upon the necessity of more of the members taking an active part in preparing papers and sustaining the interest of the meetings. He also drew attention to some of the problems in connection with the Lepidoptera which awaited solution, some of which the members ought to be able to get some light on during the season.

Mr. G. Kearley, in moving a vote of thanks, suggested that the list of problems should be printed and a copy sent to each member.

The meeting then adjourned.

LACHLAN GIBB,
Secretary.

ANNUAL ADDRESS OF THE PRESIDENT OF THE MONTREAL BRANCH.

GENTLEMEN,—In most societies it is usual for the President to deliver an annual address at the annual meeting and this custom can, I think, be adopted in our Branch without disadvantage.

From the reports of the Council and of the Secretary-Treasurer it can be seen that the Branch has had a reasonably successful season, in regard both to the number of papers read and to the large number of new members who have joined us.

There is one point, however, to which I would earnestly invite your attention and that is that the labour of providing papers for the meetings is left too much to the President and I feel that I do not receive the assistance in keeping up the interest of the meetings that any President has the right to expect from the members.

With the single exception of Mr. Winn's "Note on *Allopos Titan*" read at the October meeting, all the papers were contributed by me or secured by me from outside friends like Mr. Fyles and Mr. Fletcher.

It seems to me that every member might do something to contribute to the interest of the meetings.

The simplest paper upon anyone's experience would at least do something to relieve the annual report of the monotonous repetition of my name as the contributor of papers.

Subjects of discussion might be suggested and genera or groups taken up and systematically studied, the members bringing together all their material in these genera, and verifying determinations, studying up the generic characters and so learning why a particular species is placed in a particular genus.

I doubt if any of our members can tell in what a *Neonympha* differs from a *Satyrus* or an *Erebia*, or a *Phyciodes* from a *Melitæa*. Then more interest might be shown in bringing specimens to the meetings. Specimens do not need to be rare in order to be worth showing. Well-set specimens in fine condition of even the commonest species are always a pleasure to look at, and it would at least show that the members were actually collecting specimens.

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Further, I hold that every true entomologist should be something more than a mere collector of specimens. We should all seek to do some original work, no matter how little, in the field that we study.

A great temple of knowledge of scientific truth is being built up by the workers in all departments of science, in all lands, and through all the centuries and we should all strive to bring at least one stone, well cut and true, to build into this great temple.

There are many interesting questions awaiting solution and some of us ought to be able to do something towards elucidating some of them. To mention a few among the butterflies, *Danais Archippus*: How early does this species appear here? Is it ever seen before the end of June? Is there a second brood? Scudder thinks not in the north.

Argynnis Cybele. For this species my paper read at the last meeting is a sufficient indication of points that require elucidating and I should be very grateful for any assistance, particularly for the donation of living females as early as obtainable.

Argynnis Myrina. Why is the emergence of this species spread over so long a time as described by Scudder? Are there three broods here?

Melitæa Phaeton. This species is attacked by a Pteromalid parasite which has not been determined and its life history is unknown, though there is some reason to believe that it passes two years before completing its cycle, is this the case? I greatly doubt it.

Of *Grapta Comma*, Scudder writes that "careful statements of its comparative abundance are needed from all parts of Canada, before its geographical distribution can be fully understood." It is attacked by an unknown Dipterous parasite which should be determined.

Grapta Progne. Does this species feed on elm as stated by Harris? How late in the spring do the hibernators fly? When does the summer brood appear, become abundant, and disappear?

Eugonia J-Album. So little is known of this species that notes of every kind are desirable. Is there more than one brood? Why are there more individuals late in August and September than earlier? How long does it continue on the wing?

Vanessa Antiopa. When does the first brood of the season appear here? When the second? Does it ever hibernate as a chrysalis?

Limenitis Disippus. How many broods are there in this locality?

Satyrus Nephela. Is it subject to attack by any parasite?

Neonympha Canthus. Has it any parasites?

Neonympha Eurytris. Is there a second brood or part of a brood here? If so how does it compare in numbers with the first? Are there any parasites?

Pieris Oleracea. How many broods are there? Why has it so generally disappeared before *Pieris Rapæ*?

This last question is one which might puzzle any scientific man even of the first rank. Still there must be some reason for it and any of us might stumble on it.

Is it possible that *Oleracea* was comparatively free from parasitic attacks before the advent of *Rapæ* which is preyed upon by many species and that some of the latter's enemies have turned their attention to the former?

Our meetings are now closing and field work should begin. Will not the members strive to have something of interest to tell or show when we again begin our meetings in the autumn.

The branches other than Lepidoptera and Coleoptera, are sadly neglected. Can we not do something to work up our local forms of the Neuroptera, Orthoptera, Hymenoptera, Diptera, and Hemiptera?

H. H. LYMAN.

The following paper was then read :

NOTES ON THE SEASON OF 1896.

By THE REV. THOMAS W. FYLES, F. L. S., SOUTH QUEBEC.

For half of the year Quebec seems to be the very throne of the ice king. The winters are long, and, in them, the storms are frequent, and the frosts severe. This spring people were crossing the St. Lawrence on the ice till St. George's day (April 23rd). When the "bridge" broke up a school-girl and one or two other persons were taken from the floating masses in canoes. Frost and snow come upon us in the end of October. The season then for out door Entomological work is a brief one—little can be done before the first of May, and but little after the end of September.

The fancy of the English Entomologist in Canada, must often revert with regret to his experiences in the old country—to his early spring work at the willows, and his late captures at ivy bloom—to his welcome of *Gonepteryx rhamni* in February, and his farewell to *Pecilocampa populi* in December.

To those who make a practice of rearing insects there will, even in the winter months, be occurrences of interest. Thus, early in the year on examining some cocoons and chrysalids that I had in the house, I found that a fine specimen of *Trogus fulvipes*, Cresson, had made its exit from a pupa of *Papilio Turnus*, Linn.

From a jar of earth in which a batch of larvæ of *Deilephila chamænerii*, Harr. that had fed on *Epilobium coloratum*, Muhl, had buried themselves, I obtained—not the moths I expected, but—a number of two-winged flies of the species *Muscivora anonyma*, Riley. The maggots of this species had destroyed the larvæ of the moth.

Our long winters afford us many opportunities for going over our summer captures, for identifying them and placing them in their proper order. And here I would record the capture at Sherbrooke, on the 25th of May, 1895, by the Rev. Abbe Begin, of that very rare and elegant butterfly *Thecla leta*, Edw. It was sent to me in February of this year for identification.

The following is a description of it :

THECLA LETA, Edwards, (Male).

Colour above :—Black with a purple blush. Near the hind margin of the secondaries are three ultramarine patches, with a black reniform spot near the outer edge of each.

Colour beneath :—Ash grey approaching to brown with a slight blush of purple on the primaries. Towards the hind margin of these there is an indistinct line, with a touch of light red near the upper part of it.

On the secondaries there is an irregular, but curved, row of light red spots, each with an outer edge of white. Near the outer angle there are three other such spots with the inner edge of white.

One of our earliest species is *Brephos infans*, Moesch. It is found in the birch woods around Montreal, while the snow is yet on the ground. I have not found the species in this neighbourhood though I have often searched for it.

It is a common saying at Quebec, "We have no spring." Summer seems to burst upon us all at once. This year on the 19th of April the swallows came; on the 21st flocks of ground-birds appeared; on the 26th the first hibernated butterfly shewed itself.

The first caterpillars to appear openly are the "Woolly Bears." Fall grown specimens of *Phragmatobia rubricosa*, Harr. may be seen in April, shuffling over the snow. In colour they are soft seal brown, slightly darker towards the head. The head is black and shining, and the feet are reddish brown. The specimens I have taken have not seemed inclined to feed, but have soon spun themselves up. Their cocoons have been light, and have had the larval hairs entangled in the meshes.

There is usually a space under the snowbanks, in the spring, caused by the warmth of the earth, and in this space vegetation commences. The creatures therefore may have fed up before they appeared upon the surface.

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Among the immature larvæ that shew themselves in the early spring are those of *Euprepia caja*, Linn. On their first appearance at that season they are black, and about three fourths of an inch in length. They crawl out upon the side-walks, and upon the floors of out-buildings.

Some years ago I brought a batch of this species from the egg to perfection. They hibernated—if I remember rightly—after the second moult.

In the spring of 1891 I collected some larvæ of like appearance and habits, thinking I would raise a few more specimens of the moth. These larvæ moulted on the 4th of May, and shewed a broad side-line of red hairs, so I knew that I had been mistaken in supposing them to belong to *E. caja*. They again moulted on May 20th. On emergence from the old skins the heads and legs of the larvæ were honey-yellow, but they soon changed to jet black. On the 17th of June after having drawn, in every instance, a few leaves together for a tent, they went into chrysalis without spinning a cocoon. The chrysalid was blue-black with a bloom like that of an Orleans plum. The larval skin remained attached to the extremity of the chrysalis case. On July 10th the perfect insect appeared. It was *Arctia virgo*, Linn.

Speaking of larvæ, I would tell of the strange winter-quarters of a caterpillar of a noctuid which I found early in the year. The year before I had obtained a specimen of that very rare hymenopterous parasite, *Sphecophagus prædator*, Zabriskie. From its position when I found it, I judged that it must have come either from a nest of *Vespa media*, Oliv., or from a mud castle of *Pelopeus cementarius*, Drury, both of which I was keeping in a window of my study. Hoping to obtain more specimens of *Prædator*, I collected in the winter all the wasps' nests I could. Saugly coiled up in a cell of one of those brought to me was the larva I am telling of. It became active in the warmth of my room, but I had nothing among my house-plants that it would feed upon, and it soon perished.

May the 1st was a bright, cold day. Frogs were croaking amid the broken ice and masses of snow in the pools, and large banks of snow lay in the woods. The poplars, birches and alders were in catkin, and the leaf-buds of the red elder (*Sambucus pubens*, Michx.), near the ground, were opening. On this day I saw on the sunny side of a stem a specimen of *Vanessa Antiopa*, Linn., bright in colour, and without a flaw.

After the 1st of May vegetation progressed by leaps and bounds, and insect appearances multiplied. By the 13th such delicate forms as *Lycæna marginata*, Edw., *Nemoria gratata*, Walker, *Rheumaptera intermedia*, Gn., etc, were on the wing. On this date I saw a pair of *Osmia proxima*, Cresson, in *coitu* resting upon willow catkins. At the same time larvæ of *Pœdisca saligneana*, Clemens, which had remained through the winter enclosed in webs within their galls on *Solidago*, left their domiciles and buried themselves in the soil. The imagos appeared on the 30th of May.

On the 15th of May a specimen of *Feniseca Tarquinius*, Fab., appeared in my breeding-cage. As the chrysalid had been out of doors all the winter this marks the date of appearance of the early brood of the species.

Lobophora angulinea, Grt., was common on the bolls of spruce trees on the 19th, and on the 21st *Lobophora atroliturata*, Walker, appeared.

On the 20th a full grown larva feeding upon choke cherry (*Padus Virginiana*, L.) was brought to me. The next day it buried itself and went into chrysalis. The following is a description of it: Length an inch and three quarters. Head, rather small, brown. Body plump and smooth. Colour, light drab. Spiracles outlined with dark brown. Just above them is a dark brown narrow side-line. On each segment a transverse dark brown line runs backward to a sub-dorsal line of lighter brown. On each segment along the back and pointing backward is a light brown V-like mark, with a pale patch on each side of it.

The larva could not have attained its growth in the fortnight in which the choke-cherry had been in foliage—it must have hibernated.

The buried caterpillar made a cyst strengthened by a slight web. The chrysalis was very dark glossy brown, and had a terminal spine. The moth appeared on the 27th of June, and proved to be *Mamestra imbrifera*, Guen.

The beautiful larvæ of *Phyciodes Harrisii*, Scudder, were common on the white aster (*Diplopappus umbellatus*, Tor. and Gr.), on the 21st of May and till the end of the month.

On the 6th of June I went to "The Gomin." In the fact that I knew no place there in which to sit down lay the chief discomfort of my first visits to this swamp. Fortunately in one of my rambles I discovered a huge solitary boulder half imbedded in the spongy soil. Now I am sure of a resting-place whenever I can find leisure to visit the swamp. I can sit or recline at ease on this stone, which surely some benevolent genie, anticipating the needs of weary naturalists, deposited far away from its original matrix.

Seated upon this stone that 6th of June I looked round upon the scene. Before me, some hundreds of yards distant, was the one tall pine, my landmark and guide to exit from the swamp. Around extended the level reaches of sphagnum, forming a vast amphitheatre bounded with tamarac and spruce. The surface of this area was beautified with innumerable blossoms. The prevailing colour was rose, from the lovely blossoms of *Rhodora Canadensis*, L., and *Kalmia angustifolia* L., but this was relieved by the white tufts of cotton-grass, *Eriophorum polystachyon*, L., and the clustered blossoms of the *Ledum latifolium*, Ait. The pitcher-plant, *Sarracenia purpurea*, L., lifted here and there its tall stalks, each surmounted by a yet unopened bud and resembling the maul-stick of the painter, and here and there the handsome blossoms of *Cypripedium acaule*, Ait., appeared.

In this solitude, seated upon my chair of state, I could almost fancy myself the monarch of all I surveyed, but thoughts of the kind were dispelled when I saw a *habitant* approaching. I noticed a peculiarity in this man's gait—he lifted his knees like a high-stepping horse, as he made his way through the yielding sphagnum. The motion struck me as grotesque; but soon afterwards, on moving away, I found myself making progress through the swamp in the same absurd fashion. I suppose it to be the mode of progression natural to the case.

As the man passed there now and then arose, disturbed by his approach, a specimen of that handsome chestnut-coloured moth *Epirranthus obfirmaria*, Hbn., or one of *Ematurga faxonia*, Minot, or one of *Chionobas Jutta*, Hübner.

Speaking of Jutta, I lately found among my papers a description of that butterfly written by a former member of this society, whose memory is dear to many of us—Mr. G. J. Bowles. I give it as a memento of our departed friend:

"*Chionobas Jutta*, Hübner. Lighter brown than *Nephele*, 3 eyelets in each fore-wing, centre one smallest, 4 or 5 on each hind-wing, the one at anal angle largest. All the eyelets are small in size. Beneath, markings of fore-wings are repeated. Hind-wings marbled with brown and light grey, one eyelet near anal angle."

On June 10th, I took a pair of *Dolerus Aprilis*, Morton, among young spruce trees on Levis Heights.

On June 11th, a specimen of *Cerura cinerea*, Walker, burst from a cocoon that had been sent to me by a friend. This cocoon had been cut out from the boll of a poplar. It seemed to be formed of very fine woody particles cemented together into a case so hard that one might wonder how the insect could break from it. Examination showed that at the point of rupture the case was very thin. Besides *C. cinerea* I have taken, in Quebec province, *C. borealis*, Boisd., *C. scolopendrina*, Bdv., and *C. multiscripta*, Riley, the last named at Cowansville.

On the 15th June I saw several specimens of that handsome beetle *Rhopalopus sanquanicollis*, Horn, escaping from their tunnels in the stem of a red plum tree. They left oval openings large enough to allow of the insertion of a medium-sized goose-quill.

On the 24th upon buck bean spot, and only on head on the outer lighter shade just the larva is lead. anal segment are spot with an oblique black spot. Bet pale yellow dots. conspicuous black are small and black with two black dots tipped with black

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In September (*L.*) eye-like spots, Sacken made a guess from the black substance years I endeavored collect the blistered fly abandon the parasites of the same, viz.: *Torym* named, as seen unchanging with crimson, described by Mr. A. of the species may

This year I took a *Sciara* closely allied of wings, two-tenths twentieth; hairy, 14 jointed; mouth rather dusky—a pe

While speaking for the work among his confreres.

On the 24th of July I found full-grown larvæ of *Zarea Americana*, Cresson, feeding upon buck bean, *Menyanthes trifoliata*, L. I find this species every season in the same spot, and only in that spot. The larva has the habit of curling itself round with the head on the outside. The following is a description of it:—Head black and shining, a lighter shade just above the mandibles. Eyes protuberent, glossy black. The back of the larva is lead colour, inclining to blue. The second segment near the head and the anal segment are paler. Along the back are eleven cross-bars, formed of a central black spot with an oblong patch of yellow on either side, terminated on either side with another black spot. Between every pair of these bars are two cross lines of smaller black and pale yellow dots. Along the edge of the lead colour on either side is a row of eleven conspicuous black dots. Below it is a broad yellowish-white spiracular line. The spiracles are small and black. Underneath them is a row of deep yellow warts each surmounted with two black dots. On the underside the larva is yellowish-white. The true legs are tipped with black.

I do not know the larvæ of *Abia Kennicotti*, Norton. There are two specimens of the fly in the Provencher collection. The differences between the imago of this species and that of *Z. Americana* are these: Kennicotti is smaller than Americana. Its colour is black with a tinge of green, whilst that of Americana is brown with a tinge of fuscous. Kennicotti has a distinct mark like a reversed Y, extending from the costa to the inner margin of the fore-wing. In Americana this wing mark is confused. The costal line and the venation of the fore-wings in Americana are heavier and more distinct than those of Kennicotti. The abdomen in Americana is somewhat spatulate; in Kennicotti it is rounded. The underside of the abdomen in Kennicotti is black; in Americana it is fuscous.

During the month of August pressing duties and frequent journeys hindered me from giving attention to entomological pursuits. This was unfortunate, for in one of my times of absence I lost a brood of young larvæ of *Hepialus argenteomaculatus*, Harris, which had come from eggs sent me by Mr. A. F. Winn. These eggs were round and black, and under the microscope resembled grapes. In the hatching they were ruptured irregularly. The young larvæ appeared in the last week of August. They were one-tenth of an inch long. The head was disproportionately large—suggestive of a boring habit. It was brown, and there was a brown shield on the second segment. The body was yellowish white, warty, and set with long hairs. The fore-legs were brown.

In September may be found in the leaves of the Golden Rod (*Solidago Canadensis*, L.) eye-like spots, yellow in the centre with a surrounding of reddish brown. Osten Sacken made a guess at the insect producing these, and named it *Cecydomyia carbonifera*, from the black substance, not unlike charcoal that is found in the galls. For several years I endeavored to raise the fly without success—I think for the reason that I did not collect the blistered leaves early enough. I am under the impression that the larvæ of the fly abandon the leaves, and undergo the pupal change in the herbage or the soil. The parasites of the species remain in the leaves. I raised two kinds of these in abundance, viz.: *Torymus Sackenii*, Ashmead and *Polygnotus solidaginis*, Ashmead. The first named, as seen under the microscope, is a marvel of grim beauty—a polished gem, glowing with crimson, green and gold. The latter is of more sober hue. It is admirably described by Mr. Ashmead in his monograph of the Proctotrypidæ, p. 307. The cocoons of the species may be found in the blisters, three or four in a cluster.

This year I think I have succeeded in raising the original cause of the gall. It is a *Sciara* closely allied to *S. ocellaris*, Coms. The following is a description of it: Expanse of wings, two-tenths of an inch; length of body, one-tenth; length of antennæ, one-twentieth. Hairy, of a uniform light brown; head rather small; eyes reniform; antennæ, 14 jointed; mouth organs large; thorax large, round; abdomen long, attenuated; wings rather dusky—a peculiar loop in the venation; halteres, club shaped.

While speaking of Hymenopterous parasites, I should like to express my admiration for the work among the Hymenoptera that is done at Washington by Mr. Howard and his confreres.

Mr. Howard's bulletin on the Joint-worm Flies, for its grasp of the subject, its clearness of description, and the beauty of its illustrations is a model work. Mr. Marlatt's NEMATINÆ is also first-class—excellent in every way. Of Mr. Ashmead's PROCTOTRYPIDÆ I can say, that the more I study it, the more I marvel at the amount of care and research that it betokens. It is a very mine of information.

I have said above that I wanted to obtain wasps' nests for a special purpose. Sometimes wasps' nests are plentiful enough. This season there has been a scarcity of them, from the nests of *Vespa maculata*, Fab. downwards.

Here is a story of a wasp's nest: Two Irishmen were working in the woods one day. One called to the other, "Pat, here's a bees' nest in a blather, let us take the honey!" "And sure," said Pat, telling the story afterwards, "there was more cry than honey; and the cry was from Terence."

A short time since I was at a village in the eastern townships; and a farmer I there called upon reminded me of a circumstance that occurred thirty years ago. At that time I was on a visit to a friend for whom this man was then gardener. He was troubled about a colony of wasps that had suspended their nest in the centre of the ceiling of the carriage-house. He was "afraid to burn it, and afraid to crush it." What could he do? "Meet me at night fall," I said "with a pair of steps and a lantern; and I will take it for you." At the time appointed I went, taking a cork, and a small bottle of chloroform in my pocket. I placed the steps under the nest, whilst the gardener held the lantern at a respectful distance. Having mounted the steps I deftly slipped the cork into the hole at the bottom of the nest, and then poured a teaspoonful of chloroform upon the top of the insect habitation. It immediately soaked through the paper covering; and then there was a great commotion within; but in a few moments all was still. I cut the nest from the ceiling with my pen-knife and brought it down in my hand. "Well," said the gardener, "that was neatly done!" And he has remembered all these years *the way to take a wasps' nest*.

On the 10th of this month I went to the St. Henri woods. *Colias Philodice*, Gdt. and *Chrysophanus Americana*, D' Urban, were on the wing. Besides them a few locusts and crickets, two noctuids out of reach, a two-winged fly (*Sericomyia militaris*, Walker), and a beetle (*Necrophorus tomentosus*, Web.) were all the perfect insects I saw.

I found larvæ of *Aulax nabali*, Brodie, in the stalks of the Wild Lettuce, *Nabalus altissimus*, Hooker, a foot, or so, from the ground. They were feeding in the white, downy lining of the stalk, and in some instances had commenced their cells or cocoons which as the stalk dries up will stand out in the hollow like bubblets, the size and shape of grains of hemp. Some years ago I exhibited cocoons of the species at one of our meetings. The perfect insects came from them early in the year following.

I have taken many a walk and examined many a tamarack in the hope of finding cocoons of *Platysamia Columbia*, Smith, a species that was taken at Quebec by Mr. Bowles. Some years ago I found a vacated cocoon of the species. I greatly fear that *Nematus Erichsonii* by stripping its food trees has banished this fine species from the locality.

SOME INSECTIVOROUS MAMMALS.

BY ROBERT ELLIOTT, PLOVER MILLS.

Under the above heading I would like to treat in a popular way of a group of animals which, on account of their food habits, have a more or less direct bearing on the science of economic entomology.

Three orders—namely, *Cheiroptera* (Bats), *Insectivora* (Moles and Shrews) and *Carnivora*, represented by such non-typical forms as the Raccoon and the Skunk—include all of our own species which deserve the appellation "insectivorous mammal."

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Unfortunately the term "insectivorous" as applied to a bird or a mammal seems to imply that the food of the species in question is in some way necessarily confined to what we call injurious insects. As a matter of fact little or no discrimination between beneficial and injurious insects has been ascertained as being made by any of our mammals in the choice of their food.

A skunk, foraging through the damp and shady wood, will, on finding one, munch a golden Calosoma with the same avidity that it crushes a May beetle. Most of our terrestrial insects, good and bad as we classify them, are no doubt held to be invariably good by the hungry shrew lucky enough to capture them. From the bat point of view, the *raison d'être* of night flying insects is quite likely enough considered simply as an essential requirement in order to keep the old and exclusive bat family in its proper position at the head of all living things. Nevertheless much good may be done without conscious discrimination; the farmer may derive a benefit from an act performed by a creature not dreaming of his existence. If it can be shown that the despised bat, the misunderstood shrew and the persecuted mole, from an economic point of view, "do good by stealth and blush to find it fame," it may be accepted as sufficient justification for the appearance of this paper in the pages of an entomological report.

THE BATS.

The Bats, as an order, are very distinct from any other mammalian group. The most casual observer recognizes these uncanny-looking nocturnal swallows as simply *flying mammals*, and thus far no other mammals than bats have been found adapted for true flight.

Their relationship to other groups has never been clearly elucidated. No scientific explanation of their origin is afforded by the investigation of their fossil remains. In short any fossil hitherto discovered has been either all bat or no bat at all. While they are thus easily separated from all other groups, when we come to the consideration of how many species we have, the greatest difficulties are at once encountered.

In previous reports of this Society our able Curator, Mr. Moffat, has put with force the pertinent query, "What constitutes a species?"

That this question presses with peculiar force on any one attempting the classification of our bats is admitted by that eminent authority, Dr. Harrison Allen, from whose monograph—"The Bats of North America"—I quote, "The difficulties acknowledged in identifying the American species (*Vespertilio*) are apparently innumerable, so great is the range of variation in the proportions of the ears, thumbs, feet, tail and phalanges of the manus and in the coloration of the fur and the membranes. If the purposes of zoological science should end with the identification of species, the student might well be discouraged in his studies in this field. But, fortunately, the very intricacies of the subject suggest problems in the attempts to solve which his knowledge of the life and structure of these little organisms cannot fail to be increased."

Owing to the courtesy of W. E. Saunders, Esq., I have had the opportunity of making an extended study of a series of bats collected by him, chi fly in the vicinity of London. As I feel quite unable with the space at my disposal to give a non-technical description that would prove of practical value, I simply give a list of species with short notes on their distribution, etc.

All our species belong to the family *Vespertilionidae*, are pre-eminently insectivorous and apparently hold the same relation to the night-flying insects that our swallows do to those insects which fly by day.

1. *Vespertilio gryphus* (Fr. Cuvier), The Little Brown Bat. Five specimens. One of our commonest species, ranging in different forms from the north-eastern United States to Hudson Bay, and west to the Rocky Mountains. Pastoral in local distribution as contrasted with the more urban Brown Bat.

2. *Lasionycteris noctivagans* (Leconte), The Silvery Bat. Four specimens. Common throughout North America. Partial to waterways and known to be a good swimmer.

3. *Adelonycteris fuscus* (Palisot de Beauvois), The Brown Bat. Five specimens. Perhaps the commonest species in the more settled parts of the country. Of wide range.

4. *Atalapha noveboracensis* (Ecxleben), The Red Bat. Five specimens, three adult and two young. Our most brilliantly coloured species. Habitat, North America at large, excepting the coldest regions.

5. *Atalapha cinerea* (Palisot de Beauvois), The Hoary Bat. Two specimens. Our largest bat. Habitat, Northern regions, occurring southward only at high altitudes. The capture of two specimens at London must be considered highly interesting to the student of zoo-geography.

Of the twenty-eight species treated by Dr. Allen as North American, the five given above seem to be all that have as yet been found in Ontario.

Vesperugo carolinensis (Geoff), The Carolina Bat. Ranging from Massachusetts and Pennsylvania southward, will possibly be found in Ontario.

Upwards of 400 species are known in the world. In the tropics large fruit-eating forms are abundant. Those of temperate regions, as ours, are almost exclusively insectivorous and as such must, generally speaking, be considered beneficial.



Fig. 1. Shows a Red Bat hanging by hind feet. Natural size.



Fig. 2. Profile of head of same. Natural size.

Occasionally bats find shelter in badly constructed dwellings. There they congregate each morning in increasing numbers and finally, with much chattering and quarrelling they sink into their long hybernatory sleep.

In some cases the owner of the house, after different attempts to smoke them out with sulphur, is often driven to tearing off boards, and after considerable trouble and expense, gets rid of a colony of one hundred or more.

The most curious zoological fiction connected with bats is the absurd belief that they are the offspring of bed-bugs. Once a wise-acre of our country-side gravely advanced to me this untenable theory of the origin of bats. While admitting that owing to the similarity of their retreats bats might transfer the "bugs" to new quarters, I combated as best I could the ridiculous statement by showing that it was a wholly unnecessary assumption. But lo! he, as if to demonstrate that "there are more things in heaven and earth than are dreamt of in our philosophy," challenged me to deny that gorillas had crossed over from Africa and had taken an effective part with Wellington in the Peninsular campaign against the French. In vain I defined the term "guerilla warfare"—he, forsooth, was a captain of our Canadian volunteers, and not wishing to have exemplified on myself his conception of a "gorilla attack," I escaped the dilemma with the diplomatic rejoinder that one story seemed as true as the other.

THE MOLES AND SHREWS.

While we have here to treat of (scientifically speaking) a very different order from the bats, from an economic point of view their similarity is well shown by a quotation from Carl Vogt: "One may, indeed, say with truth that they continue on and under the earth, yes, and even in the water the persistent hunt for insects, snails and all possible vermin, begun by the bats in the air."

The insectivora is a large order of mostly small mammals, forming one of the primitive types of their class. Two families—Talpidæ (moles) and Soricidæ (shrews)—are well represented in the fauna of Ontario. While externally these animals simulate the appear-

ance of mice, illustrated by shaped incisors of the farmer's denotation. pointed crow terrestrial in

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ance of mice, they are in internal structure widely different. The rodent type of teeth as illustrated by the common meadow-mouse, or *vole* (*Arvicola riparius*), whose sharp, chisel-shaped incisors and flat-topped molars are admirably adapted to the gnawing and grinding of the farmer's grain and roots, is replaced in the moles and shrews by a totally different dentition. Here we have projecting incisors, mostly one pair, canines, pre-molars with pointed crowns and (usually) trifid molars—a machine well fitted for the capture of terrestrial insects, whose hard elytra are crushed with a facility truly surprising.

That the distinction between a *shrew* and a *mouse* is not more clearly known is a decided misfortune to both the farmer and the shrew. Meadow-mice feed on the farmer's crops and are generally treated as they truly are—that is, unmitigated pests. Shrews feed on insects and (in the case of one species, at least) on those very mice the farmer so cordially dislikes. Yet to the average farmer every little furry creature that runs through his fields is merely a mouse, nay even worse than that, if any distinction is made at all, it is usually against the poor little "screw mouse"—an unreasonable prejudice allied to superstition. I have seen a farmer really afraid of a tiny shrew as it darted hither and thither with amazing rapidity in its frantic efforts to escape. To one of such I told, with a touch of irony, a curious superstition held by the Eskimo of Norton Sound, as related by Mr. Nelson in his "Natural History of Alaska."

"Those Indians claim that there is a kind of water-shrew living on the ice at sea which is exactly like the common land shrew in appearance, but which is endowed with demoniac quickness and power to work harm. If one of them is disturbed by a person it darts at the intruder, and burrowing under the skin, works about inside at random and finally enters the heart and kills him. As a consequence of this belief the hunters are in mortal terror if they chance to meet a shrew on the ice at sea, and in one case that I know of a hunter stood immovable on the ice for several hours until a shrew he happened to meet disappeared from sight, whereupon he hurried home, and his friends all agreed that he had had a very narrow escape."

The moles are completely fossorial in their habits, and possess in a high degree the traditional pugnacity of all miners. One meeting by chance a rival above ground, fights with a fierceness that carried on in proportion by large animals would be really terrific.

The earth worm forms the staple food of moles, and as this worm is accounted an important factor in the formation and improvement of soils, the mole must, to that extent, be considered an injury to the agriculturist.

The disfigurement of lawns and gardens by the large quantities of soil thrown up by even a single mole in a night is a serious charge, more applicable, however, to the English mole than to any of ours. The still more serious indictment that our common mole eats the roots of vegetable and other garden plants is likely enough a slander. A mole in a garden burrows along a row of plants in order to procure the numerous grubs and insects which congregate in just such places. Later a *vole* (meadow-mouse), entering the tunnel, finds ready access to its favorite article of diet—the roots of garden vegetables. There is the mole's tunnel—there are the potatoes eaten—and so the mole is condemned.

The Ontario species are three in number.

1. *Condylura cristata* (Linn).—STAR-NOSED MOLE.—A most unique species, owing its

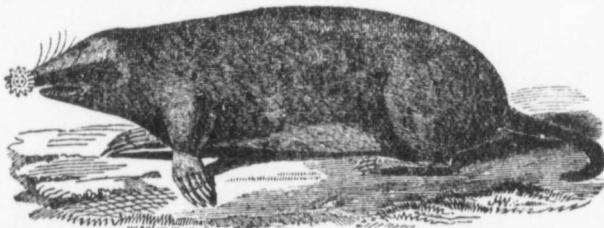


FIG. 3. The Star-nosed Mole (reduced)

name to about a score of radiating cartilaginous processes on the nose. Partial to moist situations, and so far as my own observations go, our commonest species. Fig. 3 (reduced).

2. *Scalops aquaticus* (Linn).—SHREW MOLE.—The term *aquaticus* as applied to this species is a misnomer, as in its habits it shows a preference for the drier ground, coming frequently into gardens and being of doubtful utility there. Apparently rare in Ontario.

3. *Scapanus Americanus* (Bartram).—HAIRY TAILED MOLE, BREWER'S MOLE.—More northern than either of preceding. In habits resembles the shrew mole. One taken at Ottawa, as reported by Ottawa Field Naturalists' Club, 1890.

The shrews are much more terrestrial than the moles, and are still more mouse-like in their appearance. However, their long, pointed and movable muzzle should serve to distinguish them from mice. Their position in the economy of nature is, as has been pointed out, vastly different. They feed on insects the year round, and are nocturnal in their habits. They are all small, some exceedingly small, the Etruscan shrew, found in Italy, being the smallest of known mammals. Its head and body measure only an inch and a half in length, and its tail adds about an inch more.

What shrews lack in size they atone for in numbers, activity and voracity, and from an economic point of view they must be reckoned among the farmer's best friends. Two genera and several species occur in Ontario.

1.—*Blarina brevicauda* (Say.) SHORT-TAILED SHREW. More mole-like in appearance than any member of the next genus. Besides destroying innumerable injurious insects in the course of a year, this industrious mammal is a persistent enemy to mice, following them into their burrows and killing them there. Common in Ontario.

2.—*Sorex Cooperi*, Bachman.—COOPER'S SHREW. This little dweller of our fields and woods is by no means so rare as its infrequent capture would lead one to suppose. While it moves in its agile, restless manner usually on the surface of the ground, it manages to travel under cover of dead leaves and herbage, thus eluding the notice of all but the keenest observer. Once in the woods about the middle of May, searching for salamanders, under rotten logs, etc., I captured alive a specimen of this diminutive shrew which I had disturbed and driven from his sylvan retreat. Placing it in a large bottle with a handful of cotton batting, I watched it dart through and through the cotton with astonishing rapidity. Half an hour later I introduced a live May beetle which was instantly attacked and entirely eaten. Within ten minutes I proffered an earth-worm which was immediately caught at the head and bitten down the middle throughout its whole length. The action although quickly performed left a groove or cut as neatly as any dissector could have done with a knife. The worm at once collapsed and from its whiteness I inferred that its blood had been extracted during the nipping process. As it remained untouched, within another ten minutes, wishing to know whether the shrew's appetite had been satisfied or whether



Fig. 4. SOREX ARANEUS.—A Typical Shrew.

it preferred insects to worms, I dropped in a second May beetle which was at once killed and the major portion eaten, the head and elytra alone remaining. Shortly afterwards the voracious little creature died, overcome as it seemed by the very abundance of supplies—a death suggesting, though somewhat dissimilar from, that of the farmer who, according to the Porter in "Macbeth," "hanged himself on the expectation of plenty."

3.—*Sorex platyrhinus* (De Kay) BROAD-NOSED SHREW. In August, 1895, I captured in a field of reaped oats near Plover Mills, an individual of this species which as far as I know remains the only record for Ontario. In habits it differs in no marked degree from

its congener, Cooper's Shrew. Fig. 4.—The common European Shrew (*Sorex araneus*)—a typical representative of the large and useful genus, *Sorex*. Natural size.

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Mr. Fyle West India I were brought

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THE RACCOON (*Procyon lotor*.)

While the Raccoon is perhaps the most omnivorous of all our mammals, eating with avidity birds and their eggs, frogs, fish, cray-fish, nuts, fruits, corn and sometimes poultry, yet before framing an indictment against him we should give him fair credit for large numbers of insects and mice destroyed in the course of a season.

I have examined the stomachs of many 'coons killed during the time the corn was in the milky stage, and have nearly always found more insects than anything else, notably the red-legged locust, in seasons when that pest was most destructive.

THE SKUNK (*Mephitis mephitis*.)

In the face of the unsavoury reputation with which common report invests the Skunk—a reputation partly acquired from an *occasional* raid on the poultry yard to kill chickens or to suck eggs, and partly by reason of his defensive and offensive odour, it is pleasant to quote from Dr. Merriam, the highest authority on North American mammals, the following testimonial as to his sterling qualities: "Of all our native mammals perhaps no one is so universally abused, and has so many unpleasant things said about it, as the innocent subject of the present biography, and yet no other species is half so valuable to the farmer. Pre-eminently an insect-eater, he destroys more beetles, grass-hoppers and the like than all our other mammals put together, and in addition to these devours vast numbers of mice."

In discussing this interesting paper, Mr. Fyles asked whether it were correct that a noticeable difference between a mouse and a shrew was that a cat would not eat a shrew, because it was carnivorous and therefore not suitable for food.

Mr. Saunders said that this was probably not because the shrew is carnivorous, but because it had a peculiar and unpleasant odour, derived from a sack or gland, and that this caused cats, hawks and owls to prefer other mammals. He then exhibited a series of skins of bats, and gave a brief account of each species.

Dr. Bethune, in commenting on the usefulness of skunks, mentioned the benefit they confer upon hop-growers by destroying the larva of a moth, *Gortyna immanis*, which is often very injurious to the plants. This caterpillar eats into the crown of the root and if unmolested gradually burrows through and causes the death of the whole plant. In the hop-yards in the northern part of the State of New York it is related that the owners encourage the presence of skunks and do not allow them to be molested. These animals prowl about the yard and by listening at the foot of a hop-plant discover whether there is a worm gnawing at the root; if so they speedily dig away the earth and extract and devour the worm. It only remains then for the grower to replace the earth and thank his unsavoury friend for the benefit that he has conferred in saving the life of the plant. This injurious insect the speaker had found very abundant some years ago in a large hop-yard at Erindale, near Springfield-on-the-Credit.

Mr. Fyles then exhibited a fine collection of insects recently taken in Barbados, West India Islands, by his son. After the inspection of these and other specimens that were brought by the members present, the meeting adjourned.

EVENING SESSION.

In the evening the Society held a public meeting in its rooms in Victoria Hall, at which there was a largely increased attendance of members, between thirty and forty being present. The chair was taken by the President, Mr. Dearness, at 8 o'clock. After explaining the much regretted absence of Dr. Fletcher, who was unavoidably prevented from attending, he proceeded to deliver the annual address, which he illustrated with specimens and drawings on the blackboard, and also with photographs, and which was listened to with great interest and attention.

ANNUAL ADDRESS OF THE PRESIDENT.

BY J. DEARNESS, LONDON.

Friends and Members of the Entomological Society of Ontario :

I have the honor this evening to welcome you to the thirty-fourth annual meeting of the Society. By name, at least, I know of five other similar Societies on this continent: the American, the Cambridge, the Newark, the New York, and the Washington. The organization of only one of these, the first named, antedates that of our own Society.

The thirty-fourth annual meeting! To the younger members, who, but for a year or two have been witnesses of the work done in these rooms, and who have been reading the reports and the monthly issues of the *Canadian Entomologist*, it may be worth while to say that there is evidence that each and every one of these thirty-four years has been characterized by energy, progress and success, one almost equally with every other from the first until now.

The evidence is not far to seek, in fact we are overwhelmed with it. These shelves, stocked with reports and volumes, filling two sides of the room, tiers of drawers and cases of specimens, classified and catalogued, crowd us so that we scarcely have room for our chairs. Very material evidence this, even on the surface, that busy men founded this society and labored to promote its interests. In doing this great work two objects or purposes conspicuously inspired them—devotion to science for its own sake, and the desire to discover and disseminate knowledge for the sake of their fellow-men. No other incentive seems to have had any existence in their minds.

On the eve of removing from these rooms, where so much of the society's work has been done, to more commodious and convenient quarters, it seems opportune to turn our thoughts to the labors of the Society's veterans. We younger members cannot over-appreciate the rich heritage left us by these pioneers, and we should be stimulated by the contemplation of it to prepare ourselves to carry on the work in the spirit and enterprise of the example they have set us. The events of the year give emphasis to this statement. I presume only one person here can recollect attending an annual meeting before this one from which our beloved friend, the late Mr. Denton, was absent. His kindly voice, and that of another officer of this society, Capt. Gamble Geddes, of Toronto, have lately been hushed in death. The thought of their passing and leaving the work here which they had so much at heart suggests the desirability of the Society's compiling a memorial album, with portraits and sketch of its founders and its most earnest and useful workers.

A moment ago I said, "only one person here." I need not name him, as you all know it must mean the venerable editor of the *Entomologist*, Dr. Bethune, of Port Hope. Was he not at the inception of the society thirty-four years ago (in fact he and Dr. William Saunders, now director of the Dominion Experiment Stations, were its parents in every sense), and has he not attended nearly every annual meeting since its inception? May that one be many a year distant when he shall cease to be present; I can hardly conceive what one would be like without him and Dr. Fletcher and the Rev. Mr. Fyles. And although they all seem good for many years to come, yet you younger members must prepare to take their places sometime. I trust that even now you are observing, studying, reading—equipping to sustain and extend the good work so successfully begun.

Much has been accomplished, a very considerable library has been founded, much valuable material has been accumulated, a fairly complete taxonomy of the important insects of Canada and the neighboring States, has been placed on exhibition, and thus a foundation has been well laid that will enable future workers to specialize and to engage in practical studies with definite purpose.

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* Dr. James F. Astoma (or *Atoma*) Entomology Astoma are Andrew Murray's Eighth Report, 1891, As a rule the six-leg

SOME INJURIOUS INSECTS.

It has been usual for the President, in his annual address, to present an economic entomological survey of the province. My field of observation has been limited to the six or seven townships around London.

Last year our Curator, Mr. Moffatt, reported the prevalence of the cut-worm moth, *Hadena Arctica* (Fig. 5). Householders in town and country remember the nightly dance of these moths around the lamps and their soiling of curtains and clothes during the day. This spring I noticed many a patch of spring grain that had been sown on plowed sod so badly eaten that the ground was plowed again and sown with peas or otherwise used. The farmers said the wire-worms are at work, but in any plot I examined it was no trouble to discover the greenish-yellow cut worm, the larvæ of the *Hadena*. Would rolling the affected part of the field at night with a heavy roller across the drills destroy enough of these larvæ to save the crop? I should like to hear the point discussed whether we may expect another invasion of our homes by this moth next year, such as Mr. Moffatt described in the last report. I did not find any specimens that seemed to be parasitized.

The grasshopper or locust (*Melanoplus femur-rubrum*, De Geer, Fig. 6) was not nearly so injurious as in 1895. Its partial disappearance is probably mainly due to the increase of its parasite, the red mite, *Astoma* (Fig. 7).* The spring was favorable for the development of the grasshopper, and in some localities it was present in prodigious



Fig. 5.



Fig. 6.



Fig. 7.

numbers. I never saw them more numerous or vigorous than on the 18th of June along a side road between Con. vii. and viii. of McGillivray. Two or three miles on either side of this locality but few were to be seen. Where they were numerous I did not find one parasitized specimen; where they were scarce but few had not the red mites adhering to them under the wings.

In a few limited areas of the country the army-worm, *Leucania unipuncta*, appeared in countless numbers and destroyed or greatly damaged oats, barley and corn. In early September the imagines were abundant everywhere in the range I travel. With the moths so numerous and generally distributed one would naturally expect the insect to be destructive next year. If such expectation is fortunately not realized, the interesting question arises—what influences have checked it? Is the multiplication of the Tachina fly so rapid as to prevent its appearance in destructive numbers the second year in the same district?

* Dr. James Fletcher, of Ottawa, writes that the prevailing opinion of arachnologists is that the *Astoma* (or *Atoma*) is the larval form of *Trombidium*, and that in Henshaw's Bibliography of Economic Entomology *Astoma gryllarium* is given as synonymous with *Trombidium locustarum*. Further references are Andrew Murray's "Aptera," pp. 128-129; Riley's "Rocky Mountain Locust," pp. 128-130; Lintner's Eighth Report, 1891, page 180; First Annual Report United States Entomological Commission, pp. 306-311. As a rule the six-legged mites are the larval forms.

The Fall web-worm, *Hyphantria textor*, has been very common in this county. I know two localities where every black ash—of which there was a considerable number of trees—was completely defoliated. Not a vestige of leaf was left. The trees were literally enwebbed from the top to the root. Seizing the webby fabric on the trunk it could be pulled off in strips reaching to the lower branches.

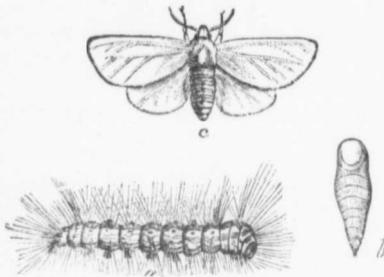


Fig. 8. a, worm; b, chrysalis; c, moth.

The orchard fruits in this country have been unusually free from insect injury. In 1895 fruit was a failure, owing to the heavy frost late in May. Its scarcity caused every apple that escaped to be gathered carefully. None was allowed to remain on the ground. This year all wormy fruit, and indeed much that is not wormy, is left to rot, so abundant is the crop and so insignificant the price for it. Hence the insects will develop without let or hindrance, save from their natural enemies. The abundance of this year's crop points to increased need for spraying next year.

FAILURE OF PEA CROP.

It would be out of place here to speak of fungal and bacterial injuries to crops, etc., to which I give more attention than to insects, but I may refer to the failure of the pea crop in Prince Edward County. Some farmers there find it profitable to raise garden pease for sale to the seedsmen. This year the crop failed; the diseased plants looked as though they were affected by a parasitic fungus. Mr. Craig, the Dominion Horticulturist, kindly sent me a large number of specimens. On many of them I found fungi, all probably saprophytic, not disease producing, but produced in the diseased or dying tissue, and, what is more noteworthy, on many, in fact nearly all the roots I examined, a minute Nematode or Anguillula-like worm. There were not any nodules such as the rose anguillula produces on the roots of that plant in the green-house. Much damage is done to plants in the Southern States by anguillulæ, but it has been thought that the winters in our latitude are too severe for any organism of this class to survive in injurious numbers. The failure of the pea crop in that county needs further investigation. I believe it was due to several causes, one of which was the presence of these nematodes.

PARASITIC FUNGI.

Speaking of fungi naturally leads one to think of the work done in a new and important field, that of artificially controlling injurious insects by vegetable parasitism. Colonies of silk-worm and of the honey bee are occasionally devastated by a muscardine and pebrine and foul-brood respectively, which are fungal and bacterial parasites. It is not unreasonable to suppose that similar parasites may be discovered capable of artificial cultivation which may be introduced among gregarious insects as grasshoppers, army-worm, etc., and used to control them effectively. Prof. Forbes, of Illinois, has experimented extensively upon inoculations of the Chinch bug.

Laboratory experiments have been conducted in Cornell Agricultural Experiment Station by Mr. R. H. Pettit, under the direction of Professor Atkinson, with various parasitic fungi upon several different kinds of insects. Dr. Roland Thaxter has done splendid work on the *Entomophthoreæ*. Prof. Snow, of Kansas, Prof. Webster, of Ohio, and others, have also labored in the same field. So far, while many of the laboratory experiments have been successful and promising, the work in the field has not yet, to my knowledge, reached very satisfactory results.*

* Since writing the above I am informed by Dr. Bethune that at the Buffalo meeting of the Economic Entomologists, August, 1896, Prof. Webster, of Wooster, Ohio, stated that farmers in the districts of that State badly infested with the chinch-bug had eagerly obtained and used specimens of the pest artificially inoculated with *Sporotrichum* to distribute where chinch-bugs would come in contact with them, and thereby contract and spread the disease. He reported satisfactory and encouraging results.

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Fig. 9.

Fig. 9.—Twig phores of the fungu

Fig. 10.—Head

Fig. 11.—Cross perithecia are filled

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The subject of entomogenous fungi is too large to enter on here, but it may be of interest to show specimens of a few of those most commonly met with.

The first is a parasite on the scale insect (*Lecanium* sp.), which I find on oak, ash, and blue beech. It is called *Cordyceps clavulata* (Schw); the genus is in the same order with the medicinal ergot or smut of rye. The fungus feeds upon the tissue of the insect, displacing the latter by its vegetative portion. It matures by producing erect sporophores, $\frac{1}{8}$ to $\frac{1}{4}$ inch long, bearing papillate conical heads. Under each papilla is embedded a perithecium containing numerous sacs or pods called asci, each of these sacs contains eight long, separate sporidia or "seeds."

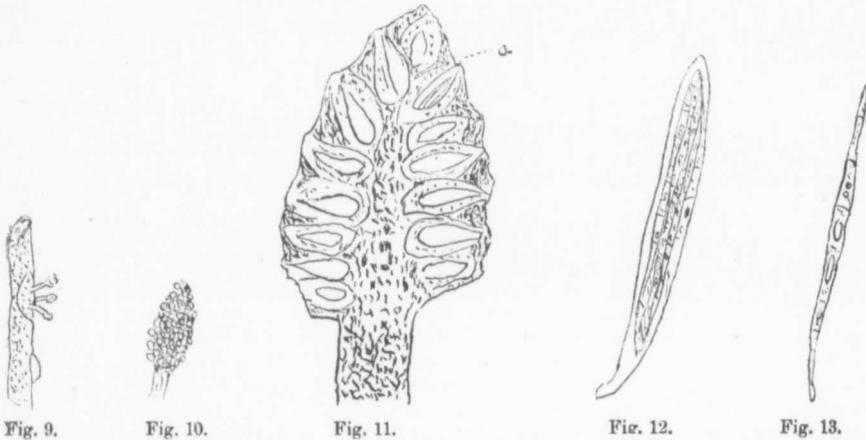


Fig. 9.—Twig with two scale insects. One of them killed by *Cordyceps clavulata*, having three sporophores of the fungus.

Fig. 10.—Head of one of the sporophores enlarged.

Fig. 11.—Cross-section of head of sporophore showing the flask-like perithecia greatly enlarged. These perithecia are filled with sacs as indicated at *a*.

Fig. 12.—A sac or ascus containing eight sporidia still more highly enlarged.

Fig. 13.—A sporidium or "seed" magnified 750 diameters.

The fly-fungus, *Empusa muscae*, Cohn, belongs to a very different group of fungi. The former is placed in the class with black-knot of the plum tree and the mould on the gooseberry. This has close relationship to the white mildew of the grape, to the peronospora which produces soft rot of the potato, and to that causing a peculiar stinking decomposition of fish. No doubt you have observed dead flies surrounded by a whitish halo adhering to a pane of glass. This halo consists of the spores, conidia—and secondary spores thrown off by the growing fungus from the body of the infected fly.

When one of these living spores gets attached to the under side of a fly's abdomen, it puts out a tube which penetrates the skin and rapidly spreads through the whole body in the manner in which yeast grows through bread, feeding upon the fatty substances within the fly. The exhausted fly finally settles, it may be on a pane of glass, there the fungus by abjunction scatters its spores around the body producing that smoky halo to which I referred.

Dr. Roland Thaxter in his masterly monograph on the Entomophthoræ in which he describes the various known species which affect flies, mosquitoes, gnats, aphides, cicadæ, thrips and lepidoptera, says of the house-fly fungus that its occurrence out of doors is an exceptional phenomenon, and that he knew of only two instances. His observation makes the specimens I have laid on the table the more interesting, as they were collected

off leaves and twigs near the edge of Cranberry Lake, in the County of Oxford. (A box containing twenty or thirty olive-colored flies killed by this fungus was passed round for examination.)

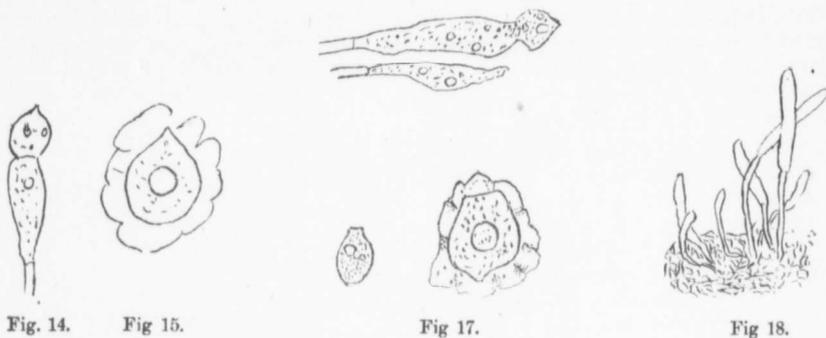


Fig. 14.

Fig. 15.

Fig. 17.

Fig. 18.

Figs. 14 and 16.—Conidiophores forming white rings between the segments of the abdomen. Highly enlarged.

Figs. 15 and 17.—Primary and secondary conidia which form the smoky halo seen round the fly adhering to the pane of glass. Highly enlarged.

Fig. 18.—Conidiophores of *Isaria farinosa* slightly enlarged.

Another fungus, or stage of a fungus, doubtless quite common though not frequently observed, bears the name *Isaria*. These specimens which I have here grew upon pupæ, probably of Arctiids, and are labeled *Isaria farinosa*, Fr. They are supposed to be a stage of *Cordyceps*. Out of the insect grew these conspicuous sporophores, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, orange at base but covered when fresh for two-thirds of their upper part by a white dusty layer of spores which arise from the ends of the threads forming the sporophore. At Cornell, spores from a potato culture of this fungus were painted on the ventral side of seven "woolly-bear" caterpillars; in twenty days the fungus had attacked all but two of them, and in another month one of them had developed showy sporophores like that from which the culture had been taken.



Fig. 19.



Fig. 20.

Fig. 19.—A thread of *Sporotrichum globuliferum* bearing spores greatly enlarged.

Fig. 20.—A thread of *Isaria* bearing spores separated from the compact sporophore. Greatly enlarged.

The fungus which has been used for infection experiments with the chinch-bug is known as *Sporotrichum globuliferum*. It was first found on Carabidæ and is somewhat like *Isaria* in its method of growth. Instead of the filaments being compacted into sporophores they envelop their hosts in a loose white cottony swathing. (An example of sporotrichum on a beetle was exhibited, also larvæ bearing *Isaria*).

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ENTOMOLOGICAL LITERATURE.

The President's addresses have usually presented a brief review of the entomological literature of the year. That duty will be discharged this time by Dr. Bethune. I have just a word in reference to two publications that have recently come to these rooms—one, a report of the Gypsy Moth Commission prepared by Drs. Forbush and Fernald,—a volume of over 600 interesting pages, devoted to one injurious insect. I refer to this to show what labor may be involved in studying and combatting even one insect. The labors of the Massachusetts entomologists in controlling the spread of the gypsy moth are a monument to the value of economic entomology.

The other publication to which I refer is a bulletin called "Practical Entomology" by Messrs. Hopkins and Rumsey of the West Virginia Agricultural Experiment Station. It is a veritable *multum in parvo* and although it contains only about 80 pages it keys and classifies the insects injurious to farm and garden crops in a very unique manner. The most inexpert farmer or gardener is led directly to a pretty certain identification of his insect foes and the approved remedies are briefly indicated. I wrote a letter to the authors complimenting them upon their plan of presenting practical entomology to the agriculturist. Director Myers acknowledged the letter and stated that it is their intention to continue this line of practical instruction to the horticultural and other interests and probably finally to publish the work in book form.

TEACHING NATURAL HISTORY IN SCHOOLS.

On every occasion that has offered the opportunity, I have put in a plea for such modification of our school curriculum of studies as would provide for the education of the observing faculties of our children. Training to observe facts, and to relate causes and effects not only affords good mental discipline but is of the highest practical value. We must all to a greater or less extent be experimenters throughout our active lives; hence skill in observing, comparing, relating and judging is necessary to success. Properly conducted nature-study is therefore of very great value. For the purposes of such study local geography, and the phenomena of weather, plant and insect life, furnish the very best material.

The flower and the insect appeal powerfully to the child's interest and while in botany and entomology there are many problems that the greatest observers and thinkers have not answered, yet there are others that even the little kindergartners find a pleasure in solving when the proper method is pursued. At teachers' meetings and at the Central Farmers' Institute I have outlined a course of study pointing out what might be attempted, especially for the benefit of farmers' children in entomology, etc., in each grade. A few years ago Prof. Wm. Saunders read papers here entitled "Entomology for Beginners." He treated in a popular way the life history of the cabbage butterfly, the leopard moth, the polyphemus, the satellite sphinx, the red humped apple-tree caterpillar and the eyed elater.

We need such papers as those—modified so as to treat in an experimental manner the life history of a half-dozen common typical insects—containing practical suggestions on observing their habits, capturing, caging, feeding, and preserving them. The paper might be issued by this Society as a bulletin. The teacher would find additional assistance in such works as Prof. Pantón's "*Insect Foes*" and Packard's "*Entomology for Beginners*." Besides the educational value and pleasure to the children of such study consider what important practical bearing it would have. Such mistakes as I knew a gardener to make would not then occur. He killed the tomato sphinx larvæ by stamping on them, but those bearing the cocoons of its parasitic ichneumon he carried to the house to be immersed in boiling water to kill the eggs as he thought. Think of it, ignorantly scalding his best helpers!

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Last spring I went to the proper committee of the Western Fair Board with the request that it offer prizes or diplomas to schools for exhibits of the life history of injurious insects. Our thanks are due to the committee for compliance with the request as it has shown what can be done by a teacher and his pupils in this line when he seriously addresses himself to the task. I have the exhibits here from school No. 14, N. Dorchester, and Union 5 and 15 London. The teacher in No. 14, Mr. J. W. Atkinson, had no technical knowledge of insects when he set about this work but taking advantage of the presence of the army worm in his section and following a few written suggestions on technique, he caged the larvæ, reared the moths, secured the eggs, and captured several beetles which prey upon the larvæ. What an object lesson this was to the children! How much more interesting, useful and exact their knowledge of metamorphosis having thus observed it, than if they had merely read the account of it in a book, even in a pretty picture-book. I think the result of this effort is well worth publishing. To that end I have had this photograph of the exhibit taken. See opposite page 32. It does not and cannot show the written sketch and the specimens of barley, oats, corn and mangolds damaged by the larvæ, but it will afford suggestions and stimulation to teachers who may see this report.

The exhibit of the squash-bug showing this injurious insect in seven stages from egg to adult males and female with a biographical sketch and specimens of its work on the pumpkin was prepared under the guidance of one of our young members, Mr. Robert Elliott of Plover Mills, in Un. 5 and 15. (The exhibits, written accounts and mounted specimens of the damaged crops, corn, oats, etc., were passed round.)

The report of the Council outlines the work of the Society for the year. The general verdict on its persual will be "Well done." The only opinion meant to be adverse which I have ever yet heard upon the work of this Society is that too much attention has been paid to American insects and that our pages have shown too much intercourse with the entomologists of the United States. Congress gives to every State in the Union \$15,000 annually to devote to experiment station work. To each of these stations are attached one or more practical entomologists. What a large staff of trained workers this liberal policy must tend to produce. Are we to be blind or indifferent to the wealth of investigation and result these men are accomplishing? The potato beetle, the horn fly, the army worm, have to be combatted—in short which of our injurious insects has not to be combatted by the farmers of the northern United States as energetically as by ourselves, indeed it is usually from and through that country they reach us for unfortunately these insects pay no attention to political boundaries nor customs' officers. I believe the Americans as well as the vast majority of our own people realize that entomologically theirs and ours is one country. The Americans have honored two of our members—Dr. Fletcher and Dr. Bethune by electing them in 1889 and 1893 respectively as president of the entomological section of their chief national science association, President Cook at the Indianapolis meeting in 1890, speaking of "our country" said, "by ours I include, of course, our Canadian brothers for we, as scientists know no line of separation." That sentiment is reciprocated here.

Our American entomologists cordially work with ours for the common good. I remember Prof. Saunders relating that Prof. Lintner, State Entomologist, Albany, N. Y., had enlisted his co-operation to control the gooseberry saw-fly, *Nematus ventricosus*, by sending him parasitized eggs of that species. This is but an instance that might be multiplied. At a meeting in Brooklyn, N. Y., Mr. L. O. Howard, Chief Entomologist at Washington, after highly complimenting the Rev. Dr. Bethune as a Canadian entomologist testified that—in a large measure due to Dr. Fletcher and to Dr. Saunders—economic entomology had been energetically prosecuted in Canada. "Canada" he says "has the man (Dr. Fletcher) and the knowledge but has been hampered by want of funds. The result is that while she has immediately and intelligently adopted the results of researches made in this country she has not been able to lead us in original investigation."

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May our entire American confieres and worthy in the ventions.

In rising to mo address, Dr. Bethune manner to the found speaker set to work entomology. After Croft and Hicks, t was at the head of t marked by the addit early members was c our last annual meet him. We all miss always welcomed the weifare of the societ ment success. The s death of Captain Ga one of the Council re

Dr. Bethune the life history of parasi and referred to the e in the United State made to the annual space was given to mologists. In the fir by Dr. Fletcher, of (is therefore as much that science has no p the whole world, and American cousins, w our knowledge. We insects have come to custom-house officers, receive them on their other side" But for were trying experime nched over our take the earliest opy experience that has stations scattered ove unlikely otherwise to

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It is foolish to think of entomological areas being demarked by parallels of latitude or even by rivers and lakes. President Saunders in his address in 1882, declared that although belonging to Ontario and sustained in our work mainly by the liberal aid granted us by the Ontario Government, our sphere of usefulness extends throughout the length and breadth of this great Dominion, and also across the lines into the United States. That declaration is true; we can and do help our cousins across the lines and we are helped in return. The close student of the intercourse knows that we get as much or more than we give.

May our entomologists ever keep a watchful eye on the methods and results of their American confieres and continue to be regarded by them as skilful and helpful co-workers, and worthy in the future as in the past to fill places of honor in their national conventions.

DISCUSSION ON THE ADDRESS.

In rising to move a vote of thanks to the President for his very able and interesting address, Dr. Bethune said that he had been very kind in referring in so complimentary a manner to the founders of the society. Many years ago, Dr. William Saunders and the speaker set to work to gather together all those in this Province who were interested in entomology. After a meeting had been called, much assistance was given by Messrs. Croft and Hincks, two professors in the University of Toronto, and Dr. Sangster, who was at the head of the Normal School. Thus a beginning was made, and each year was marked by the addition of more members, and by some good work done. One of the early members was our lamented friend, Mr. John Denton, who had passed away since our last annual meeting, and who was esteemed and respected by every one who knew him. We all missed his kindly presence and the genial hospitality with which he always welcomed the members from a distance. He took the deepest interest in the welfare of the society, and by his exertions and wise counsels did much for its permanent success. The speaker also referred to the loss the society had sustained by the death of Captain Gamble Geddes, who had been an active member for many years and one of the Council representing Toronto Division.

Dr. Bethune then spoke of the great value of the President's researches into the life history of parasitic fungi and the practical advantages that may result from them, and referred to the excellent work that was being done in this respect by scientific men in the United States. He had learnt, with much surprise, that objections had been made to the annual reports of the society on the ground that so much attention and space was given to the proceedings of the American Association of Economic Entomologists. In the first place it should be remembered that this association was originated by Dr. Fletcher, of Ottawa, and was organized and held its first meeting in Toronto; it is therefore as much a Canadian as an American society. Furthermore we must all feel that science has no political, geographical, religious or sectional boundaries; it embraces the whole world, and on this continent we know that, while we can sometimes help our American cousins, we are largely indebted to them every year for valuable additions to our knowledge. We who study entomology are especially aware of this. Many noxious insects have come to us across the frontier, paying no respect to political boundaries or custom-house officers, and we have been prepared for their coming and taught how to receive them on their arrival by the experience and the labours of our friends "on the other side." But for this knowledge we should be in an unhappy plight, and while we were trying experiments and studying out the history of the insect, it would be sweeping unchecked over our fields or fruit trees. Surely it is most important that we should take the earliest opportunity possible of giving to our farmers and fruit-growers the experience that has been gained by the various state entomologists and experimental stations scattered over the continent, and afford them information which they would be unlikely otherwise to obtain.

Mr. Fyles, in seconding the vote of thanks, expressed the great delight with which he had listened to the President's address, especially to the part relating to fungi, which

opened a wide field of great interest, and he felt personally very grateful to the President for giving such a clear account of the growth of fungi and bringing before the meeting matters with which few of them were familiar.

After the vote of thanks had been put to the meeting and pronounced "carried," amid much applause, the President introduced Professor Panton, of the Ontario Agricultural College at Guelph, whose work and labours were, he said, well known to all who are interested in agriculture and entomology. Prof. Panton, who was very warmly received, said he had great pleasure in being present at this annual meeting of the Entomological Society of Ontario. He had done a good deal himself to disseminate the teachings of the society during the last fifteen years, and each year he had been much interested in reading the reports of its proceedings and researches, but till now he had always been prevented from being present at its meetings. He then proceeded to give the following address:

ENTOMOLOGY FOR RURAL SCHOOLS.

BY PROFESSOR J. HOYES PANTON.

It is a gratifying thing to observe, that within the past few years, there has been a growing desire, on the part of farmers, to know more of the teachings of science, as it bears upon agriculture. It has been the privilege of the writer to attend many Farmers' Institutes since their commencement. At first, any topic of a scientific nature excited but little interest. The great majority cared little to hear about a subject, which seemed entirely of a theoretical nature; and, far removed from the truly practical work of the farm. However, that condition has passed away, and the average farmer now feels, that a knowledge of the teachings of science lies at the very foundation of success in the pursuit of agriculture.

He has learned that science is simply systematized knowledge; that its principles are founded upon the facts which are discovered daily on the farm, or in the orchard. In reality, the farmer is one of the most scientific of men, and is surrounded by conditions especially fitted to develop observation, comparison, and method in work. The Farmers' Institutes have done a great work in awakening farmers to the necessity of a study of science, as it relates to their work. But we believe, a greater future is in store for the people of rural districts, when their children shall have become acquainted with the teachings of science, by giving some attention to its study, while, at the common school, in their neighbourhood. With a view to direct attention to how the study of economic entomology might be taught in country schools, this address is given before the Entomological Society of Ontario. The subject of entomology is one well fitted for study in rural schools; specimens are readily obtained for illustration, and, it is especially suited to interest young minds.

This can be accomplished without additional expense in purchasing books, and with little withdrawal of time from the time-table.

The writer would suggest a series of talks upon the subject, the last hour on Friday afternoon, during a portion of the summer months, when insects are most numerous.

Especial attention should be directed to such insects as are beneficial, or injurious, invariably having the pupils collect specimens and contribute them so as to form a collection that would represent the economic entomology of the section.

The following might be taken as an outline of several talks, before specific forms of insects were discussed, and with a little study on the part of any teacher, would supply valuable information:

I. *Definition of an Insect—Nature of the Mouth—Life History.*

An insect, Fig. 21, may be described as having three well-marked divisions: head, thorax, and abdomen; one pair of antennæ (feelers), three pairs of legs, usually two

pairs of wings; compound eyes; and a mouth through a series of conditions.

Among insects of beetles and in butterflies and application of insect applying some poison must be tre into the digestive are suitable for th able to suggest wh

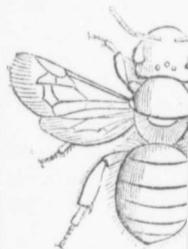


Fig. 21.

The development of the following and black species w



which is handsome!



Fig. 24, shows the process of changing into a lovely green

pairs of wings; respiration by means of tube-like structures (*tracheae*), simple and compound eyes and jointed limbs. Most insects undergo metamorphosis—that is, pass through a series of well-marked changes in their development from the egg to the adult condition.

Among insects we find two typical mouths: the masticatory or biting, characteristic of beetles and the larvæ of many insects; and the suctorial or sucking, represented in butterflies and plant-lice. A knowledge of these facts becomes of importance in the application of insecticides. Insects with *masticatory* mouths can be readily poisoned by applying some poison, such as Paris green, to their food; but those possessing a *suctorial* mouth must be treated with a substance that kills by contact and not by being introduced into the digestive system. Such insecticides as *Kerosene Emulsion* and *Pyrethrum* powder are suitable for this mode of treatment. Thus, by knowing the nature of mouths, we are able to suggest what substance is likely to be effective in destroying insects.

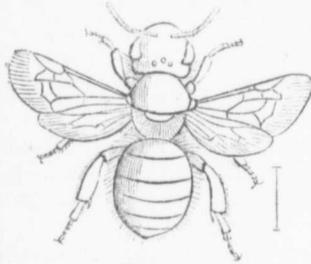


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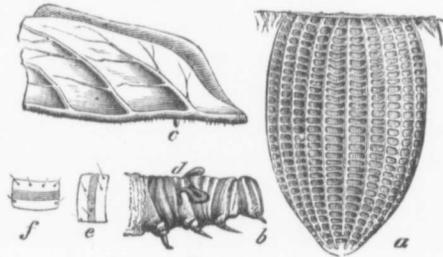


Fig. 22.

The development of an insect is represented by four stages—*egg, larva, pupa, imago*

The following figures illustrate the different stages of the *Archippus* butterfly, a red and black species which is familiar to every one.

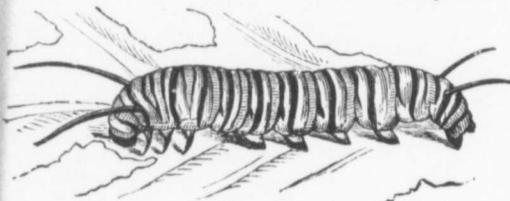


Fig. 23.

Fig. 22, *a* represents an egg, highly magnified, and *c* the egg of the natural size on the underside of a milkweed leaf; *b* shews the head and anterior segments of the caterpillar before its last moult, at *d* are the long fleshy horns, which at this stage are tucked under the skin; *e* and *f* shew the arrangement of the bristles on the segments.

Fig. 23 represents the caterpillar which is handsomely marked with black, yellow and white transverse stripes.

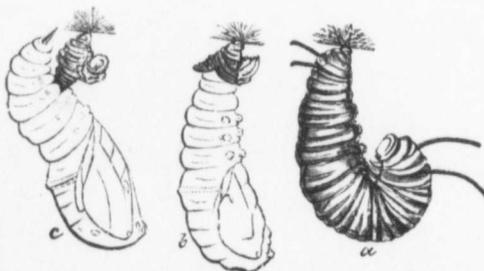


Fig. 24.



Fig. 25.

Fig. 24, shews the caterpillar at *a* suspended from a little button of silk preparatory to changing into a chrysalis; at *b* and *c* it is making further developments, till it becomes a lovely green pupa decorated with a band of golden spots, Fig. 25.

From this emerges in course of time the splendid butterfly, Fig. 26, which soars so gracefully through the summer air.

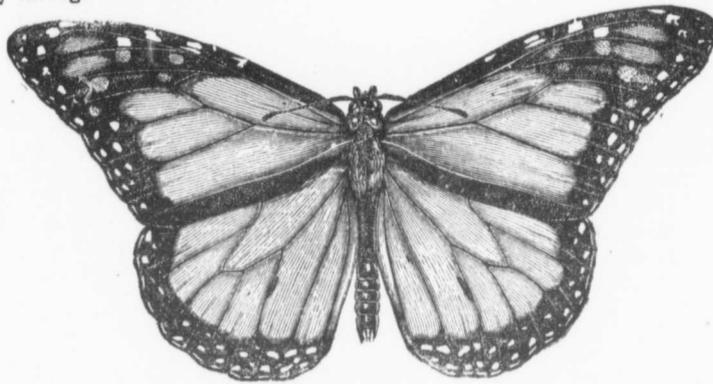


Fig. 26.

The *larva* (*larva*, a mask) is frequently without external organs and has a biting mouth; hence, it is a great feeder and usually very destructive to vegetation. The larval condition continues from two to six weeks in most; but there are some in which it is more than a year, e.g., the wire worm, white grub, and some "borers."

Pupa (*pupa*, a doll). This is generally a resting condition, which, in summer, usually lasts but a short time (about two weeks); but if entered in autumn, continues till the next spring. The term *chrysalis* (*chrysos*, gold) is often applied to this stage in butterflies, because in some it is dotted with golden spots. In most moths a *cocoon* is woven around the pupa. Nymph is applied to the young of such as do not undergo complete metamorphosis in development; in such the young are much the same in appearance as the adult, but smaller, and usually wingless; e.g., grasshoppers, bugs, etc.

Imago (*imago*, an image). This term is applied to the perfect insect, which is often harmless, as far as feeding upon vegetation is concerned.

The following names show some of the common terms applied to these stages in some orders of insects:

Larva	Pupa	Imago.
Borer, grub	"	Beetle.
Maggot	"	Fly.
Caterpillar or worm	Cocoon	Moth.
"	Chrysalis	Butterfly.
Nymph	Nymph	Grasshopper.

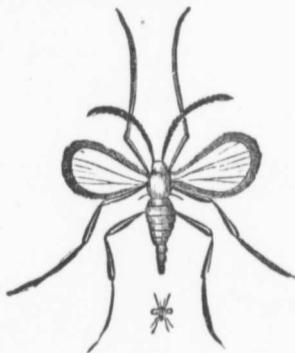


Fig. 27.

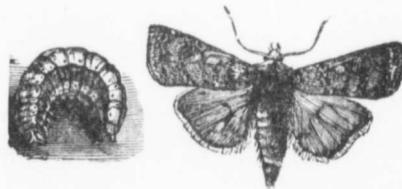


Fig. 28.

II.—Insects may be Beneficial or Injurious.

Beneficial.—The bee (honey); silkworm (silk); cochineal (dye); ichneumon (feeds on injurious insects).

Injurious.—Those affecting the products of the field (midges, Fig. 27, the wheat midge, etc.); the garden (cut-worms, Fig. 28, etc.); the orchard (borers, Fig. 29, etc.)

26, which soars so



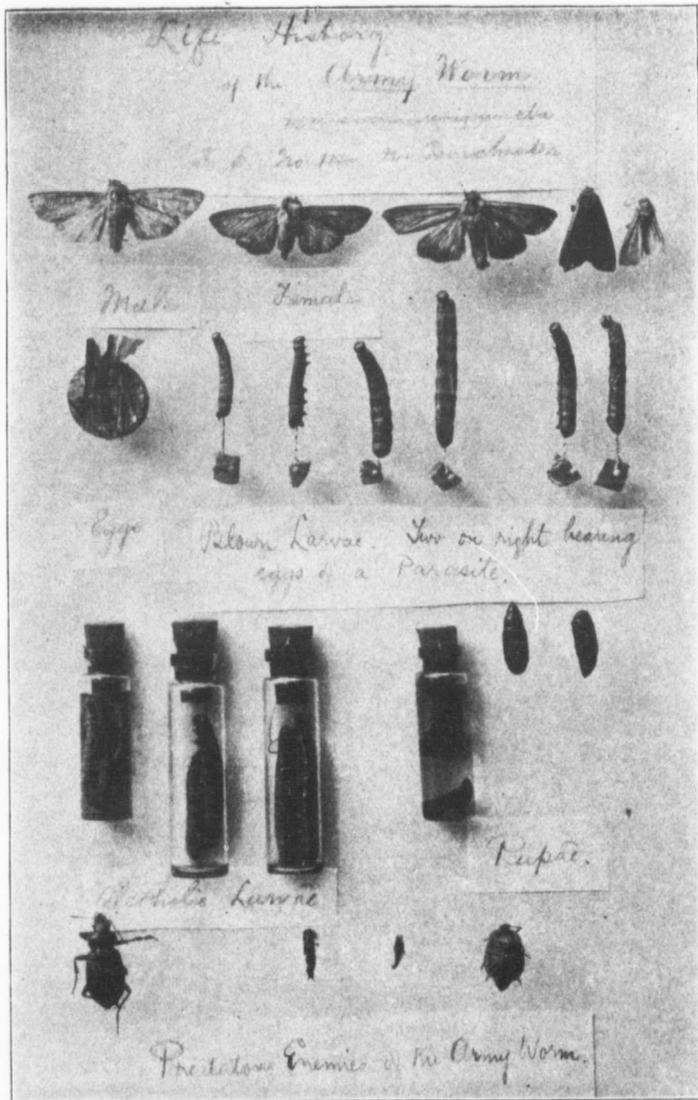
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- Imago.
- Beetle.
- Fly.
- Moth.
- Butterfly.
- Grasshopper.

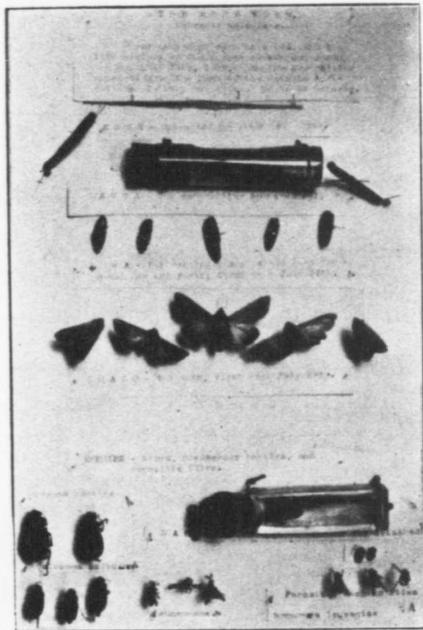


SCHOOL EXHIBIT OF THE LIFE-HISTORY OF THE ARMY WORM (see page 28).

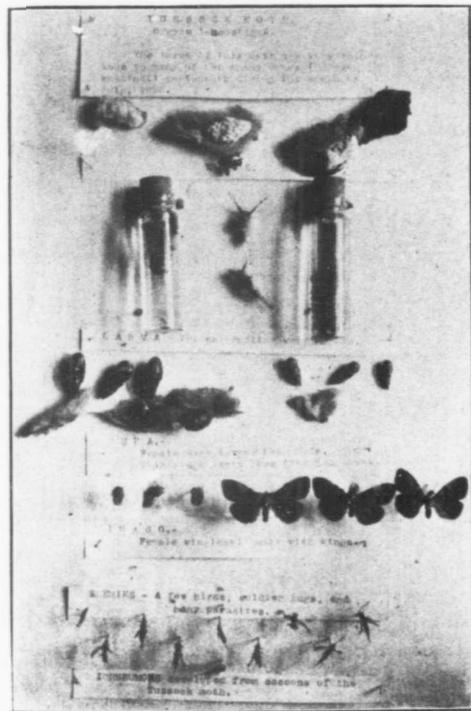
fe); ichneumon (feeds

es, Fig. 27, the wheat
orers, Fig. 29, etc.)

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A CASE ILLUSTRATING THE LIFE HISTORY
OF THE ARMY WORM.



A CASE ILLUSTRATING THE LIFE HISTORY
OF THE TUSOCK MOTH.

1. *Natural*
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Fig. 29.

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(c) *Insects*,
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Fig. 30.



Fig. 31.

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Fig.



Fig.

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III.—Remedies.

1. *Natural enemies.* a. *Birds.* Many investigations have been carried on to learn what insectivorous birds are useful in assisting man to keep in check his insect foes.

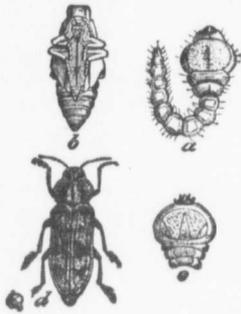


Fig. 29.

Thousands of birds have been shot, and the contents of their stomachs examined so as to ascertain with accuracy if the insects eaten were injurious. In some cases as many beneficial insects were devoured as harmful. The result of careful examination into the subject has been to consider the birds named in the following list as benefactors to the farmer, the fruit grower, and the gardener, and should, as far as possible, be protected and permitted to increase in number:—

King bird, pewee, night-hawk, swallow, whip poor-will, American redstart, yellow-billed cuckoo, blue bird, white-bellied nuthatch, red-headed woodpecker, high-holder, hairy woodpecker, downy woodpecker, golden warbler, red-eyed greenlet, yellow-throated greenlet, Wilson's thrush, brown thrush, cat bird, red-winged blackbird, crow blackbird, oriole, meadow lark, indigo bird, song sparrow, grass finch, chipping sparrow, chewink, purple finch, snow-bird, American goldfinch, horned lark, wren, chickadee, golden-crowned kinglet, ruby-crowned kinglet, and American creeper.

(b) *Mammals.* Moles, bats, shrews, racoons and skunks. (See Mr. Elliott's paper on Insectivorous Mammals.)

(c) *Insects.* Among the most beneficial insects we find the following in the different orders:



Fig. 30.



Fig. 31.



Fig. 32.

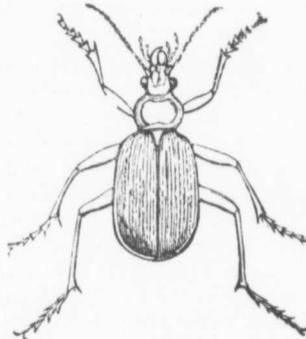


Fig. 33.



Fig. 34.

Order *Diptera*.—Syrphus fly (Figs. 30 and 31); Tachina fly.

O. *Coleoptera*.—Cicindela (tiger beetles) (Fig. 32); Calosoma (Fig. 33); Harpalus (Fig. 34) (ground beetles); Coccinella (lady-birds) (Figs. 35 and 36).



Fig. 35.



Fig. 36.



Fig. 37.

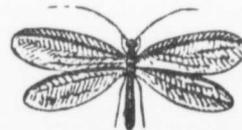


Fig. 38.

O. *Hemiptera*.—Reduvius, Arma (soldier bugs) (Fig. 37).

O. *Neuroptera*.—Chrysopa (laced-winged flies) (Fig. 38).

O. Hymenoptera.—*Vespa* (wasps) (Fig. 39); *Chrysis* (cuckoo flies), *Ichneumons*, (Fig. 40).

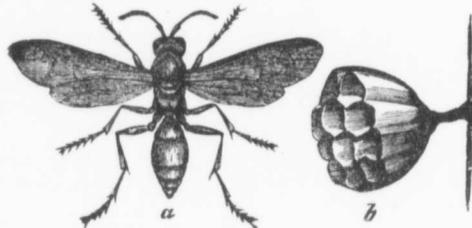


Fig. 39.



Fig. 40.

The above insects are of great importance in keeping the injurious insects upon which they prey in check. The ichneumons are most valuable in this respect. They are very numerous, and prey on many injurious insects, by depositing eggs in the larval forms. These eggs give rise to larval ichneumons that feed upon their host, which finally dies. About this time the ichneumons are developed and escape as perfect insects. The lady-birds are destroyers of plant lice; ground beetles prey on the potato beetle and several caterpillars, and the tiger beetles are great devourers of several species of insects.

(d) *Plants*. Some plants in the lowest orders do good service in destroying insects by being parasitic. Some (*Empusa*) attack the flies in autumn; some (*Sporotrichum*) the dreaded chinch bug, which is sometimes a serious pest in various parts of the United States; while the white grub has among its destroyers the parasitic fungus *Cordyceps*.

2. *Insecticides* (substances used for killing insects), *Gas*, *Paris Green* and *Kerosene Emulsion*.

Poisonous gas, generated in tents placed over shrubs and trees affected by scale insects, etc.

Carbon Bisulphide.—This colourless liquid is a most effectual remedy to get rid of insects in granaries, but great care requires to be taken as it is very inflammable and explosive, and may lead to serious results if any fire is brought near; even a cigar or pipe used where the vapor is being evolved may prove disastrous. It readily volatilizes; the vapor is heavier than air and is deadly to insect life. In using it the liquid may be placed in a small shallow vessel and put on the top of the grain, in bins or barrels. These are covered so as to keep in the vapor, which sinks down through the grain, destroying insect life wherever it comes in contact with it. After the operation is over the grain will lose all odor in a short time if exposed to the air. Some prefer taking a wad of cotton or tow, saturating it with the liquid, then plunging it into the middle of the bin and leaving it. Two or three bunches thus placed among the grain will soon kill all such pests as are found in it. One ounce is about sufficient for two bushels of grain.

Paris Green.—(Arsenite of copper, containing 50.60 per cent. of arsenic.) This is applied dry or in solution. In the dry form it should be mixed with 50 to 100 parts of plaster, wood ashes, flour or air-slacked lime and dusted upon the affected plants. The form in solution is usually one pound of Paris green to 200 gallons of water; but if the foliage is tender, 250 to 300 gallons of water may be used. This is the usual strength applied upon the plum and peach. As the green powder does not dissolve it requires to be kept thoroughly mixed by constant stirring. One pound of lime to every 100 gallons will prevent injury to the foliage. The Paris green should be first made into a thin paste, in a small quantity of water, and then added to the full amount of water.

Kerosene Emulsion.—This is a mixture of coal oil and water.

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Riley-Hubbard Emulsion.—Consists of half-a-pound of hard soap in one gallon of water. Boil till dissolved, and then add two gallons of coal oil, and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. This can be done by forcing it through the nozzle of a force-pump repeatedly until the mixture appears complete. It will then form a creamy mass which thickens into a jelly-like substance on cooling. In using dilute with nine parts of soft water. This form is very commonly used and is easily prepared. If the foliage is very tender the emulsion must be more dilute, fifteen to twenty parts water.

Whale oil soap is better than the common hard soap, especially if the emulsion is to be kept for some time. Soft soap may be used instead of hard, using one quart. Where the water is very hard sour milk may be taken ; in that case you require only to mix the coal oil (two gallons) and milk (one gallon) to get the emulsion, the soap not being required. This emulsion is liable to spoil if kept long. Kerosene emulsion is a most successful remedy for plant lice and scale insects.

3. Barriers.

Using barriers to check the progress of injurious forms, such as chinch bug, army worm, etc.

4. Traps, Baits.

Entrapping the insects, such as codling moth, canker worm and cut worms.

(a) Trap the larvæ crawling up and down the trunk by bands of rough cloth or tow, under which they will crawl and spin their cocoons.

(b) Use means to trap the climbing females. This may be done by putting a band of some material smeared with tar around the tree, or using what are known as "tree protectors," a sort of funnel-shaped structure that is fastened around the tree three or four feet from the ground ; these prevent the females from getting up the tree.

(c) In gardens poisoned baits may be successfully used, such as small bunches of clover, cabbage leaves, etc., dipped in Paris green solution (one pound Paris green to one hundred gallons water), and placed near the attacked plants. The cut worms will feed upon these and be destroyed.

5. Agricultural.

1. A proper rotation, so as to avoid sowing crops in fields where they are likely to be destroyed by insects.

2. Using good seed, e.g., peas without bugs.

3. Varying the seeding time so as to have the plants either too late or too early to be attacked by injurious insects.

4. Summer fallowing, so as to starve the insects and expose them to birds, etc.

5. Drainage. Some insects prefer moist soil, in such cases drainage will render it unfit for them.

6. Fall plowing is injurious to many insects especially the wire worm.

7. Manure. The use of manure helps the plants and enables them to overcome insect attacks. Vigorous plants are more likely to escape than sickly ones.

If such an outline were followed, a portion being taken for each talk, the leading principles of economic entomology would soon become familiar. Then, particular insects might be studied, and the pupils be encouraged to work out the life history of some. Starting with the egg, and observing the different stages passed until the perfect insect is reached.

Would it not be an excellent plan to influence the directors of county fairs to offer prizes for the best collections of beneficial and injurious insects, or for the best case illustrating the development of an insect from the egg to the imago?

If our teachers, in rural schools, were to follow a course something like what has been outlined in this address, who could estimate the influence upon the rising generation of farmers? Teachers desirous to take up this work could readily secure bulletins and books that would serve their purpose admirably. The writer would not have pupils get books, but to depend entirely upon the instructions of the teacher and their own observations in the orchard and upon the farm.

Such study of the great Book of Nature would result in developing observation in young minds, something that is aided very little in our system of education among rural schools. No faculty in the young mind is so ready for development as observation, and yet how little is done to assist it. Nature furnishes material on every side in the country, and surely we should take advantage of it and early train our young to be close observers.

We have no doubt that the study of such subjects would increase the attractiveness of farm life, and serve to keep many a boy upon the farm who, with such surroundings as we find to day, seeks the shadowy allurements of a home among overcrowded centres in town and city.

We hope the day is not far distant when the teachings of nature will be better known in country sections, and that the boys and girls of our farming districts will see more in farm life than what some bemoan as drudgery; that they will see in it that which tends to health, peace, independence, and an ideal home; and that while they eagerly learn *how* a thing should be done, they will also know the reason *why*, so that practice and science, the handmaids of agriculture, will be more closely associated than in the past.

In the discussion which followed the reading of the paper, Dr. Bethune said that as he had been a school-master for six and twenty years he could well appreciate all that had been said, both by the President and Professor Panton, on the subject of teaching entomology in schools, especially in those situated in rural districts. Any one who tried it would be pleased and surprised to find how readily people in general are interested in subjects of this kind, even when they have not paid any attention to them before. And in the case of children, who are always curious about anything that attracts their attention, it is an easy matter to excite their interest and lead them to observe for themselves some of the wonders and beauties of Nature. He thought that the plan of devoting the last hour on Friday afternoons in country schools to talks upon Natural History was an admirable one, and he hoped that it would be widely adopted. He had formerly made use of this hour in a similar manner himself, but of late years the large increase in the number of subjects for the Matriculation Examination had rendered it impossible to spare the time. He thought that if country life could be made more interesting to the young people fewer of them would be so eager to abandon their farms and rush into the towns and cities.

Mr. John S. Pearce spoke of the valuable work of the Society, which he did not think was as generally known as it should be. He thought that more should be done, especially by paragraphs in the newspapers, to draw the attention of the public to the great benefits which the Society has been for years conferring upon farmers, fruit-growers and gardeners throughout the Dominion.

Mr. John Law moved a vote of thanks to Professor Panton for his excellent address to which he had listened with great pleasure. This was seconded by Dr. Woolverton, and carried unanimously. In putting it to the meeting the President (Mr. Dearness) spoke on the importance of training the powers of observation of children by bringing subjects of nature before them. The object would then become the teacher, and the school-teacher the interpreter.

The Rev. T. V.

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The Rev. T. W. Fyles then read the following paper :

THE IMPORTANCE OF ENTOMOLOGICAL STUDIES TO AN AGRICULTURAL AND FRUIT-GROWING COMMUNITY.

REV. THOMAS W. FYLES, F.L.S., SOUTH QUEBEC.

It is wonderful proof of the wisdom and goodness of God that this earth, which He hath given to the children of men,* is so fitted and prepared that it affords scope and claim for the exercise of man's powers, and that man himself is so constituted that the employment of those powers is conducive to his well-being and enjoyment of life.

So true is this that though the fiat has gone forth—"Thorns and thistles shall the earth bring forth to thee. In the sweat of thy face shalt thou eat bread," it is also written, "Thou shalt eat the labour of thine hands. O well is thee, and happy shalt thou be."

In the vegetable kingdom materials in such great variety are so abundantly furnished, and man finds that he can, to so great an extent, select, transplant, modify and improve the plants producing them, for the supply of his necessities and gratification of his tastes, that he is stimulated to exertion, and comes to realize that he is, in a humble way, a co-worker with God; and his work is ennobled to him by the thought.

And not only do men, whose very living depends upon their endeavours in the field, the garden, the orchard and the vine-yard, take an interest in rural occupations and their rewards; "The king himself"—says the wise man—"is served by the field"; and the devotees of Ceres, Flora and Pomona are to be found as well among the highly gifted and trained leaders of the public as among the hard-handed sons of toil. The most eminent statesman can take pleasure in a *primrose* or an *orchid*. The great Lord Bacon spoke of Horticulture as the "purest of human pleasures; and the "Judicious Hooker," one of England's most learned and thoughtful divines, desired no higher preferment than a country cure, in which he might see God's gifts spring from the bosom of the mother earth.

It is the general interest in the productions of the soil, and whatever affects those productions, that is the *raison d'être* of the scientific associations fostered by our Department of Agriculture.

The task I have set myself is to shew the importance of Entomological studies to those who take an interest in the cultivation of the soil.

Entomology has to deal with "the locust, the caterpillar, and the palmer-worm"—God's "great army." So vast is this army that—to use the words of Dr. Lintner, the State Entomologist of New York—"it has been truthfully said that insects have established a kind of universal empire over the earth and its inhabitants. Minute as many of them are, and insignificant in size to other than naturalists, yet in combination they have desolated countries and brought famine and pestilence in their train." (First Report, p. 2.) Happily the hordes are duly apportioned. Each natural division of territory has its share. And there is such a marvellous arrangement of checks and counter-checks operating upon them that, as a rule, every kind is held in proper subjection.

The intentional or accidental transportation of an injurious species beyond the sphere of the operations of its natural foes sometimes occasions disaster.

Of the injuries wrought by imported insects we have had instances never to be forgotten, in the ravages of the Hessian Fly (*Cecidomyia destructor*, Say), the Cabbage Butterfly (*Pieris rapae*, Linn.), the Colorado Potato Beetle (*Doryphora decem-lineata*, Say), the Larch Saw fly (*Nematodes Erichsonii*, Hartig), the Gypsy Moth (*Oenocera dispar*, Linn.), and the Fluted Scale (*Icerya Purchasi*, Maskell).

It must not, however, be supposed that all insects are injurious. Many species must be ranked among the cultivator's friends. Indeed, of the 25,000 named species of North American insects about 8,000 only can be regarded as pests.

Some species are injurious in one stage of their existence and useful at another.

Our Hawk-Moths by dispersing pollen act beneficially for the fertilization of blossoms; but if unchecked increase were allowed them, their caterpillars would become terrible pests, and would destroy not only our fruit-trees but many of our shade and ornamental trees also. Their numbers are however kept down by various species of ichneumons belonging to the genera *Ophion*, *Cryptus*, *Microgaster*, *Apanteles*, etc. I have seen as many as 150 parasitic grubs issue from one larva of *Sphinx Kalmiae*, A. & S. It can easily be conceived that foes so numerous and so deadly would soon exterminate the Sphinges altogether.*

This would be a pity for, as I have said, the moths of the family perform a useful part. They are moreover very beautiful, and

"A thing of beauty is a joy forever."—Keats.

But the checks are met by counter-checks. Of those 150 grubs that I have mentioned not more than two or three escaped the attacks of a secondary parasite, *Pteromalus tabacum*, Fitch. This last named insect is a brilliant little object that once seen can hardly be forgotten.

People are familiar with the idea of one grub feeding inside another grub; but it is not so generally known that there are insects that pass their early stages and attain perfection inside the eggs of other insects. Ashmead in his valuable work on the Proctotrypidae, published in 1893 by the Smithsonian Institution, has given descriptions of forty-one such insects.

Then there are numerous kinds of ground-beetles, lady-birds, syrphus-flies, soldier-flies, dragon-flies, etc., predaceous on other sorts, and therefore beneficial to man.

The first point I make then is this:—*A knowledge of Entomology is important that men may rightly distinguish between their insect friends and their insect foes.*

In a paper which I had the honour to read before the Fruit Growers' Convention at Ottawa, I showed the important work done by Humble Bees in the cross fertilization of blossoms. These insects are so entirely beneficial that some of their kind have been—with a sort of grim propriety—transported to New Zealand to labour there for the public good.

But, at the very time that the Humble Bees are operating in the orchard for the fruit grower's benefit, there are a number of other insects at work that do a vast amount of harm, namely, the Bud-worms, Canker-worms, Leaf-rollers, etc. *The great remedy against all these hurtful insects is arsenical spraying.* But if this spraying be delayed till the blossoms are opened the nectaries will become clogged with the arsenite, and though the instinct of the bees may lead them to shun the poisoned blossoms, the good those insects would do will be left undone. *The first spraying should be given before the flower-buds are opened; the second after the fruit is fairly set.*

The Ontario Legislature passed a law in April, 1890, which says:

"Sec. 1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use, or cause to be used, any mixture containing Paris green, or any other poisonous substance injurious to bees."

Promptitude in dealing with in various insects is always of the utmost importance.

A patch of aphides neglected will spread, and spread, till it covers a tree—a little one becoming a thousand.

The apple tree Aphis (*Aphis mali*, Fab.) lays its eggs in the fall; and Mr. F. M. Webster suggests that apple trees should be sprayed in winter (see 24th Rep. of the Ent.

* Let us suppose that the whole number of grubs mentioned would produce perfect insects, and that half of these would be females; then let us see what the natural and unchecked increase of these would be at the end of five years. A little figuring will shew that it would amount to the enormous number of 4,746,093,750.

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Soc. of Ont., p. 90) for the destruction of the eggs. We should have to take an unusually mild time for such a purpose in this country! I dare say, however, that a spraying early in November, or early in the spring would be beneficial. Kerosene emulsion, made by violently agitating a mixture of two gallons of kerosene and one gallon of hot soap solution is prescribed as the remedy for use. It should be diluted with nine gallons of water (Lintner's 5th Rep., p. 161).

Late in the fall, or on favourable days in winter, the fruit grower can do good work by examining his trees and removing the egg masses of various species of injurious insects. A trained eye can readily detect the eggs of *Clisiocampa Americana*, Harris, Fig. 41.

Orgyia nova, Fitch, *O. leucostigma*, A. & S., and the cocoons of *Platysamia Cecropia*, Linn., *Telea Polyphemus*, Linn., *Callosamia Promethea*, Drury, Fig. 42. etc. But in removing such as these he should be careful not to destroy the clustered cocoons of microgasters, nor the downy masses of those of *Apanteles longicornis*, Prov.—a species that is parasitic in the Tent caterpillars—for these insects are among his most valuable friends.

The destruction of every hibernated Potato Beetle in the early spring is the destruction of an incipient host. The potato plants should be sprinkled with Paris green as soon as they appear above ground.

A friend of mine when the beetles first invaded the province, and before it was quite known how they should be dealt with, broke up a piece of land in the very centre of his extensive farm, and planted it with potatoes, hoping that its isolation would secure him a good crop. One early day he went to the enclosure to see if the potato plants were shewing themselves. They were not; but to his disgust there was, to use his own words, "a durned potato-bug sitting on the fence, and awaiting for them to appear." His action in regard to that individual was both prompt and effective!

Gooseberry and currant bushes should be gone over with white hellebore as soon as the leaf-buds begin to open.

The eggs of many of our hurtful species are laid in patches, as for instance those of *Datana ministra*, Drury, which produce the yellow-necked apple tree caterpillars, and those of *Cedemasia concinna*, A. & S., which produce the Red-humped apple tree caterpillars, Fig. 43. The young broods of these may be found in July, each brood feeding on the under side of a leaf. The plucking and destroying of a leaf and its burden is easily accomplished.

The Round headed Borer of the apple tree (*Saperda candida*, Fab.), Fig. 44, is a

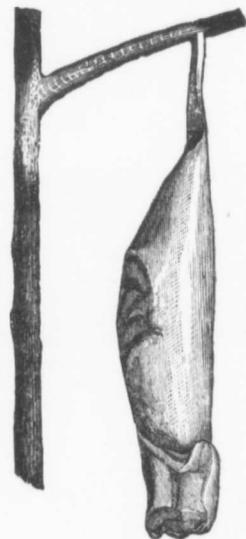


Fig. 43.

Fig. 44.

troublesome pest. Its native food-plants are the thorn, the moosemilla and the shad-bush, but it takes far too readily to the apple tree. The perfect beetle appears in June,

and lays its eggs in the end of that month and in July. In June then is the time for the fruit grower to go over the stems of his young apple trees with a brush and diluted soft soap. He can give them a scrubbing at the same time if he likes. Sir Joseph Banks freed his apple trees from the American Blight (*Erisoma lanigera*, Hans.) by the use of the scrubbing brush alone (Kirby and Spence's Entomology, Letter VI.). The second point I make is:—THE STUDY OF ENTOMOLOGY IS NECESSARY THAT THE CULTIVATOR MAY KNOW HOW AND WHEN TO DEAL WITH HIS INSECT FOES.

The study of Entomology is profitable. What harm and loss have been averted by the making known of insecticides and how to use them! *But greater good is sometimes done by calling in the aid of friends than by direct attacks upon foes.*

The introduction of the Australian Lady-bird (*Vedalia cardinalis*, Mulsant) has probably saved the orange groves of California from extinction.

I have no doubt that if the parasite (*Diplosis grassator*, Fyles) which keeps down the numbers of the Phylloxera in this country had been carried over to Europe it would have saved many a vine-yard that has disappeared.

The late Professor Riley introduced from Europe the species *Microgaster glomeratus*, which is a check upon the cabbage worm (*Pieris rapæ*, Linn.). The insect is figured and described in Wood's "Insects at Home," pp. 325-7. Wood tells us that "so rapidly does it multiply that after watching its progress from the larva to maturity, it seems strange that a single cabbage white butterfly should be found in the country." * * * "If a hundred cabbage caterpillars be captured, there will be only one or two which do not contain the larvæ of the microgaster."

Mr. A. D. Hopkins, of the West Virginia Agricultural Experiment Station, has lately introduced the European predaceous beetle, *Clerus formicarius*, Linn, to the United States; and it is thought that this insect will check the destruction of the spruce forests which has proceeded to such an alarming extent in that country. The clerid larva is the natural foe of the bark-boring and wood-boring larvæ. It searches them out and devours them with avidity.

As *Clerus formicarius* is a new importation to this continent, and is at present little known, a short description of it may be acceptable. The beetle is about three-eighths of an inch in length. Its head and the fore part of its thorax are black. The after part of the thorax and the base of the wing-covers are brick red. The remaining portions of the wing-covers are black crossed by two somewhat wavy, snow white lines.

The name *Kleros* was given by Aristotle to certain larvæ found in bee-hives. The trivial name *formicarius* was given to this species by Linnaeus because of the ant-like form of the beetle. (See Wood's "Insects at Home," p. 138).

A knowledge of Entomology was necessary for the understanding of the habits of these predaceous and parasitic insects, and for placing them where they might work to man's advantage. And this bringing about of good by the direction of natural agents is only in its inception. As our knowledge increases we shall, in all probability, be able to direct and control forces that are at present but little understood. My third point is:—THE STUDY OF ENTOMOLOGY IS NECESSARY THAT THE AGRICULTURIST AND FRUIT GROWER MAY MAKE THE MOST OF THEIR INSECT FRIENDS.

The Americans—a practical people—are fully alive to the importance of entomological research. Their division of entomology in the Department of Agriculture; their national museum; their experimental stations dotted all over the Union: their numerous scientific commissions, with their reports and bulletins—all bear witness to this fact.

Our own authorities do not mean to be behind hand. The establishment of experimental farms, the encouragement given to scientific and economic societies, farmers' clubs and institutes, etc., the printing and distributing of reports upon practical subjects, betoken an enlightened policy on their part.

But notwithstanding all that has been accomplished, sufficient care has not, I think, been taken to reach the young.

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In 1887, in a paper read before the Teachers' Convention at Sherbrooke, I advocated the cultivation in schools of a taste for natural history. The means I recommended to teachers were :

I. Conversations on natural objects ; informal lessons ; extempore sermons on texts from the book of nature.

II. The formation of school museums, libraries and gardens.

III. The giving of formal object lessons, each complete in itself, and bearing upon the purpose in view.

Examples of peripatetic lessons on natural history may be found in Gosse's "Canadian Naturalist" (which is now, I am sorry to say, out of print) and in "Country Walks of a Naturalist with his Children," Groombridge & Sons, London.

Hints for the formation of school museums may be found in a work written by a brother of a former rector of Quebec, and published by the S. P. C. K., viz.,—"The Story of our Museum," by the Rev. Henry Houseman, A.K.C.

We need some one to do for Canada what Miss Ormerod is doing for England to popularize PRACTICAL ENTOMOLOGY.

We need a hand-book on this subject, written after the model of that useful work "Spotton's High School Botany," for use in our public schools.

We need school wall-sheets, representing the most important of our insect friends and insect foes in their different stages, and giving a few brief particulars concerning them.

But it is time I brought this paper to a close. I will only say in conclusion that I know of no study more fascinating than that of entomology. It deals with objects of such exceeding beauty ; the life histories it makes known are so marvellous that they tell like fairy tales ; and, above all, the revelations that it makes to us of the Divine power, wisdom and goodness so lift our thoughts from earth to heaven that we are ready to exclaim with the Psalmist, "Oh Lord, how manifold are Thy works, in wisdom hast Thou made them all ; the earth is full of Thy riches." Ps. civ. 24.

Mr. Wm. Lohead spoke very highly of Mr. Fyles's papers in the annual reports, which he always read with great interest and pleasure. He thought that the popularizing of the study of entomology in our schools would form another step in the progress and advancement of Canada. He then gave an account of the work that was carried on at Cornell University in connection with entomology and described the advantages to be gained from the lectures, and the practical work in the "Insectary," from such able teachers as Professor Comstock and Mr. Slingerland.

Mr. J. Law moved a vote of thanks to Mr. Fyles for his valuable paper, and was seconded by Mr. W. Scarrow, who spoke of the lack of mental interest in farmers, which might, he thought, be developed by education in entomology and the study of other natural objects, and in this way farm-work would become a pleasure instead of mere drudgery.

A very humorous paper was then read by Mr. Law, in which he gave amusing descriptions of the experience he had with ants and other insect pests during a residence in Cuba ; he related an attack which he witnessed of a large spider on a humming-bird, and spoke of the size and beauty of the fire-flies and the profusion and variety of insect life in the tropics.

The meeting adjourned at 10.30 p.m.

THURSDAY, October 22nd.

MORNING SESSION.

The society met at 9.30 o'clock, the President occupying the chair, and proceeded with the reception of the reports of the several sections of the society and other matters of a business character.

The following report of the Geological Section was read by its secretary, Mr. John Law:—

REPORT OF THE GEOLOGICAL SECTION OF THE ENTOMOLOGICAL SOCIETY FOR THE YEAR 1895-6.

The members of this section beg to submit the following report for the past year:

Regular meetings were held weekly during the year, with a fair attendance. There has been no great increase of membership, but we look forward to our future place of meeting in the new building of the Y. M. C. A. as a means of stirring up our members to increased action in matters relating to the mineral wealth of our country and the welfare of the local section.

Additions have been made from time to time to our individual collections obtained from trips to outside places during the season. Our hopes for forming a central collection have not yet materialized owing to the failure of the effort to obtain the only rooms suitable for that purpose in the new public library building. This Section is pleased to state, however, that a collection of minerals has been presented to the free library, through the influence of Sir John Carling, by the Dominion Government. It is now accessible to our members, having been recently arranged and classified by the chairman of the section; this is putting into effect what was suggested in our last year's report, viz., "That it would be a great advantage to students of mineralogy if some steps could be taken by which the small number of geological and natural history societies in the Province could be provided with suitable collections of accurately named specimens of the chief economic minerals of the Dominion." A collection of minerals at the Western University is also available.

A number of places of geological interest have been visited by one or more of our members during the past season. A stroll through the Niagara district from Grimbsy to Hamilton afforded a collection of fossils from the prevailing rocks in that vicinity, viz., Niagara, Clinton, Medina, the upper Silurian formation. Other places visited were Owen Sound, Kettle and Stony Points (Lake Huron), Forest, St. Thomas, Sault Ste. Marie, Petosky, St. Ignace and Mackinac Island (Michigan), and Bruce Mines on the north channel.

Collections were made from each of these locations, affording the section plenty of new material for the coming winter's work. Valuable papers have been read from time to time before the section on natural history, astronomy and physiology. Some four to five lectures were also given on psychological subjects by the Rev. Mr. Falling.

A number of second year students of the Western University are also taking up the study of geology and mineralogy with the section.

Signed on behalf of the Geological Section by

JOHN LAW, Secretary.

S. WOOLVERTON, Chairman.

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ENTOMOLOGICAL SOCIETY OF ONTARIO.

REPORT OF THE BOTANICAL SECTION OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

In presenting their annual report the Botanical Section have pleasure in stating that the work of the year has been on the whole satisfactory and encouraging.

The meetings have been well attended, interesting and profitable, the new members especially showing an unusual interest in the work.

Meetings were held regularly every Saturday from the 1st May till the middle of July, after that the absence of many members on holiday trips and other uncontrollable circumstances interfered much with our meetings.

The work of the section was arranged so that the more advanced was taken one Saturday, and instruction classes in the more elementary work the next Saturday, the senior members taking turns in directing the examination of types of the common orders collected by the members.

The outings this year were mainly to localities near the city—one exception being a very pleasant trip to Woodstock and neighborhood, where the section were very hospitably entertained by Mr. Thos. P. Hart of that district.

Rare specimens obtained were *Orchis rotundifolia* and *Ophioglossum vulgatum*.

It is believed that the removal to more commodious rooms in the new Y. M. C. A. building will place the section as well as the society and their objects more prominently before the citizens, and result in a greatly increased membership, and consequently usefulness of both.

The section, while congratulating its ex-secretary, Mr. W. T. McClement, M.A., on his appointment to an important position in the Armour Institute, Chicago, regrets his removal from London. When he left he had tabulated the flora of London and environs as far as the Compositæ. This important work will be carried on by the section during the coming season.

A. HOTSON, M.D., Secretary.

REPORT OF THE MICROSCOPICAL SECTION OF THE ENTOMOLOGICAL SOCIETY.

Under the leadership of Mr. Rennie, the Microscopical section has had a year of continued success. The interest of members has kept them diligent in the good work. Notwithstanding the drawbacks consequent upon the poor position of our meeting place, the attendance has been well sustained. We think that in no year have we had more interesting subjects and never have they been presented with greater ability.

Meetings began on October, 11th, and were held each alternate week till April, 17th, when this section closed its meetings in favor of the Botanical, these two sections covering the year between them. We had but one meeting open to the public. This was well attended and general satisfaction was expressed at the many wonderful and beautiful objects under the microscopes.

The subjects studied during the year were as follows:

Desmids.—Their history, structure, distribution and classification, with drawings. These were illustrated by a large variety of specimens. Led by the Secretary.

Crystallography.—Specially as it applies to minerals, with specimens viewed both with and without polarized light. Led by Dr. Wolverton.

The Perisporiaceae.—Practical classification by members. Led by the Secretary.

Chemical Staining of Vegetable Tissues. Led by Dr. Hotson.

Mosses—Their history and dissection. Alternation of Generations, etc. Led by W. T. McClement, M.A.

Bacteriology. Led by Dr. Neu.

Photo-micrography. Led by Mr. Rennie, who had apparatus present and produced a very fine photo-micrograph of a small insect.

Seeds and their microscopical appearance. Led by Mr. Balkwill.

The relations between Gymnosperms, Cryptogams and Angiosperms. Led by Prof. Dearness.

Animal Hairs.—The significance of their structure, accompanied by a large number of mounts. Led by Prof. W. E. Saunders.

This section has suffered during the year by the loss of two of its active members, Mr. J. M. Denton whose removal by death we all deeply mourn, and Mr. W. T. McClement, M.A., whose home is now in Chicago.

We look out upon another year with anticipations of greater usefulness than we yet have had. The new rooms which we are to occupy will give the Microscopists an opportunity, such as they never have had, of coming under the public eye. It is the intention of this Section to infuse renewed zeal into their work. The wonders the microscope reveals as well as its delights are almost unknown to the public, and it is our purpose to make our meetings more popular during the fall and winter months.

JAS. H. BOWMAN,
Secretary.

The following paper was then read by Professor Panton, who prefaced his remarks by suggesting that a paper should be written by some one connected with the Society setting forth the advantages of the study of Economic Entomology. He spoke also of the necessity of making the work of the Society better known throughout the country and advised the publication of an abstract of the Annual Report in the daily papers. He also recommended that the conductors of county exhibitions should be urged to offer prizes for the best life-history of injurious insects, with specimens illustrating its various stages and modes of operation.

TWO INSECT PESTS OF 1896.

BY PROFESSOR J. HOYES PANTON.

During July of 1896, the attention of the public was, almost, daily directed to a newspaper item referring, either to the "Army Worm" or "Tussock Moth."

The former appeared in many parts of the Province or Ontario; and, in some places, destroyed considerable grain; the latter, was confined to the City of Toronto; where it did much damage to ornamental trees in different parts of the city. The writer having had the opportunity of visiting several of the infested districts, has thought it expedient to place before the Entomological Society of Ontario the results of his investigations.

THE ARMY WORM.

Leucania unipuncta.

We find the army worm reported as present in the township of Eldon, Victoria county, in August 1833, and, common in many places throughout Ontario Province in 1861.

In July, 1894, it did considerable damage in the counties of Lambton and Victoria.



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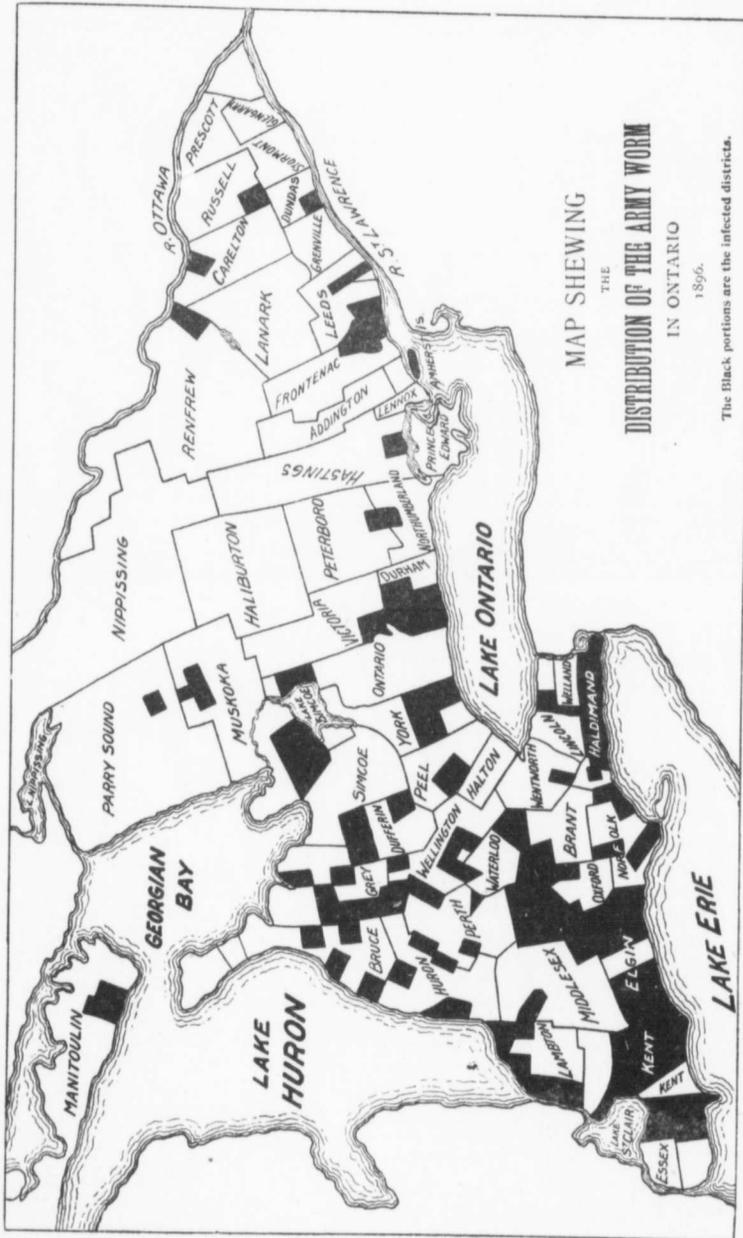
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MAP SHEWING
THE
DISTRIBUTION OF THE ARMY WORM
IN ONTARIO
1896.

The black portions are the infected districts.

The first notice received at the Agricultural College of its appearance in the Province of Ontario this season, was, in a letter from Marshville, county of Welland, dated July 3rd. On that date, Mr. J. Reavley, living near Marshville, sent some of the worms and a letter describing the attack. The writer visited Mr. Reavley's farm on July 9th, and several others in the townships of Wainfleet, and Humberstone the next day. Throughout the month, letters were daily received, announcing its arrival at different places throughout the Province of Ontario. On the 8th of July, the caterpillars appeared in an oat-field at the Agricultural College, by the 11th, they were very numerous, and reached their maximum on the 15th. From that date a perceptible decrease was daily observed, so, that by the 18th, only a few remained. They began to pass into the pupa stage on the 14th, and, the first moth was observed on 29th of July. Circulars were then sent out, with a view to learn something of the distribution of the army worm at this time; the damage done by it; the means employed to check its progress; and the length of time the caterpillars continued. About 450 replies were received from different townships, throughout the Province.

The accompanying map shows the distribution of this insect pest in Ontario during 1896.

The counties reported as infested are as follows:

Essex (5); *Kent* (8); *Elgin* (6); *Norfolk* (3); *Haldimand* (4); *Welland* (4); *Lincoln* (1); *Wentworth* (1); *Peel* (1); *York* (3); *Ontario* (1); *Durham* (3); *Northumberland* (1); *Hastings* (1); *Lennox* (1); *Frontenac* (2); *Leeds* (4); *Dundas* (1); *Russel* (1); *Carleton* (1); *Renfrew* (2); *Parry Sound* (1); *Muskoka* (5); *Simcoe* (6); *Grey* (6); *Bruce* (5); *Huron* (5); *Lambton* (7); *Middlesex* (4); *Oxford* (5); *Waterloo* (2); *Wellington* (5); *Perth* (3); *Cardwell* (1); *Dufferin* (3); *Victoria* (1); *Peterboro* (2); *Algoma* (1); *Manitoulin* (2); 39 counties and 118 townships.

The counties written in italics are referred to by observers, as suffering considerable loss. The figures after each county indicate the number of townships reported as infested. In many places the damage was slight, as the worms were too late in arriving to do much harm, owing to the advanced condition of the crops attacked. Early sowing is evidently favorable to an escape from disastrous results by an invasion of this pest. Of the crops attacked, oats suffered most; they seem to be a very attractive food for this caterpillar.

From a count made of crops reported attacked, 58 per cent. were oats, 20 per cent. corn, 16 per cent. wheat, and 5 per cent. barley. Some observers report a loss of 50 per cent. in oat-fields, while in most of the other cases the damage was comparatively slight. There were a few cases reported in which almost the whole crop was destroyed. In one oatfield at the college 50 per cent. of the crop was destroyed. In this case the worms were in all parts of the field before being discovered, and no measures could be adopted to stop their ravages. In most cases the attack did not continue longer than two weeks, in several, it lasted but a few days, and very seldom lasted longer than three weeks.

Several worms are known as the "army worm," but the true one is that which has appeared in so many parts of Ontario during the month of July, 1896. It seems also to have been common in several parts of the United States about the same time.

A despatch in one of our daily papers, dated, Washington, July 16th, reads: "Reports to the agricultural department indicate great ravages by the army worm, in all states from Maine to Wisconsin. The pests have been particularly destructive in New York, Massachusetts and Pennsylvania; there is no doubt that the losses will foot up into the millions." In New York State it appeared in 48 counties, and is reported, as the worst invasion in the history of the state. They were, also, common in Ohio and Illinois.

As grain crops were well advanced before its arrival, in many places of Ontario, the damage done was much less than it might have been. The attack, though in many

counties, was not great.

The army worm, at this time, appears in



Fig. 45.
the army

1743, 1861 is known to have occurred in the year it received its name in 1872; 1875, 1861, 1875, 1880

The moths feed on grasses, and some are preferred, but they are also found upon

In one of the stalks from last year the sadder first attacked, and were not confined to the stalk, but were found to be laid in rows, on the fold of the leaf, 500 to 700 eggs,

counties, was usually confined to small areas in each case, so that on the whole, the loss was not great.

The army worm (figures 45 and 46) is not at all a rare insect, and, from time to time, appears in Canada and the Northern States. We find it referred to as far back as



Fig. 45. Eggs, larva, pupa, imago of the army worm (*Leucania unipuncta*).



Fig. 46.

1743, 1861 is known as, "the army worm year," in the United States. During that year it received considerable attention and study. In 1869, it was quite common, also in 1872; 1875 was a bad year, and in 1880 it attracted much attention. The years 1861, 1875, 1880, are those in which the insect seems to have demanded most attention.

The moths are hatched from small, round white, eggs laid on wild, or cultivated grasses, and sometimes on grain along the inner base of the blades, where they are doubled, or, between the stalk and its surrounding sheath. The rankest tufts of grass seem to be preferred, but, in some cases, the eggs are found on pieces of cornstalk, and they have been found upon spring and winter grain.

In one of the worst attacked oat fields, at the College, there were many old cornstalks from last year's crop; these, likely, afforded a suitable place for eggs, and this explains the sudden appearance of the caterpillars in all parts of it. This field was the first attacked, and from it many of the caterpillars appeared to have come, in this they were not confined to the edges, as was usually the case in the other fields. The eggs appear to be laid in the evening, or early night. They are deposited in rows, 15 to 20 in a row, on the folded leaf, which serves to conceal them. One female may deposit from 500 to 700 eggs, and seldom takes longer than two or three nights to do so.

The eggs hatch in about a week after being laid. The young caterpillars, in the first stage, can drop by means of a thread, and move with a loop-like motion. At this time, they are of a light greenish color, and thus resemble the plants on which they feed, and escape the notice of their enemies. The larva passes through five moults, at intervals of three or four days until it reaches the sixth stage, and is fully developed in about four weeks. The caterpillar is about one and a half inches in length, of a dark gray color, with blackish stripes, and numerous white lines along the back. In many specimens examined by the writer, comparatively few were light colored, until about the close of the attack, and then, the light ones were much more common. Some claim that the dark color is due to exposure. The length of time before complete development of the larva is reached depends a great deal upon temperature, and may vary from 16 to 28 days.

The mid-summer brood usually takes a shorter time than that of the fall. During the day they avoid the rays of the sun by hiding under clods, pieces of boards, chips, etc., and about 5 p. m. they emerge to feed.

In making observations about noon with Mr. Reavley near Marshville, we were surprised that so few worms could be seen at that hour, in a field badly attacked.

But on turning over sods among the oats, we found them in great numbers. We counted over 30 occupying a space no larger than the hand, and, in some parts, more than 50 to the square foot.

In a small patch of late oats on the Reavley farm scarcely a blade was left. The worms abandoned the ripening oats near by, and congregated upon the patch of late oats, no doubt, because they were more succulent.

Every stalk had from one to five worms upon it, and many were eaten to within three inches of the ground. They feed chiefly during the night, and sometimes in cloudy weather. Where they are in great numbers, they make a peculiar sound, which can be heard distinctly, while they are feeding, and cutting off the stalks and heads of grain. Under ordinary conditions, they do not travel, but live much as many other species of the cut worm family do (Noctuidae) to which they belong feeding by night, and hiding by day. However when food becomes scarce, they then undertake to march for new feeding grounds.

They stop at no obstacle, death only will make them halt. A piggyery at the college impeded their progress for some days. They never attempted to go around it, but in vain tried to scale its walls, and kept constantly dropping, yet always ready to try the ascent again.

From observations made, as to this rate of travel, while crossing the lane between two fields they were seen to move two feet a minute (40 yards per hour.)

With us they usually appeared active from 4 o'clock p. m., and after that continued to move in great numbers, in all directions, and not in a definite line of march. While feeding, they devoured the leaves and then nipped off the head, which falling to the ground was no longer touched. In attacking some bearded wheat they nibbled off the awns, and only partially fed upon the grain. Oats, timothy, wheat, rye, and barley are their favorite plants; they also feed readily on corn, if young and tender; but they seem to have no inclination for any plants not in the order *gramineae* unless forced by hunger. In a hay field, they will leave the clover and devour every plant of timothy. Several of our fields had excellent crops of young clover; these were left untouched, while the oats and wheat were continually fed upon. In bringing some caterpillars from Humberstone, pea plants were put in the box with them for food, but they were scarcely touched in two days.

The following are results reached during our observations regarding the plants upon which they feed, oats, barley, wheat, and corn they readily devoured.

Clover. This was eaten very sparingly and was left if wheat or oats were introduced into the boxes containing caterpillars. Clover was put in the boxes on Monday, by Tuesday night it was hardly touched, but they began to feed upon it on Wednesday. They ate it, only when nothing more attractive was obtainable.

Lucerne. The beans and lucerne increased, the b were not touched

Peas. They the latter were no

Turnips. The box, the turnip oat fields; the cat ing upon a single

Potatoes, wer

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From these largely restricted *leguminosae* and s little fear of any c and corn.

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The moth is fa The wings when sp It conceals its seen flying around female has a more hairy, than those o

Lucerne. This seemed less attractive and was not touched until Thursday. Clover, beans and lucerne were put in the same box; all were avoided at first, but, as hunger increased, the beans were first eaten, then clover, and lucerne last. Beans in the box were not touched till Wednesday.

Peas. They were not touched for two days. In a field sown with oats and pease, the latter were not attacked, as long as the oats remained.

Turnips. These were left untouched for a day; as soon as a leaf of corn was put in the box, the turnips were at once deserted. A turnip field bordered one of the infested oat fields; the caterpillars in leaving the latter passed through the former without feeding upon a single plant.

Potatoes, were left untouched in the boxes.

Mangels adjoining one of the invaded fields escaped damage, though caterpillars were constantly passing over and among the plants. In the boxes they were slightly nibbled.

Beets remained untouched for three days.

Buckwheat was taken after a day's fast, when nothing else was presented; but as soon as corn was added they immediately left the buckwheat to feed upon it.

Carrots escaped for a day, but in two days were fairly well eaten. They would not touch carrots in the presence of grass or corn.

Cucumber vines were preferred to beans, and were almost as readily eaten as some corn leaves.

Celery was continually avoided, and the worms began to devour one another before they would feed upon it.

Maple leaves were avoided, but some apple were sparingly fed upon, after two day's fast.

Grape leaves were taken, when no other food was present.

Strawberry leaves remained untouched till the third day.

Currant leaves were avoided for three days and then eaten, but sparingly.

Canadian thistles remained untouched.

When no food was put in the boxes containing caterpillars, in 24 hours they began to devour one another. Frequently in boxes containing unattractive food, heads were found among the leaves, these no doubt belonged to bodies that had been devoured by the survivors.

From these experiments, it would seem that the food of the Army worm is largely restricted to the *gramineæ*, and that they will not feed upon plants from the *leguminosæ* and some other orders unless pressed by hunger. Consequently, there is little fear of any other farm crop being attacked than oats, wheat, timothy, rye, barley and corn.

Having become fully developed caterpillars at the end of three or four weeks from the time of being hatched, they pass into the ground, just below the surface or under stones, clods, etc., and enter the *pupa* stage. In a field at the College many pupa cases were found in cracks in the soil.

This condition lasts two weeks, and then the perfect insect (*imago*) emerges from its pupa case.

The moth is fawn-colored, with a small white spot near the centre of each front wing. The wings when spread measure one and a half inches across.

It conceals itself during the day and begins to fly towards night. Many could be seen flying around the electric lights in Guelph about the second week in August. The female has a more pointed abdomen than the male and her antennæ are smoother, and less hairy, than those of the male.

The moths feeding on flowers are more likely to be found near low ground, and hence they appear to come from such places. There appear to be three generations represented in a season or two broods in a year; the first wintering as larvæ, the second forming the "Armies," and the third larvæ derived from these after the imago has been developed; the last wintering as larvæ. The army worm usually winters in the larval form, but sometimes as the moth.

In the vicinity of our fields at Guelph, where the caterpillars were so numerous, we have as yet (Oct. 18th) failed to find any of the second brood.

The following stages (taken from Riley's report 1882) in the life history of an Army worm gives a good idea of the length of time that elapses in passing from the egg to imago. Eggs laid May 4th, hatched May 11th, 1st moult May 17th, 2nd moult May 20th, 3rd moult May 23rd, 4th moult May 26th, 5th moult May 29th: pupa June 2nd, imago June 17th.

At the College the first caterpillars were observed on the 8th of July; on the 9th there was a perceptible increase, 12th a marked increase; 13th large numbers; 14th, 15th still very numerous; on the 16th a perceptible decrease; 17th the decrease quite marked; 18th, 19th comparatively few; 20th only a few stragglers could be seen, and, most of these, were light colored. Towards the close of the attack, a bacterial disease seemed to destroy some of them. It is a matter of surprise to many how these caterpillars appear and disappear so suddenly, but a little reflection upon their life history explains the mystery.

Hidden in the grass by day, and feeding at night, they escape observation. If one or more dry seasons come, they multiply rapidly. Large numbers winter in the larval condition, and during the following spring moths appear and lay many eggs, which hatch and give rise to innumerable caterpillars which from a scarcity of food are forced to "march" and thus become suddenly conspicuous. These develop, pass into the ground to enter the pupa stage, and thus disappear suddenly.

Dry weather seems favourable for their development. Consequently a dry season, followed by a mild winter, and a dry summer, as in 1895, and 1896, supplied conditions very suitable for increase of the army worm in many parts of Ontario.

Having referred to the distribution, and life history of this insect, and some of our investigations in connection with it, we may now direct attention to some of the means by which it is, and may be prevented from being a source of alarm.

Natural remedies. The army worm has many enemies; nearly all insectivorous birds relish it as a sweet morsel, and are ready to feed upon it the moment it becomes conspicuous. In Guelph, this season, the English sparrows congregated in great numbers, where the caterpillars were numerous, and fed voraciously upon them. In some parts of the United States the bobolink is called the army worm bird.



Fig. 47.
Tiger Beetle.



Fig. 48.
(*Calosoma calidum*.)
[After Riley.]



Fig. 49.
Ground beetle (*Harpalus caliginosus*)
[After Riley.]

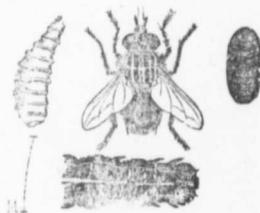


Fig. 50.
Nemoraea leucania.

The ground beetles, *Calosoma calidum*, fig 48, and *Harpalus caliginosus*, fig 49, especially the former, were very numerous in the infested fields. Tiger beetles (*Cincin-*

delidae) fig 47, also to assist in destroy 50. In the infested caterpillars, bearing a caterpillar, and th more than a single tion not easily reac number of the flies grub bores into the life. At first, non caterpillars were e a benefactor had a red tip at the end the first army wor fly (*Tachina flavic*

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Frequent re effectual barrier case the worms n difficulty.

delidæ) fig 47, also prey upon them. But, probably, one of the greatest insect friends to assist in destroying the army worm is the red tailed tachina fly (*Nemoræa leucanæ*) fig. 50. In the infested fields of Wainfleet near Marshville, the writer found many of the caterpillars, bearing the eggs of this insect upon them. In some cases, several eggs upon a caterpillar, and the flies themselves buzzing around. At the college we seldom saw more than a single egg upon a caterpillar and this was usually near the head, in a position not easily reached by the worm to tear it off. We succeeded in developing quite a number of the flies. Shortly after the egg is deposited it hatches, and the small white grub bores into the worm (host) and feeds upon it, developing at the expense of the host's life. At first, none of the minute white eggs of the fly could be seen, though many caterpillars were examined, but in a few days, some were observed which indicated that a benefactor had arrived. This beneficial insect resembles a large house fly, but has a red tip at the end of the body. The first one appeared in our breeding cages Aug. 4th; the first army worm moth July 29th. Some observers have seen the yellow-tailed tachina fly (*Tachina flavicauda*) preying upon the army worm.

While developing the caterpillars in securing several specimens of *Ichnemon leucanæ*, another parasite, and one of *Ophion purgatus*.

Altogether, investigators have found some twenty different species of insects that attack and assist greatly in destroying the army worm.

It will thus be seen that the moment these insects emerge from their hiding places in grass fields, they are pursued by a host of relentless foes in the form of birds, predaceous beetles and parasitic flies.

Artificial remedies. 1. As this insect breeds largely in rank grass, such as is seen bordering swamps, it is well, where practicable, to burn such in the fall or spring. Clean cultivation, and the keeping of fence corners, etc., clean, should be followed, as far as possible.

2. Where the worm has appeared its progress may be stopped by plowing a furrow with its perpendicular side next the field to be protected, or a ditch may be dug in the same position. Holes dug at intervals of ten to fifteen feet, in the furrow or ditch will be useful in catching the worms, failing to climb the sides, and wandering aimlessly along the furrow. The worms collected in the furrow or ditch may be destroyed as follows: (a) Plowing a furrow, so as to bury them; (b) Sprinkling coal oil upon them; (c) Scattering straw over them and firing it; (d) Dragging a heavy pole along the ditch.

3. Where Paris green may be safely used a strong mixture (one pound to seventy-five gallons water) sprayed upon the plants likely to be first attacked will be effective. Windrows of green oats sprinkled in this way in the line of march will destroy myriads as they feed upon their favorite food. At the College immense numbers were destroyed in this way in a short time. By actual count made by the writer July 18th, 2,560 dead worms lay on a single square foot beneath the windrows.

4. Sometimes, conditions are such, that great numbers may be crushed under a roller.

5. Windrows of straw sometimes afford a place of concealment for the worms, and may be fired so as to destroy many beneath them.

6. Some recommend spraying several times a day with kerosene emulsion, a strip of ground over which the insects are passing.

Frequent reference has been made in newspapers to the use of salt or lime as an effectual barrier to their progress. We experimented with both, and found that in each case the worms moved over and through the lime and salt, apparently without the least difficulty.



Fig. 50.
Nemoræa leucanæ.

gnosus, fig 49, es-
ter beetles (*Cincin-*

TUSSOCK MOTH.

Orgyia leucostigma.

The Tussock moth is another insect pest which has attracted considerable attention during July, 1896. Though not widespread in its attack, it has occupied considerable space in the newspapers.

Its ravages have been largely confined to the defoliation of shade trees in the city of Toronto, and hence, appearing at a place where important daily papers are published, it received much notice.

Although in Toronto this caterpillar confined itself largely to an attack upon the horse-chestnut trees, yet it feeds upon the foliage of other trees. It has been found doing much injury to the elm and apple, and also feeding upon the plum, pear, maple, oak, walnut, butternut, locust and spruce. Few, if any trees, are exempt from its attack. It made its appearance in Toronto about July 1st, and remained for about three weeks, during which time it defoliated many of the horse-chestnut trees on Jarvis street, College avenue and in some other parts of the city. The writer visited the city July 27th, and had an opportunity to investigate its ravages.

This insect is readily identified in all its stages—egg, larva, pupa and imago.



Orgyia leucostigma. a Adult female on cocoon. b Young larva. c Female pupa. d Male pupa. e Adult male (after Riley).

The eggs appear in masses (400-700) covered with a froth-like substance, that dries and hardens upon them, and serves to protect them from injury by the weather (rain), predaceous insects, and even birds. This covering is very white, and thus renders the

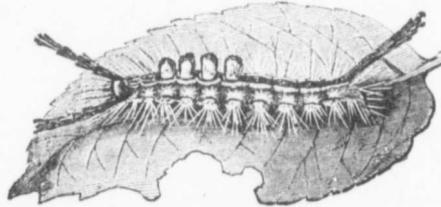


Fig. 55. *O. leucostigma*, full-grown larva (after Riley).

egg masses quite conspicuous at a considerable distance where they are deposited. These masses may be found on the trunk of the trees, in crevices of the bark, on the larger limbs, or in sheltered spots, such as fence boards and on bunches of dead leaves hanging upon the tree. In Toronto, the trunks of the horse-chestnut trees attacked presented in some cases quite a spotted appearance, from the innumerable white masses of eggs and cocoons attached to the bark.

As soon as the eggs hatch, tiny caterpillars (fig. 51, b) make their appearance (usually about June), and, as development proceeds, they pass through a series of molts, three—(one

a week). After the it so readily identify bright red color; the covered with long, cream colored dense segments; while from one projects back

The young caterpillars leaves: when distorting ascending the tree:

Having reached they have reached (and 53), which last and very thin; w texture. The male much larger, and sl

The cocoons in sheltered spots near the trees were in s beneath the window

In about a week about 1 1/4 inches across legs. The general shade, with two black inner edge, also near numerous females.

The female (fig. She is scarcely able upon the old cocoon life work ends, she stage, when clustered

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Natural remedies ones that seem to cuckoo. Some but parasites follow in

A great many from Toronto for fu

Two Tachina fly army worm, but we

Artificial remedy (of water) will destroy of injuring the foliage may be used.

2. Gather the readily destroyed.

3. Bands of prevent the caterpillar

This caterpillar difficult one to control and destroying

a week). After the third, the larva (fig. 55) presents all the striking characters which make it so readily identified. The head, and the spots on the 9th and 10th segments are a bright red color; the back is black, with yellow lines along the sides; the body is sparsely covered with long, pale yellow hairs, giving the caterpillars a yellowish appearance. Four cream colored dense tufts of hair form a row upon the back of the 4th, 5th, 6th and 7th segments; while from each side of the head a long black tuft extends forward, and a single one projects backward from the posterior end of the body.

The young caterpillars soon after hatching scatter over the trees, feeding upon the leaves; when disturbed, they drop by a silken thread to the ground, wander about, many ascending the tree again.

Having reached full development, which takes about six weeks, during which they have reached a little over an inch in length, they enter the *pupa* stage (figs. 52 and 53), which lasts less than two weeks. The cocoon of the male is whitish, or yellowish, and very thin; while that of the female is much larger, of a gray color, and firmer texture. The male chrysalis is brownish, and shows rudimentary wings; the female is much larger, and shows no wing sheaths.

The cocoons may be found in crevices of the bark on the trunk, and large limbs, or in sheltered spots near where the caterpillars have been feeding. In Toronto the trunks of the trees were in some cases almost covered with them, and very many could be found beneath the window sills and the top boards of fences.

In about a week the *imago* appears. The male moth (fig. 54) is winged, and measures about $1\frac{1}{4}$ inches across the expanded wings; has feathery antennæ and very hairy front legs. The general color is ash-grey; the front wings are crossed by heavy bands of darker shade, with two black markings on the outer edge, near the tip, and a white spot on the inner edge, also near the tip. The writer succeeded in getting very few of the males, but numerous females.

The female (fig. 51) is wingless, of a pale gray color; short antennæ, not feathered. She is scarcely able to walk. Soon after emerging from the cocoon she begins to lay her eggs upon the old cocoon, and covers them with a frothy substance; as soon as this is done her life work ends, she drops exhausted and dies. The winter is usually spent in the egg stage, when clusters of them may be seen upon the trees.

Much depends on the season whether there will be one or two broods (a brood occupies about two months in completing its development).

Natural remedies.—Very few birds care to swallow this hairy caterpillar; the only ones that seem to feed upon it are the robin, Baltimore oriole, and the yellow-billed cuckoo. Some bugs (*Prionidus cristatus*) occasionally attack it. A large number of parasites follow in its trail, and do good work in checking its increase.

A great many ichneumons (*Pimpla inquisitor*) developed among the cocoons brought from Toronto for further examination.

Two Tachina flies also were developed in the cages. They resembled those of the army worm, but were smaller,

Artificial remedies.—1. Spraying with Paris green mixture (1 lb. in 150-200 gallons of water) will destroy the caterpillars feeding upon the leaves. If there is any danger of injuring the foliage, 1 lb. to 160 gallons of water, to which is added 1 lb. of quicklime, may be used.

2. Gather the eggs in winter, as they are very conspicuous at that time, and may be readily destroyed.

3. Bands of adhesive material may be painted around the trunk. These will prevent the caterpillars ascending the tree.

This caterpillar, though capable of doing much injury, is not considered to be a difficult one to control. Spraying as above is very effective, and this followed by collecting and destroying egg masses when the leaves have fallen, cannot fail to be successful.

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In the case of the attack at Toronto, active measures were not adopted until the caterpillars had almost completed development, and were about to enter the pupa condition.

Energetic efforts were then put forth to destroy the innumerable cocoons that were soon visible. No doubt thousands of egg masses were destroyed upon the trunks of the trees, in the work of rubbing the bark with a coarse brush. At first a band of adhesive material was painted upon the trunks, and thus many caterpillars were prevented reascending the tree, but as soon as cocoons were discovered, this method was abandoned and that of destroying the cocoons followed. It will be well for those interested to be on the watch the coming season, and if caterpillars appear, at once resort to spraying. During the winter all egg masses should be destroyed as far as possible.

Dr. Beshune thought that the Society should be congratulated upon being favoured with so valuable a paper as that to which they had just listened. There could hardly have been presented a more complete life-history of these two species of injurious insects and he was sure that its publication in the Annual Report would prove most useful to a large number of readers. He then proceeded to give his experience of the army-worm this year. (See his paper, Notes on Insects of the year 1896, page 55). At the recent meeting of the American Association of Economic Entomologists held in Buffalo, N. Y., in August last, at which he and Dr. Fletcher had the honor of representing the Society, the army worm formed one of the most conspicuous features among the reports on the season given by many of the members present. Dr. Lintner, State Entomologist of New York, reported its occurrence in forty-eight out of the sixty counties in the state, and considered it the worst insect attack in his experience. Mr. Kirkland stated that it had been very abundant and destructive in Massachusetts, especially to cranberry plants; he estimated the damage done in that state alone at \$250,000 at least. In New Jersey, Prof. J. B. Smith had found it numerous in isolated fields, but did not consider that very much damage had been done. Mr. Johnson reported that it was very destructive in Illinois, but its numbers were materially reduced in June, by a fungous or bacterial disease which spread rapidly among them. Prof. Duggar had observed the same thing in Minnesota and considered that the disease was similar to the febrine of silk-worms. Prof. Webster considered that the chinch-bug was the worst insect of the year in Ohio, but the army-worm came second, and was very abundant and destructive. From all this testimony it was evident that the army-worm was wide spread throughout the states adjacent to Ontario; he did not, however, think that we need dread a very serious outbreak next year, as experience taught us that natural enemies so reduced their numbers as to make their ravages insignificant in the year following one of great abundance, nevertheless it would be well to instruct the farmers that their ground should be well cleaned up, and plowed up as far as possible in the fall in order to destroy the hibernating insects.

The Rev. T. W. Fyles regarded Prof. Pantou's paper as a very valuable one to the community, and was personally grateful for the information it contained. He came from England to Canada in 1861, which was an army-worm year, and while visiting a friend at Côte des Neiges took a walk into the country. On his way he noticed a high wall around the college grounds on which was a broad black stripe of tar about three feet from the ground. This struck him as very remarkable, and on asking passers by what it was for, he could get no information. Subsequently he learnt that it was intended as a barrier to keep out the army-worm, and no doubt it proved a very effective check. He thought that a roller might be used with great advantage when the worms were crossing a hard surface, such as a road or lane. The tussock moth he had not found in Quebec until three years ago, when it became very abundant and the willow-trees were covered with the caterpillars. Another closely allied species, *Orygia nova* had always been common in that province.

Mr. Dearness, the President, discussed the question of the migration of the army-worm from marshy lands in dry seasons and mentioned some instances in confirmation of this view.

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Mr. H. H. Lyman then read a paper on "The preparatory stages of *Erebia epipsodea*, Butler." (See *Canadian Entomologist*, volume xxviii, November, 1896, pages 274-278.)

Mr. Lyman also presented a paper on some remarkable aberrations in *Colias philodice* and *Vanessa antiopa*, and exhibited the singular specimens referred to. Those of the former species were taken by Mr. Dwight Brainerd, of Montreal, at Edgartown, Mass., in August last. (See *Canadian Entomologist*, volume xxviii, December, 1896, pages 505-6.); the suffused black specimen of *V. antiopa* was captured in British Columbia.

ELECTION OF OFFICERS.

The following gentlemen were elected officers for the ensuing year: (See page 2.)

AFTERNOON SESSION.

The meeting was called to order by the President, Mr. J. W. Dearness, at 2.30 o'clock p.m. The following paper was then read by Dr. Bethune:

NOTES ON INSECTS OF THE YEAR 1896.

BY REV. C. J. S. BETHUNE, PORT HOPE.

THE ARMY WORM.

The season of 1896 is chiefly remarkable, from an entomological point of view, for the outbreak of the army worm in this Province of Ontario. The insect, in its winged state at any rate, has long been familiar to every collector and is every year more or less abundant. We have all read accounts from time to time of its ravages in various parts of the United States, but hitherto we have been free from any serious invasions in this country. As this year's outbreak is being fully discussed by others, I shall merely mention what has come under my own observation.

On the 17th of July I received the following note from the Rev. Stearne Tighe of Emerald, Amherst Island: "I send you to-day by mail, specimens of a grub that is destroying all grain, etc., on this Island. What is it? Is there any way of destroying it, or arresting its ravages? This Island contains 15,000 square acres, and is at its nearest point two miles from the mainland." I at once recognized the specimens to be the notorious "army-worm" (*Leucania unipunctata*), which had already been reported in the newspapers as having appeared in injurious numbers in various parts of the province. I immediately wrote to Mr. Tighe and informed him of the usual remedies, namely, plowing a deep furrow to stop the onward march of the "army," if it were moving on from field to field, and destroying the caterpillars thus collected by burning with straw spread along the furrow or dragging a log of wood through it; or, if the worms were congregated in a field of grain, treating them with Paris green in order to prevent their going further. The specimens sent to me proved to be badly infested with maggots, the larvæ of a *Tachina* fly, and only one in consequence succeeded in reaching the chrysalis state, the rest being destroyed by their parasites. If the same proportion of worms were attacked in the fields of Amherst Island, there is not much danger of a repetition of the outbreak next year.

A few days later in the month, specimens of the same "army-worm" were brought to me from a field of grain adjoining my own garden at Port Hope. They were then fully grown and had done a great deal of damage by gnawing the soft grain in the wheat-ears. The farmer, whose crop was thus injured, informed me that the worms had crossed the road in the form of an "army" on a Sunday afternoon (where they had come from no one had observed) and at once proceeded to scatter over the wheat field and climb up

the stalks to the ears. Fortunately the grain was rapidly ripening and soon became too hard for the jaws of the caterpillar and the loss was not so serious as might have been anticipated.

About the first of August the moths began to appear and for a couple of weeks they swarmed in countless myriads. Some Tartarean honey-suckle bushes in my garden were laden with ripened berries; these attracted the moths to such an extent that the twigs were covered with them towards evening and during the night. On being disturbed by shaking the bushes, they would fly out in clouds. The moth has always been familiar to us, and is often taken by collectors when "sugaring" in the summer, but I never before saw it in such abundance.

On writing to Mr. Tighe about this time, recommending the destruction of the moths, which could be attracted by sugar or light, and enclosing specimens in order that there might be no difficulty in identifying them, he replied that the worms had disappeared shortly after his previous communication and no further damage had been done by them. They had, of course, completed their larval period and had gone into the ground to transform into chrysalids, large numbers of them then dying from the internal ravages of parasites.

In addition to the good work of the Tachina flies, which resemble the ordinary house-fly and appeared in swarms over infested fields, the worms were attacked by several species of predaceous insects, and were also devoured in large numbers by the English sparrow, which in some localities visited the army-worm districts in great flocks.

THE TUSSOCK-WORM.

Another insect which attracted much attention this summer and brought out many articles and letters in the newspapers, was the Tussock-worm (*Orgyia leucostigma*), which defoliated many shade trees in the streets of Toronto. As it has been fully dealt with already by Prof. Panton in his valuable and interesting address, I need not go over the same ground again. During my occasional visits to Toronto, I have noticed this insect for several years past and have drawn the attention of friends to its injurious work on their shade trees. It ought not to be a difficult insect to control as it cannot spread with any great rapidity owing to the fact that the female is wingless and can only crawl a short distance. The cocoons are usually so conspicuous in the autumn after the leaves have fallen and during the winter, that boys could be employed to scrape them off and destroy them. A tree once cleared will remain for a long time free from any further attack. In Port Hope the insect is common enough, but has never been so abundant as to cause any appreciable injury.

THE BLACK POTATO BEETLE.

At the end of June I received from the Editor of the *Mattawa Tribune*, some speci-

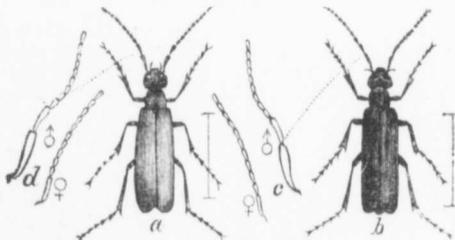
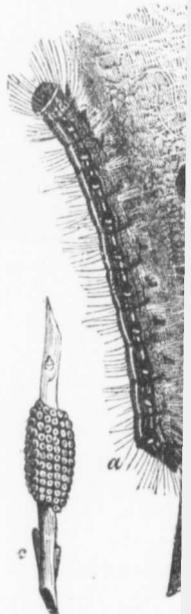


Fig. 56.

mens of a beetle that was attacking the potato plant in myriads in the neighborhood of Mattawa, Ont. They proved to be the black blistering beetle (*Macrobasis unicolor*, Kirby), a species that belongs to the same family, Meloidæ, as the "Spanish-flies," which are used for blistering purposes by the medical profession, and that possesses the same vesicating properties. The insect (Fig. 56) is long and slender, about half an inch in length,

on Windsor, or I gardens. While most injurious in feeding upon the l as to whether it d may be dealt with an application of P beetle has only o limited period, wh season, and never above the soil in s

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on Windsor, or English broad beans, and caused much damage to these plants in some gardens. While at times very destructive to these plants and to potatoes, it is unlike most injurious insects in possessing one good habit at least, and that is its practice of feeding upon the larvæ of the Colorado potato beetle. The question may therefore arise as to whether it does more good than harm. If the evidence should be adverse, then it may be dealt with precisely as its prey, and the "two birds be killed with one stone" by an application of Paris green in the usual manner. As far as I know, the black blistering beetle has only one brood in the year, and therefore only attacks the food-plant for a limited period, whereas the Colorado beetle has a succession of broods throughout the season, and never ceases its depredations from the time when the plants first appear above the soil in spring, till they are ready to be dug in the autumn.

MISCELLANEOUS.

For some ten years or so the apple-tree tent-caterpillar (*Clisiocampa Americana*, Harris) (Fig. 57) has not been seen in the neighborhood of Port Hope, but this year it has put in an appearance again and I have observed a few of the moths. In Peter-

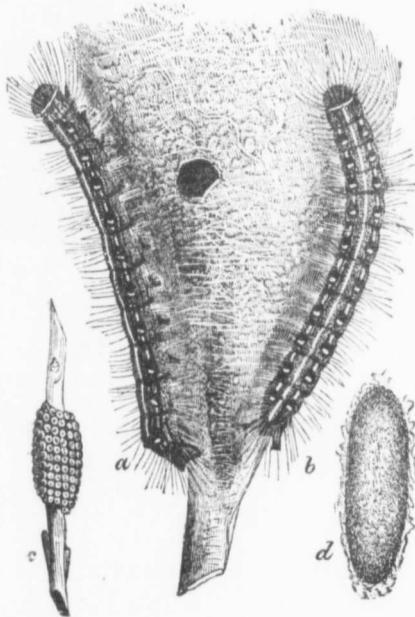


Fig. 57.

borough and about Toronto it has been quite numerous and destructive. Formerly it was one of the worst pests of the fruit grower that we had, and its webs were to be seen in spring and early summer on apple, pear, plum and cherry trees, and especially upon the wild varieties of the two latter. One spring, however, they were practically exterminated. The tiny caterpillars emerged from the eggs, which are laid in "bracelets" (Fig. 57, c) around twigs of the affected tree, at the same time as the leaf buds first opened and at once began to devour them. A few days later there came a severe frost which was too much for the tender little worms and they were all killed, giving us an immunity from the pest for a number of years. Now that they have begun to appear again, it will be well for fruit growers to be on the look out next spring and to destroy every "tent" with its inmates as soon as it is discovered.

Grasshoppers, which were very numerous and did a great deal of damage to pastures, and hay and oat crops, during the two preceding years, were this season remarkably few in numbers and caused no appreciable injury.

Various species of plant-lice (*Aphis*) were excessively abundant and injurious to plants of all kinds during the summer; the long continued hot and dry weather being very favorable to their increase. Even such weeds as the Lamb's-quarter were covered with them and many cultivated flowers in gardens suffered severely.

The Cigar case bearer (*Coelophora Fletcherella*) was found in June upon some neglected apple trees on the edge of a field near Port Hope. This pest which has been a serious one in some localities during the last few years, is evidently spreading in Ontario and should be carefully looked for in spring and early summer. A full account of the insect and the best modes of dealing with it is given in the report for 1895 of Dr. James Fletcher, the Dominion Entomologist and Botanist.

The Fall Web-Worm (*Hyphantria textor*). (Fig. 8) which has been for many years excessively abundant on ash, elm and many fruit trees, has this year been quite scarce about Port Hope, but in the neighborhood of London,—as our president Mr. Dearness relates—it has been conspicuously prevalent and many trees have been covered with immense webs. How to account for these remarkable changes in the numbers of injurious insects from scarcity or abundance in one year to the reverse in the next is one of those puzzles which may well employ the attention of the thoughtful entomologist. Sudden changes of temperature as we have seen in the case of the apple-tree tent-caterpillar, very hot and very dry weather, an unusually wet and cold season, violent storms, all these no doubt have great influence in reducing the numbers or favoring the increase of some species of insects, and in addition,—perhaps most of all—the increase of the parasites that prey upon the noxious species, and the spread of infectious diseases are great factors in the problem. It can only be solved by patient daily observations of a particular species carried on from year to year by more than one investigator. This is a field of work open to all and one that may result in the acquisition of a knowledge that will be of very great scientific and practical value.

Dr. Bethune also referred to the large number of rare butterflies that had been captured this year and gave a list of their names, with localities and dates. He then read a paper by Prof. Webster, of Wooster, Ohio, who was unable to be present, on "Warning colors, protective mimicry and protective coloration."

It was then moved by W. E. Saunders, and seconded by J. A. Balkwill, that "The Entomological Society now in Session at its annual meeting, having learnt of the sympathetic statement of its work and aims made by the Hon. John Dryden, Minister of Agriculture, at the time when the grant to the Society was under the consideration of the Committee of the Ontario Legislature, desires the Secretary to convey to the Honorable Minister its sincere appreciation of his kind interest."—*Carried*.

Moved by J. A. Balkwill, seconded by W. E. Saunders, that the Secretary be requested to communicate with the Board of the Western Fair Association, requesting them to continue to offer encouragement to the Schools to make exhibits of the life-history of insects, and that their influence be used on the Fair Boards to encourage similar exhibits.—*Carried*.

Moved by D. Arnott, seconded by W. E. Saunders, that Messrs. Rennie, Balkwill and the President, be appointed a committee to meet the Board of the Young Men's Christian Association, and endeavor to make satisfactory arrangements with regard to the renting of a room for the Society, and the approaches thereto.—*Carried*.

The meeting then adjourned, after having spent much enjoyable time during the sessions on both days in exhibiting rare captures, examining the books and specimens of the Society, and comparing notes on many interesting entomological subjects.

INSECT INJURIES TO ONTARIO CROPS IN 1896.

BY JAMES FLETCHER, DOMINION ENTOMOLOGIST, OTTAWA.

There is never a season when serious loss does not occur in some part of Canada from the attacks of our numerous insect enemies. There is, however, during a succession of years great fluctuation in the amount of insect presence in any one locality. New pests develop or old ones reappear after a period of absence, and then again sometimes suddenly disappear. Day by day additions are being made to the mass of accumulated knowledge by the use of which the injuries of insects can be prevented. The importance

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of the study of Practical or Economic Entomology is now widely recognized by all the civilized nations of the world. This confidence in a branch of science not taken up by many investigators is undoubtedly due to the fact that those concerned have found by experience that they are able to receive useful advice from those who have made a special study of the lives of insects, by which they are enabled to save a larger proportion of their crops than would otherwise be the case, and thus increase their incomes.

It requires many years of close study and constant observation before one can become familiar with all the different attacks by insects which may demand the attention of a farmer or gardener even in a single season; but the general principles upon which remedies are applied can soon be learnt, so as to prevent foolish mistakes. A fact which must never be forgotten is that all insects have their mouth parts formed after one or other of two plans only. In one class, solid food is eaten by means of jaws, with which it is bitten off from the object attacked; in the other class, liquid food, such as the sap of plants or the blood of animals, is sucked by means of a hollow tube-like beak. It is most necessary to remember these elementary facts, because in accordance with them all active remedies are devised. For biting insects, some poisonous material is placed on their food, so that when this food is eaten by the insects they may be destroyed. For sucking insects, this method would be useless, because, having no jaws, they can feed only on liquids, for which they have to sink their sharp beak-like feeding tubes beneath the surface of the object attacked. For this class of insects, substances which will kill by simply coming in contact with their bodies must be used.

Farm crops in Ontario during the past year have not suffered from any new pests, but there has been as usual considerable loss, which might have been prevented, had the attacks been promptly reported and the proper remedial measures adopted. The three most striking infestations of the season were grasshoppers, army-worm and a local outbreak or rather increased abundance of the Tussock moth in Toronto. Under the headings of the different classes of crops, attention is called here to those which have been most frequently complained of.

Cereals. The wheat crop of the Province has been little affected by insects, and although different kinds have been mentioned by several correspondents, there has been no serious outbreak. The Wheat-stem Maggot (*Meromyza Americana*, Fitch), was conspicuously less abundant and the American frit-fly (*Oscinis variabilis*, Loew.) was not only not mentioned, but it was impossible to obtain a single specimen for examination even in localities which were badly infested in 1890.

Grasshoppers were stated to be the cause of some injury to wheat, but the crops most injured by these insects were oats and hay. It is well to make special mention of the Hessian fly (*Cecidomyia destructor*, Say), fig. 58, which has been present in several places, and farmers must be prepared next year, if its injuries increase, to adopt the well known remedies of sowing their fall wheat later (about the third week in September) and burning carefully all screenings and dust from threshing machines. The Wheat Midge (*Diplosis tritici*, Kirby), fig. 59, which has been heard little of for the past six or seven years, again put in an appearance in one or two localities. This, also, will be largely controlled by the systematic burning of the rubbish from threshing machines.

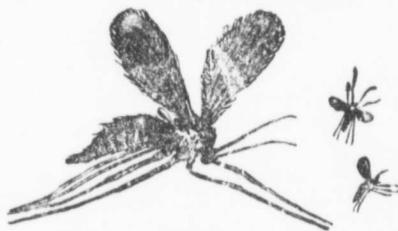


Fig. 58.

Oats have, perhaps, suffered from insects more than any other of the small grains. The Grain Aphis (*Siphonophora avenae*, Fab.) was unusually abundant in some places. Oats were also among the crops mentioned by several who wrote concerning the army-worm (*Leucania unipuncta*, Haw.) One of the most notable outbreaks of the year 1896 was by the

caterpillars of this insect. There was hardly a county in the Province where it was not reported either as a caterpillar attacking crops or as a moth which had drawn attention

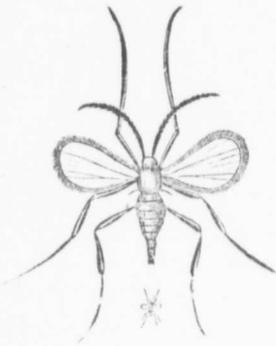


Fig. 59.

by its excessive numbers. This pest has been treated at length by Prof. Panton in the present report, so need not be mentioned further here, except to draw the attention of those interested to the excellent bulletin lately issued by Prof. Clarence M. Weed of the New Hampshire Agricultural Experiment Station. It is interesting to learn from this bulletin that in 1770 in the celebrated occurrence of the army worm in New Hampshire, the same remedies which we most rely on to-day, namely, trenching around fields infested and destroying the caterpillars in pits dug at intervals in the trenches were practised by the farmers of that State. As is almost invariably the case, the superabundance of the army-worm this year was much reduced by the natural enemies which always prey upon this species.

At the late meeting of the Association of Economic Entomologists held at Buffalo, N.Y., Dr. J. B. Smith stated that the army-worm had appeared in New Jersey in some numbers, but only in isolated localities. In Canada, in almost every instance where invasions of this insect have been recorded, the injury has been done by a brood which appears in the larval form during the month of July and in the beginning of August; but Dr. Smith stated that it was not always the same brood which did the damage in New Jersey. The first brood seemed to be the injurious one in a southern county of the State, reports having been received as early as May. At other localities in the State injury was noted in July and as late as early in August. This is practically the same as is the case in some of our northern counties of Ontario. The most interesting record, however, is given by Mr. A. H. Kirkland, of the Massachusetts Gypsy Moth Commission, who stated that "the army-worm had been seriously injurious in many parts of Massachusetts and had damaged a large portion of the cranberry crop. He writes Sept. 3 that at Hingham, Mass., a third brood of army-worms was then threatening to be as destructive as any that preceded it. He found them at that time of all stages from quite young to nearly mature." (*Entomological News*, VII, 1896, p. 310.)

Fodder crops. Early in the season grasshoppers of the three common species, the Red-legged locust, fig. 60, the Two-striped locust, and the Lesser Migratory locust, were noticed to be remarkably abundant throughout Ontario and Quebec and in parts of Nova Scotia. These species are always somewhat prevalent, but great anxiety was felt in June last when their ravages were seen in pastures and hay fields. Clover was badly eaten in some districts early in the month and also wheat, oats and barley. Later in the summer corn, beans, turnips, and even hops were attacked. There was every appearance in July that the losses would even exceed those of 1895, but early in August it was clear that for some reason the grasshoppers were much less numerous than they had been. Several correspondents made the same report, and a few of them observed that parasites were waging an effective warfare against the locust tribes. Doubtless the sudden disappearance of these pests was due to the great increase of four of their natural enemies. One of these is a fungous disease (*Empusa grylli* [Fresenius] Nowakowski), which causes its victims to crawl up to the tops of stalks of grasses and other plants, where, grasping the stem firmly with their legs they die and their bodies become rapidly filled with a dry, mealy substance, which is really myriads of the spores of the parasitic fungus. The body of the locust soon dries up and the spores are distributed by the wind, each mummified carcass thus becoming a source of infection to all other locusts which come near it. In addition to the above fungus other parasites—insects—were unusually abundant. One of these was a Tachina fly, fig 6 which was described as following the locusts closely and darting down, laying its whit



Fig. 60.

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Fig. 61.

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Probably the Locoppers is the Lo prevalent and ver grasshoppers, gene and few recognize bag-like bodies are weak legs, as may 64). The mouth p themselves to their on its blood until destroyed. When re to the ground, cre swelling and chang the larval skin; ne by the larva, are f creature very differ legs and is a true T by their velvety, br when sent in for id as in the larval form eggs in the ground mature form and ar In May the fen cavity an inch or tv have six legs only ar until they find a loc principal veins of th invisible, and this is confusion as to what until Prof Riley it bodies with six legs classified under an en immature condition eggs of locusts in the

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eggs on their bodies. From these eggs in a short time hatch white maggots which feed inside the bodies of their hosts until full grown, when they force their way out and, falling to the ground, which they enter a short distance, they pupate, and change to flies either the same autumn or the next spring. Prof. Riley describes graphically the operation of egg-laying by one of these Tachina flies, and much the same thing was observed by Mr. J. E. Richardson of Princeton, Ont., last July. Prof. Riley says: "The slow-flying locusts are attacked while flying, and it is quite amusing* to watch the frantic efforts which one of them haunted by a Tachina fly, will make to evade its enemy. The fly buzzes around waiting her opportunity, and, when the locust jumps or flies, darts at it and attempts to attach her egg under the wing or on the neck. The attempt frequently fails, but she perseveres until she usually accomplishes her object. With those locusts which fly readily, she has even greater difficulty; but, though the locust tacks suddenly in all directions in its efforts to avoid her, she circles close around it and generally succeeds in accomplishing her purpose, either while the locust is yet on the wing, or, more often, just as it alights from a flight or a hop." Locusts infested with these parasites are more



Fig. 61.

languid than they otherwise would be; yet they seldom die until their unwelcome guests leave them of their own accord.

Probably the most efficient worker in keeping down the undue increase of grasshoppers is the Locust Mite (*Trombidium locustarum*, Riley), and it has been extremely prevalent and very often observed during the past summer. As it is seen attached to grasshoppers, generally at the base of the wings, it bears little resemblance to an insect and few recognize it as such the first time they examine it. The bright red swollen bag-like bodies are really the larval form of the Locust Mite, and are possessed of six weak legs, as may be discovered by examining them closely. (See figs. 62 and 63, opp. page 64). The mouth parts are very poorly developed, and, when once the mites have attached themselves to their host by means of their beak-like mouths, they remain unmoved, living on its blood until full grown. By these little parasites vast numbers of locusts are destroyed. When ready to assume the pupal condition, they detach themselves, and, falling to the ground, crawl under some shelter to complete their transformations. Gradually swelling and changing their form slightly, the mites pass through the pupal stage inside the larval skin; new legs, mouths and other organs, of a different nature to those possessed by the larva, are formed under the old skin, and finally this latter bursts and releases a creature very different from and much more active than the larval form. It has now eight legs and is a true *Trombidium*. The perfect mites are very conspicuous and draw attention by their velvety, bright scarlet bodies; they are frequently spoken of as "Scarlet Spiders" when sent in for identification. In this stage they are equally useful allies to the farmer as in the larval form, for while they do not attack the full grown locusts, they seek out their eggs in the ground and destroy large numbers of them. They pass the winter in the mature form and are frequently seen crawling over the ground in spring.

In May the female lays a mass of between 300 and 400 small, round, orange eggs in a cavity an inch or two beneath the surface of the ground. The young, as stated above, have six legs only and are at first exceedingly minute but very active. They crawl about until they find a locust, to which they attach themselves, mostly at the base or along the principal veins of the wings. Here they swell by degrees until their legs become almost invisible, and this is the time they are most often noticed. There has been considerable confusion as to what is the proper name of this mite. In the first place, it was not known, until Prof. Riley in 1877 worked out the life history of this species, that the bag-like bodies with six legs only, which were so often found attached to locusts, and which were classified under an entirely different genus, *Atoma* (= *Astoma*) of Latreille, were merely the immature condition of the little red mites with eight legs which were found devouring the eggs of locusts in the ground, and when this fact was discovered there was still room for con-

* The locust might well say here, "It's fun for you but death to me."

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fusion as to whether it should be called by the specific name first given to the larva when named *Atoma gryllaria* by Dr. Le Baron in 1872, or by the name of the perfect insect described in full by Dr. Riley after its true nature had been found out.

In Murray's *Aptera*, without date but bound up with Official British Museum Advertisements dated October, 1876, and presumably issued in that year, this mite is treated under the head of *Trombidium gryllarium*; but, in Mr. Samuel Henshaw's Bibliography of American Economic Entomology, 1890,—a most valuable and carefully prepared work, which will probably be accepted as authoritative by all Economic Entomologists—*Astoma gryllarium* is made to equal *Trombidium locustarum*, and it is, therefore, well for us to adopt the latter name and to drop altogether the name *Atoma* or *Astoma gryllarium*, referring to the stage found attached to locusts merely as the larval stage of *Trombidium locustarum*, Riley.

Besides those mentioned there are many other different kinds of parasites which infest locusts, but none perhaps which excite more surprise when their strange habits are explained than the curious creatures known as "hair snakes" or "hair worms," with their slender hair-like bodies from six to twelve inches in length tapering to each end and only at most one twenty-fifth of an inch through at their greatest diameter. These may be seen sometimes crawling on or coming out of the ground in large numbers after a shower of rain, sometimes along the edges of streams, either coiled and knotted up one or many together, or singly swimming close to the surface of the water with an undulating snake like motion. Dr. Leidy, in his very valuable article on *Gordius* which appeared in the American Entomologist for 1870, when referring to the habit of these worms of coiling themselves in intricate masses, suggests that "similar knots no doubt were the source of the scientific name of the worm being applied to it by Linnæus from the fabled Gordian knot of antiquity. The *Gordius*, however, not only resembles the latter in the intricate condition into which it sometimes gets, but its history is yet in part a Gordian knot to be unravelled."

These worms are not, by any means, unfamiliar objects in the country, and various misconceptions as to their sudden appearance in large numbers and as to their origin are widely prevalent. They are frequently sent for identification with the statement that they had fallen from the clouds in rain. The commonest error, however, is that they are horse hairs which, having fallen into water, have "come to life." It is not necessary here, of course, to point out the absurdity of this statement. "Such a transformation is an utter impossibility. No dead organic matter can thus be changed into a living creature. It is a law of nature that every animal being, from the lowest to the highest, has its commencement in an egg." (Lintner).

Several articles more or less complete have appeared on these worms. By far the fullest is the extended account in the First Report of the United States Entomological Commission, 1878, where probably nearly all that is at present known of their mysterious life history is collected together, and good illustrations are given. The hair worms,—of which there are several species, found parasitic in the bodies of insects of nearly all the different orders, such as the Orthoptera, Hymenoptera, Coleoptera, Lepidoptera and Diptera,—belong to the Entozoa or intestinal worms. They have a very remarkable cycle of development, which may be briefly summed up as follows: The eggs are laid in water, and the exceedingly minute young worms float about in a free state until they find the larvæ of some aquatic insects into the bodies of which they effect an entrance, as was observed by Dr. Meissner, a German scientist, through the delicate membrane at the joints of the legs. They then work their way gradually among the muscles and other organs throughout the body of their host and after a time become quiescent and encysted so as to resemble their former condition just before leaving the egg, and, as Dr. Meissner says, recall to mind the similarly encysted Trichinæ in the muscles of man and the hog. Mr. A. Villot added materially to our knowledge of these curious creatures and found that, when insects infested with these encysted larvæ were eaten by fish, the bladder-like cysts were dissolved by the process of digestion and the young worms set free in the intestines of their new host, at once bored by means of spines around the head into the mucous layer of the intestines of the fish, where they became again encysted. In the next stage, which

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ROOT CROPS.—There has been mention and, as mentioned. The outbreak of *trifolii*, (Esp.), which is Rice Lake. The crop in pea fields, the locusts consumed. The locusts appeared about the

is not reached till spring, five or six months afterwards, they live a free-swimming aquatic life. To obtain their liberty, they first free themselves from their cysts in the lining of the intestines and pass into the intestinal cavity of the fish, whence they are carried out with the faeces into the water. Here remarkable changes take place. Mr. Villot says: "The numerous transverse folds of the body disappear and the worm becomes twice as long as before; its head armature disappears; the body becomes swollen, milky and pulpy. It remains immovable in the water for a variable period and then increases in size. The integument grows harder and when about two inches long the worm turns brown and begins to move."

At this point in the life history of these creatures all actual observation ceases, and it is only a matter of conjecture how these parasites can find their way into the bodies of such insects as locusts, tree crickets and beetles, many of which live preferably in dry places. It has been suggested that the worms can travel long distances on foliage and other surfaces when wet with rain or dew. It must be acknowledged that there is room for much careful investigation as to the habits of these useful allies of the farmer. What is well known, however, is that they are certainly parasites which occur frequently inside the bodies of many of our injurious locusts, and during the past season were so abundant in some places—as at Ottawa—that they could be found in varying numbers from one to five, generally two or three, in almost every large-bodied locust that was examined during the months of September and October.

With the dark-colored *Gordius* worms are usually found inside the same hosts some smaller and slenderer white specimens which are very similar in general appearance; they belong to another genus (*Mermis*) differing in many respects as to structure and some stages in their life histories, but equally useful with them from their habit of living as parasites inside and ultimately destroying locusts and grasshoppers as well as other insects.

In connection with grasshoppers mention must be made of the rather serious ravages of the Gray Blister beetles (*Macrobasis unicolor*, Kirby), fig. 56. These have been abundant in some localities during the past season and have infested fields of potatoes and beans; they were also troublesome on the Siberian Pea tree (*Caragana*), now grown considerably for hedges, also on the large-leaved and ornamental Aralias, *A. spinosa* and *A. Chinensis*. In the larval form these beetles are parasites in the egg pods of locusts, so that an abundant occurrence of blister beetles indicates that the armies of destructive grasshoppers are much smaller than they would have been but for this good feature in the habits of these otherwise injurious insects. The blister beetles generally appear suddenly and in large numbers, and if they are not attended to at once they quickly do much harm to a crop. Prompt spraying or dusting with Paris green are effective and where practicable great numbers may be beaten into pans containing water and coal oil. A long piece of Caragana hedge was saved in this way by giving it two beatings a day for a week in a locality where Paris green could not be obtained.

There have been other injuries to fodder crops: The Clover Root-borer (*Hylesinus trifolii*, Miller) occurred at one locality in the County of York, and the Clover-seed Midge (*Cecidomyia leguminicola*, Lintner) was rather more destructive than usual in the clover seed growing districts. Even in the eastern part of the Province its presence was clearly discernable by the appearance of the fields at the time of blooming. Reports vary as to the prevalence of the pea weevil, but, on the whole, while it seems to have been less injurious in the west, specimens have been found this year in pease grown as far east as Ottawa, which is a very rare occurrence.

ROOT CROPS.—The root crops have been affected somewhat both by weather and insects. There has been mention of white grubs (*Lachnosterna*) Fig. 64, in potato and carrot fields, and, as mentioned above, grasshoppers and blister beetles have done their share of injury. The outbreak of most interest under this head was of the Clover Cut-worm (*Amastrea trifolii*, Esp.), which appeared during August in large numbers in the district lying around Rice Lake. The crops attacked were turnips, mangels and peas. The loss was greatest in pea fields, the leaves and even the fleshy tissues on the outside of the pods being entirely consumed. The caterpillars which vary very much in color and ornamentation first appeared about the first of August, and were in such numbers that they had to migrate

to obtain food, and for this reason were thought by some to be the army worm. One correspondent wrote, "The green leaves and the vines themselves were eaten, but my peas were too nearly ripe before they were attacked to be much injured. I never before saw anything like it. The ground was literally alive with the crawling insects. We put

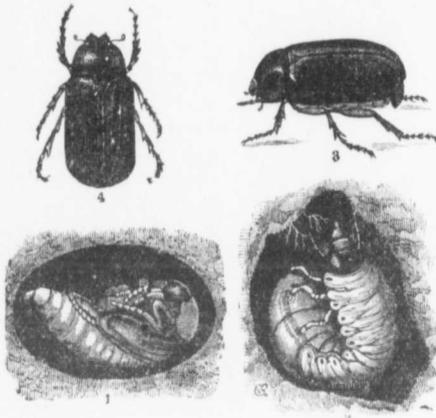


FIG. 64.

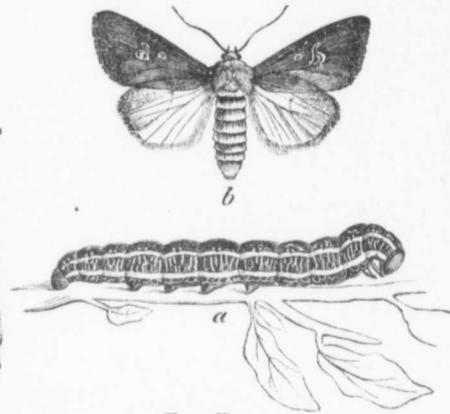


FIG. 65.

Paris green on the turnips, and this doubtless helped, but the insects were so numerous that one set after another took the place of those killed. Turnips near peas were injured most; they put forth a new set of leaves, but the growth of the roots was stunted, and they were only half a crop."

Turnips were also slightly injured by the Zebra caterpillar (*Mamestra picta*, Harris) which is a very general feeder, being found also on cabbages, potatoes, clover, celery, lucerne and many other plants. The caterpillar is a most showy insect (Fig. 65a); when full grown nearly two inches in length, velvety black on the back with the sides gaily ornamented with golden yellow lines connected by wavy white threads; the head and feet are chestnut red. When ready to transform the caterpillar spins a loose cocoon of silk with earth mixed with it and changes to a black chrysalis. The moth (Fig. 65b) has glossy brown upper wings and the lower ones are whitish. The eggs are laid in large clusters beneath leaves and seem to be, at Ottawa at any rate, much more infested with egg parasites than those of almost any other insect. In September, 1892, I found upon a plot of Bokhara clover (*Melilotus alba*, Lam.) hundreds of clusters of the eggs of this moth, which were so much parasitised by two minute hymenopterous insects, *Trichogramma pretiosa*, (Fig. 66), and a new species of *Telonomus*, that not one per cent. of the eggs gave caterpillars. The only remedies which can be applied for the Zebra caterpillar are arsenical mixtures, and this species seems to be particularly resistant to the effects of all poisons so far experimented with. There are two broods in the year, the latter of which may be noticed on fine days long after the first severe frosts.

VEGETABLES—In gardens the regular yearly pests such as cut worms, turnip flea, Colorado potato beetle, and the cabbage caterpillars have required attention. The species of cut-worm whose injuries have been most conspicuous, has again this year been the red-back cut-worm (*Carneades ochrogaster*, Gn.) This is a large and widely distributed species which feeds upon almost every kind of succulent vegetation. It was particularly destructive to newly set cabbages and tomatoes and to young beet root, as well as many annuals in the flower garden. Careful trial was made this year of the poisoned bran remedy, and good results were obtained. Bran or oat-meal was moistened with sugar in water sufficiently to allow of being ladled out with a spoon. Into this sufficient Paris green was

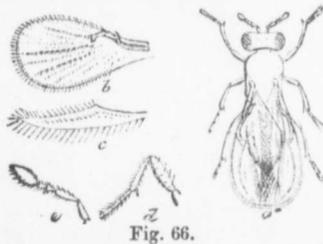


FIG. 66.

FIG. 62.—TROMB natural size indicated (Riley).



FIG. 63.—TROMB b, pupa; c, male adult, palpal claw and tibia (after Riley).

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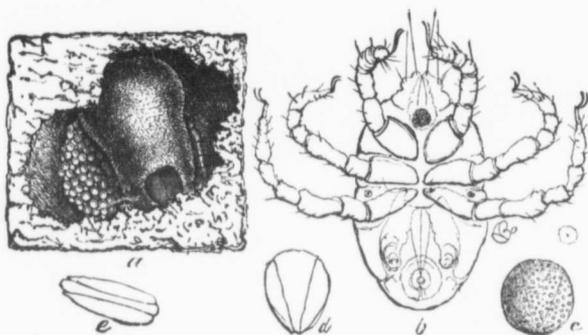


FIG. 62.—*TROMBIDIUM LOCUSTARUM*.—*a*, female with her batch of eggs; *b*, newly hatched larva—natural size indicated by the dot within the circle on the right; *c*, egg; *d*, *e*, vacated egg-shells (after Riley).

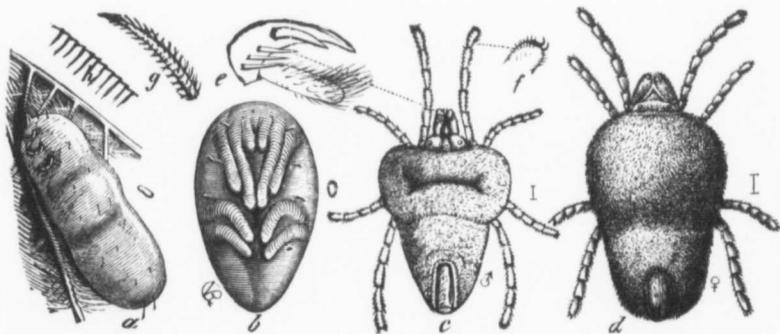


FIG. 63.—*TROMBIDIUM LOCUSTARUM*.—*a*, mature larva when about to leave the wing of a locust; *b*, pupa; *c*, male adult when just from the pupa; *d*, female—the natural sizes indicated to the right; *e*, palpal claw and thumb; *f*, pedal claws; *g*, one of the barbed hairs; *h*, the striations on the larval skin (after Riley).

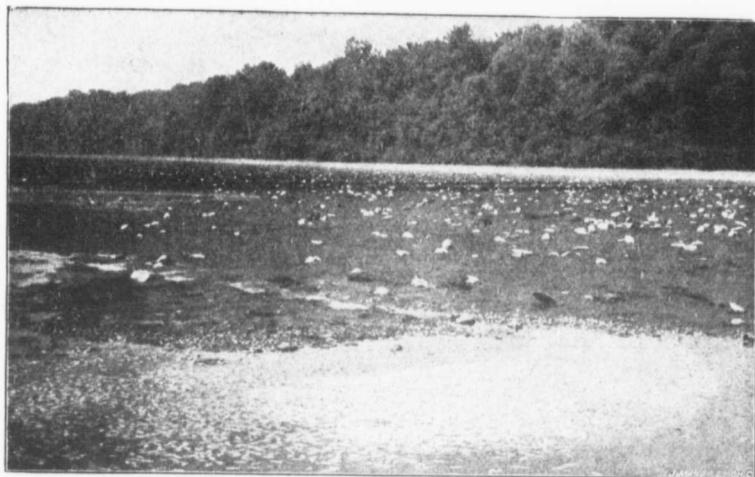
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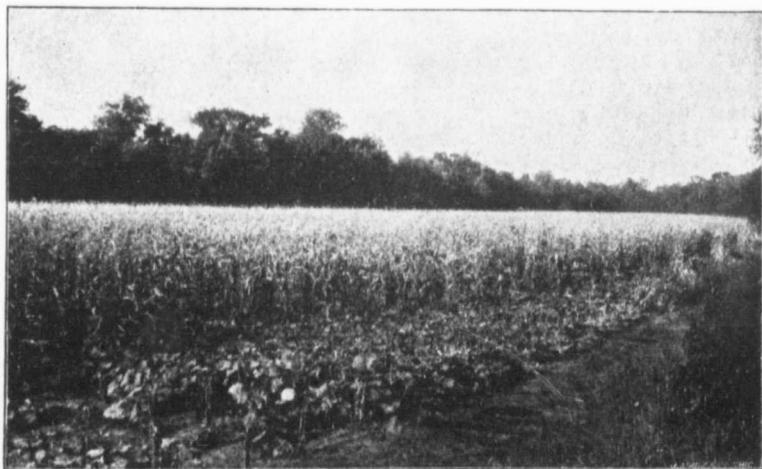
Phelps Lake



Phelps Lake, August, 1911



Phelps Lake in Illinois, August, 1894. Dead Fish and Mussels. (After Forbes.)



Phelps Lake, August, 1895. After being brought under cultivation. Corn and Pumpkins. (After Forbes.)

(See page 84.)

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FIG. 67.

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stirred to give it a decidedly green tinge. A spoonful of this mixture was placed at intervals of six or eight feet along rows of peas, beets and carrots, which were being rapidly destroyed by these cut-worms. The results were most satisfactory, the poisoned bran was apparently so attractive to the caterpillars that only two or three plants were afterwards cut off and the bran was eaten instead, many caterpillars being found dead near the bran but some distance under the surface of the soil, where they required to be looked for with some care.

The "Black Army-worm" (*Noctua fennica*, Tausch) was abundant in the neighborhood of Picton, Ont., where it did much harm to peas and other garden plants, including raspberries and other small fruit.

Squashes and cucumbers have been much injured in western Ontario by the striped cucumber beetle (*Diabrotica vittata*, Fab.), and the true squash bug (*Anasa tristis*, De Geer) Fig. 67, was reported as very troublesome at Hamilton. When the plants are young and small, probably the best remedy is to cover the hills with a square of mosquito netting, or cheese cloth, supported by two or three sticks stuck in the ground and with the edges held down with a few handfuls of earth. When the plants get too large to be so confined, the insects may be kept away to a measure by sprinkling over the hills ashes or land plaster with which coal-oil has been mixed. Hand-picking for the Squash Bug must also be resorted to; for this purpose shingles are placed near the plants for the bugs to hide under.



FIG. 67.

FRUITS.—Fruit insects in Ontario have been decidedly less noticed during the past season than for many years previous. This is probably due to the enormous crop which has been reaped; timely rains and fair weather for fruit crops seem to have prevailed over the whole Province. As in the past those who sprayed carefully, obtained paying returns. Although, on the whole, insect enemies have demanded less attention than usual, it is feared that carelessness in orchard management by which defective and infested fruit was left unpicked from the trees or to rot on the ground, may be followed next year by a large increase in the number of injurious insects which will in all probability infest a much smaller crop over the whole Province.

In western Ontario the second brood of the codling moth was particularly destructive. The work of the plum curculio, owing to the enormous crop of plums, was not so manifest as usual, but where looked for, could usually be found. In some districts where plums are not much grown, this is by far the worst enemy of the apple crop. The apple curculio (*Anthonomus quadrigibbus*, Say.) is not a very frequent enemy of the apple in Canada, seeming to confine its attacks more particularly to the fruit of the hawthorn. Two new attacks upon apples of considerable interest to fruit growers have to be recorded. The first of these by the caterpillar of a small moth which has not yet been bred to maturity, has affected to an appreciable degree the apple crop of certain localities in British Columbia, and what may possibly be the same insect has been found in a few instances at Ottawa and Montreal, but the injury to the fruit was much less serious than in the British Columbian apples, where the caterpillars burrowed in every direction through the flesh of the apple, causing it to decay and entirely destroying it for the market. The outside of the fruit was also gnarled with sunken depressions where the caterpillars had entered, and in many instances, this spot was marked with a white deposit similar to birds' droppings. This latter fact, however, is comparatively of small consequence, because the fruit bearing these deposits is already destroyed by the disclosed burrows of the caterpillars which run in every direction through the fruit for which reason the name of "apple fruit-miner" is suggested. Judging from the nature of the injury to the apples this season, this is certainly a much more serious enemy than the larva of the codling moth, and the condition of an infested apple is much more nearly like that produced by the apple maggot (*Trypeta pomonella*, Walsh) for which indeed it was mistaken by some observers, but from which it is entirely distinct. The second attack new to this country, is by the true "Apple Maggot" which this year for the first time on record has infested cultivated apples in Canada in the orchard of Dr. D. Young, a careful observer of insect habits, living at Adolphustown, Ont.

At the end of October Dr. Young sent me some apples containing a few larvæ and showing undoubtedly the work of this injurious insect which he had never found in his orchard before this season. Three or four varieties only of apples were infested. It is important to notify fruit growers as soon as possible of the occurrence of this insect in our orchards as an apple pest and to give from the experience of growers in the New England States the measures which have been found most successful in fighting against it. The insect was first described by Walsh in his first report as State Entomologist of Illinois in 1868; but it had been known in the eastern states for several years before that, having attracted attention by its serious injuries to the cultivated apples in New York, Massachusetts, Connecticut and Vermont. Strange to say, although it has never, as far as I can learn, attacked cultivated apples in Canada until this year, it is common in collections of insects and occurs abundantly in the fruit of hawthorn in many localities. In 1887 I bred the fly from haws found at London, Hamilton, Toronto, Montreal and Ottawa. In 1888 the fruit of the hawthorn bushes on the Experimental Farm was so much infested by the maggot of this fly and the grub of the apple curculio that it was almost impossible to find a sound fruit. It is, however, by no means a singular habit for an insect to confine itself to a certain food plant in one locality when others are growing close to it, which elsewhere are preferred by the same species.

The most important articles on this subject have been written by Walsh (Ill. Rep. I.), Comstock (Rep. U. S. Comm. Agric., 1881-2), and particularly Prof. Harvey, who wrote a long and complete account in the annual report of the Maine Agricultural Experiment Station for 1889, where the full life history of the species is for the first time detailed. The life of this insect may be said to be as follows: The perfect flies begin to emerge about the first of July and continue to appear until about the middle of September; eggs are laid at once, those first deposited producing the earliest flies the following season. The egg is forced through the skin of forming apples by means of the horny ovipositor of the females. The maggots hatch and run tunnels all through the fruit of the apple leaving discolored brown tracks wherever they go. In this way the fruit is rendered quite unsaleable and ripens prematurely. The maggots are full grown in about five or six weeks, and as soon as the fruit falls they leave it and entering the ground a short way turn to puparia and in that condition pass the winter. Early and subacid varieties of apples seem to be preferred, but late and winter varieties are also attacked. When the late varieties are infested, the maggots do not emerge until sometime during the winter after the fruit has been stored. In all Prof. Harvey's investigations he never saw an apple hanging on the tree from which the maggots had emerged. This is an important point because it shows the value of collecting all fallen fruit as soon as possible after it falls and destroying it so that the maggots may not leave and go into the ground to pupate. There are different ways by which this may be done. They may be collected by children and fed to stock, or, if there is no stock to eat them, they may be buried in a deep hole and afterwards covered up so that the flies may not be able to emerge the following season. Sheep or swine kept in the orchard from about the 15th July would save much labor by eating the fruit as soon as it fell to the ground, and poultry would render good service by devouring the fruit, maggots and puparia beneath the trees. The larvæ do not penetrate more than an inch or an inch and a half beneath the surface, so would easily be scratched out and found by chickens. Prof. Harvey draws attention to some important facts in the habits of the apple maggots. He points out that the perfect insects are rather sluggish and that the species does not seem to spread very rapidly in a new locality from orchard to orchard nor even from tree to tree in an orchard. He shows clearly, however, that it is a most serious pest from the way in which infested fruit is rendered quite useless for human food. The females are very prolific, each one laying from 300 to 400 eggs, and the young maggots hatching inside the apples are inaccessible to any wholesale method of treatment such as spraying. Up to the present no parasites have been detected feeding on the insect. Almost all varieties of apples are liable to attack and as many as a dozen maggots have been found in a single fruit. Under remedies, he says, "The only chances are to destroy the larvæ and pupæ. The larvæ are found abundantly in wind-falls, and the pupæ in bins and barrels where fruit has been stored. Destroying wind-

falls would prevent barrels would do and should be have to be done careful destruct.

The Cigar (ant this season reported by Mr moving on the b cleared his orch his orchard for deaux mixture in restricted loca an isolated apple Hope some speci These have been

The Pear Sh have been unusu prunus fruits are troublesome than when it appears, impossible to find

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FIG

life-history was wor of our previous repo The first produces g tration kindly lent the most injurious,

falls would prevent the maggots going into the ground, and burning refuse from bins and barrels would dispose of those in stored fruit. These methods are practical, easily applied and should be rigidly enforced." "There is no lazy way to check this insect. It will have to be done by a direct, squarely-fought battle. We firmly believe we have in the careful destruction of the windfalls the means of destroying the pest."

The Cigar Case-bearer (*Coleophora Fletcherella*, Fernald) has been decidedly less abundant this season than for three or four years previously. Good results from spraying are reported by Mr. Harold Jones of Maitland, Ont., who noticed the young caterpillars moving on the bark on May 2 and at once sprayed with kerosene emulsion and practically cleared his orchard. Mr. W. H. Little, of Trenton, Ont., says it has been numerous in his orchard for about four years, but has kept it within control by spraying with Bordeaux mixture and Paris green. The insect is reported from Goderich and Port Hope in restricted localities. It was found at the latter place by Dr. Bethune in numbers upon an isolated apple tree against a fence, a long way from any orchard or garden. At Port Hope some specimens of a small parasite were bred from the cases by Mr. Wm. Metcalfe. These have been identified by Mr. W. H. Ashmead as *Microdus laticinctus*, Ash.

The Pear Slug (*Selandria cerasi*, Peck), this old enemy of the fruit grower, seems to have been unusually abundant during the past summer in all parts of the Dominion where prunus fruits are grown. Mr. L. A. Woolverton states that the second brood is more troublesome than the first and suggests that the reason is because at the time of the year when it appears, fruit growers are so busy picking and marketing fruit that it is almost impossible to find time to spray with Paris green.

After the exceptionally heavy crop of all fruits throughout the province this year, it is almost certain that the next season's crop will be light; the careful grower who attends to all such little matters as spraying will then most certainly reap a rich harvest at the expense of his less thoughtful neighbours. It is in the off years that the skill of the horticulturist is called forth; he cannot, it is true, always make his fruit trees set fruit and bear, but he can in many instances by skilful management materially improve the quality of his crop, and it is in years when the crop is small that he has the greatest latitude to show his superiority over the easy-going grower who trusts to luck and lets things come as they may.



FIG. 68.

life-history was worked out by the late Dr. C. V. Riley and has appeared in several of our previous reports. There are two forms of this insect with very different habits. The first produces greenish red or yellow galls on the foliage, as shown in the illustration kindly lent by the editor of the *Canadian Horticulturist*; the other, which is the most injurious, attacks the roots, causing swellings on the young rootlets, which

Grapes have suffered somewhat from the Phylloxera. Mr. Woolverton found the leaf gall inhabiting form unusually abundant throughout the Grimsby district. In many cases hundreds of vines on a plantation had their foliage covered with the galls of the louse—Fig. 68. In the September number of the *Canadian Horticulturist* appeared a figure of a branch of a grape vine infested by Phylloxera. There are few insects as well known as the notorious *Phylloxera vastatrix*, Planchon, which has been the cause of such enormous losses to the grape growers of France, Italy, Spain, and other countries in Europe. This pernicious insect is a native of America, whence it was introduced into Europe and where it now commits terrible ravages, far exceeding anything that has ever been recorded here in its native country. The

finally decay and thus the root system of the vine is destroyed. The winter is passed in a dormant condition on the roots. In spring there are five or six generations of wingless females, all of which bear young without the intervention of males. In July some winged females are produced which leave the roots and fly to other vines, when each one lays a few eggs of two different sizes, from which are produced in about a fortnight perfect males and females. These are born for no other purpose than reproduction and are without means of flight or of taking food. Each female lays one egg, from which comes an egg-bearing, wingless female, thus beginning a new circle of existence. The winged females which are first seen in July continue to appear throughout the season and are most abundant in August.

Occasionally the underground form leaves the roots and produces galls on the leaves. These are more abundant in some seasons than in others, as during the past summer—but the Grape Phylloxera cannot from past experience be considered a serious pest in Canada, although at rare intervals there has been a loss of many vines in some vineyards which have been badly infested. The only remedy which has been adopted in this country has been the destruction of badly infested vines or the removal of gall-bearing leaves from those which are less severely attacked.

Another insect which has been locally troublesome on grape vines in western Ontario is the Grape Thrip (*Erythronera vitis*, auct.). Mr. Woolverton thinks that it is increasing steadily year by year. It has been treated effectively by spraying vines carefully with kerosene emulsion before the young of the first brood acquire their wings.

The two broods of the Strawberry Leaf-roller (*Phoxopterus comptana*, Frol.) Fig. 69,

did considerable injury to strawberry beds around Picton, Prince Edward County, in June last and in the autumn. Luckily for Canadian growers of small fruits it is a rather rare occurrence for this insect to be sufficiently abundant to attract notice, but in some of the northern United States it is considered the most destructive of the enemies of the strawberry grower. The caterpillars were found on the strawberry plants towards the end of June and were not noticed until they

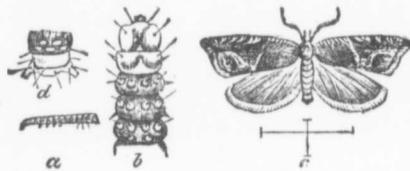


FIG. 69.

had injured one field of four acres sufficiently to give the plants the appearance of being attacked by a severe blight or as if fire had been over them. The caterpillars when full grown are about one-third of an inch long and vary in colour from yellowish-brown to dark-brown or green. They fold the leaves of the strawberry by drawing the upper surfaces together and fastening them with strands of silk. They then eat away all the green inner surface of the leaves, giving the beds a brown and seared appearance.

Mr. John Craig, of the Central Experimental Farm, who visited some of the Picton plantations on the 4th of July last, found that many of the caterpillars were full grown and ready to pupate; others, however, were small and would not turn to chrysalids for certainly a week or two later. Moths emerged at Ottawa from infested leaves sent from Picton between July 15 and 25, a period which would probably be extended at any rate till the end of the month in the fields. Eggs laid by this brood of moths produced caterpillars which again attacked strawberry beds severely at Picton in the autumn. As a remedy for this insect it has been recommended to mow off and burn the leaves of infested beds directly after the fruit is picked. The leaves containing the caterpillars or chrysalids, would soon dry up and would burn easily. That cutting off the leaves at this season can be done without injury to the plants has been proved by Mr. Craig in some experiments for controlling the strawberry rust. (See *Experimental Farm Report*, 1895, p. 113). It must be done of course before the moths begin to emerge. The second brood can be treated much more easily. When beds are known to have been infested by the spring brood, the plants must be sprayed or dusted with Paris green during August, so that the young caterpillars may be destroyed as soon as they hatch. Should the injuries be noticed only late in the season when the caterpillars are well grown, burning the foli-

age may again be the Canadian H burning the foli

Red Spider many places par

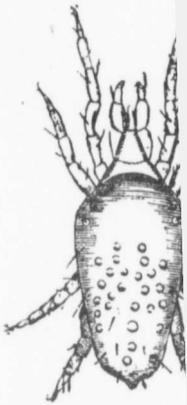


FIG. 70.

rence was discovered the orchard, on his destroyed them.

When so many by an endless succes and valuable species stalwart, handsome as fresh and unspotted more or less naked moths whose caterpillars *nyssaria*, A. & S., with mologist, vol. iii., p. which at times so s. Olub, No. vi., p. 353. age, is riddled by the most striking of variety of insects. This tree belong to the injury to the tree which record of the species Dr. Packard in his F Commission, pp. 513-

age may again be resorted to. The occurrence of this insect at Picton was mentioned in the *Canadian Horticulturist* for July last in a letter by Mr. Craig and the remedy of burning the foliage recommended.

Red Spiders (*Tetranychus*, sp.) Fig 70, have been abundant and very destructive in many places particularly during the hot weather in August. There are doubtless many species of mites included under the general head "Red Spider." These minute plant-feeding mites are extremely difficult to control—when the weather is dry and hot. Frequent waterings with a hose where possible have a good effect, and sweet peas in several gardens at Ottawa were saved in this way. Dusting with sulphur also had a marked influence on the mites. Kerosene emulsion applied early to plants known to be infested was perhaps the most fatal remedy, but in large fruit gardens upon black currants and raspberries severe injury was done both by the mites and the frequent applications of the emulsion to the enfeebled foliage. As yet it must be acknowledged no practical remedy has been discovered for these pests when they are abundant and during hot, dry summers.

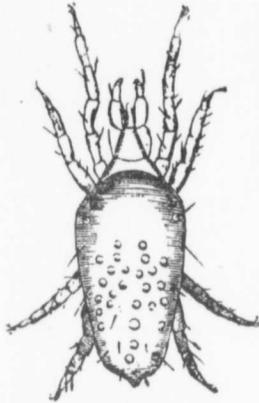


FIG. 70.

The Black Peach Aphis (*Aphis persicae niger*, E. F. Smith), appeared last year for the first time in Essex County. This year there has been no complaint from that locality; but I fear that peach-growers from not recognizing the danger of this insect are failing to report its presence. Another occurrence was discovered near St. Catharines in a newly set peach orchard. The owner of the orchard, on having his attention drawn to it, promptly rooted up the trees and destroyed them.

SOME BEETLES OCCURRING UPON BEECH.

BY W. HAGUE HARRINGTON, F.R.C.S., OTTAWA.

When so many of our forest, shade and orchard trees are defoliated and disfigured by an endless succession of insect pests it is satisfactory to find one of our most beautiful and valuable species comparatively free from such attacks. At the close of summer the stalwart, handsome beech will be found with its raiment of bright, glossy foliage almost as fresh and unspotted as in springtime, while its neighbours, the maples, elms, etc., are more or less naked and threadbare. Yet, favored as it is, there are several species of moths whose caterpillars find the tough leaves not unpalatable, such as *Hyperetis nyssaria*, A. & S., whose larva was described by Prof. Saunders in the *Canadian Entomologist*, vol. iii., p. 209, and the pretty little casemaker, *Incurvaria acerifoliella*, Fitch, which at times so seriously infests the maples. (See *Trans.-Ottawa Field Naturalists' Club*, No. vi., p. 353.) The trunk when injured, or when the trees become weakened by age, is riddled by the boring larvæ of the large Horntail, *Tremex columba*, Linn, one of the most striking of our Hymenoptera, and becomes gradually the feeding ground of a variety of insects. The majority of the insects, however, which I have found infesting this tree belong to the order Coleoptera, and while but few of the species do serious injury to the tree when it is still vigorous, it may not be uninteresting to make a brief record of the species which have been noted by myself, or which have been recorded by Dr. Packard in his *Forest Insects* (Fifth Report of the United States Entomological Commission, pp. 513-520.)

TROGOSITIDÆ.

1. *Trogosita corticalis*, Melsh. An elongated, flattened, brownish beetle, about three-fifths of an inch long, with finely striated elytra, found under the bark of old trees; cannot be considered injurious.

2. *Grynocharis 4-lineata*, Melsh. A more flattened black beetle, about twice as wide as long, and very variable in size, from a little over two tenths to nearly four-tenths of an inch long. Each elytron has four raised lines, between each pair of which is a double row of punctures. This beetle is found under bark with preceding, and is also harmless.

ELATERIDÆ.

3. *Corymbites cruciatus*, Linn. A handsome "click-beetle," whose larva is one of the wire worms which feed in decaying wood, and which has always been found by me on, or in the vicinity of, beech. It is about half an inch long, head black with the exception of the reddish mouth parts, thorax black with a bright red stripe down each side above and below, body beneath black margined with red, elytra yellow with sutural stripe, short humeral stripe and sinuate band behind middle, black. The black sutural stripe and the transverse band form the cross from which the name is derived.

BUPRESTIDÆ.

4. *Dicerca divaricata*, Say. A brownish or blackish bronzy beetle, of rather stout build, from three-quarters to almost an inch long. (Fig. 71.) It is a well known pest of such trees as the maple, apple, etc., its larvæ being one of the "flat-headed" borers, so-called because the thoracic segments (next the head) are much wider than those that follow. It is sometimes quite abundant on old trees, and in May and June can be found ovipositing therein. Some entomologists consider that the beech was the original food-plant of the insect.



F 71.



FIG. 72.

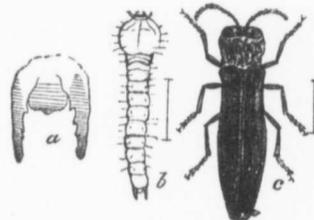


FIG. 73.

5. *Chrysobothris femorata*, Fab. This common borer of the apple tree (Fig. 72) has also been recorded (Riley, 7th Rept., p. 72) from beech, although of all the forest trees in this neighbourhood it seems to prefer the hickory. The oak, maple, mountain ash, linden and box elder are also said to be attacked by it. It is a flattened beetle, somewhat over half an inch long, of a metallic, bronzy colour with some greenish reflections, and the face of the male is bright green. It has been often mentioned in our Reports.

6. *Chrysobothris sexsignata*, Say. This beetle very closely resembles the preceding, but is slightly smaller, and is more rare with us. Mr. Chittenden records (Ent. Amer. V., p. 219) cutting a specimen from a beech tree. This beetle has also been found in yellow birch (Packard l. c., p. 485

7. *Agrilus*

FIG. 74.

11. *Thanocle*: the bark, and quite inch long and quit It is very active in burrow of some bo occurs, as it preys

12. *Eucrada* and as most of the classed as such. It spot on each should

13. *Ptilinus* found boring "pin-old beech trees. T down under the glo half as large and i species it name), th

7. *Agrilus bilineatus*, Web. This pretty little beetle is more elongated and in shape strongly resembles the Red necked *Agrilus* (*A. ruficollis*) (Fig. 73) which forms the gouty swellings on raspberry canes (Fig. 74). It is about three-tenths of an inch long, and the upper surface is black, or greenish black, with a line of golden pubescence on each elytron, and on the margin of the thorax (these lines sometimes rubbed off or wanting); below the colour is coppery. I have taken it upon beech and believe it to infest this tree. Dr. Packard and Prof. Riley have each found it infesting oak.



FIG. 74.

8. *Agrilus interruptus*, Lec. This species much resembles the preceding, but is somewhat smaller and more slender. Its colour is more of a bronze, and instead of the line of pubescence it has a minute golden dot toward the tip of each elytron. I have found it upon beech, birch and hickory, but do not find in my books any records of the trees upon which other collectors have found it.

9. *Brachys æruginosa*, Gory. The larvæ of this little buprestid have been found by Mr. V. T. Chambers (Packard. l. c., p. 519) to mine in the leaves of the beech. The posterior segments are not so tapering as in the larvæ of the species previously mentioned. The beetle very closely resembles the following in size and appearance.

10. *Brachys aërosa*, Melsh. (*B. terminans*, Lap) is rather a common beetle with us, and is found most frequently upon the basswood, but also occurs upon elm, beech, etc., and may mine in the leaves of all these trees. It has been bred by Prof. Gillette from the leaves of poplar (Can. Ent., vol. xix., p. 138). The beetle is only about one-sixth of an inch long, of a sub-triangular or narrow shield-shaped figure; general colour coppery, the elytra purplish and ornamented with pubescence, which forms a band across the tips. We have a larger species, *B. ovata*, Web., which occurs upon oak.

CLERIDÆ.

11. *Thanoclerus sanguineus*, Say. This little beetle is sometimes abundant under the bark, and quickly attracts attention by its bright red colour. It is one-fifth of an inch long and quite narrow; the head and thorax a duller red than the elytra and legs. It is very active in its movements, and when disturbed quickly hides in a crevice or the burrow of some borer. It is rather beneficial than injurious to the trees upon which it occurs, as it preys upon other insects.

PTINIDÆ.

12. *Eucrada humeralis*, Melsh. I have found this beetle under the bark of beech, and as most of the members of this family are destructive insects this may probably be classed as such. It is about one-fifth of an inch long, of brownish colour, with a reddish spot on each shoulder of the elytra which have several rows of punctures.

13. *Ptilinus ruficornis*, Say. This small cylindrical beetle which is very frequently found boring "pin-holes" in oak and maple, has also been found by me to do the same in old beech trees. The female is one-tenth of an inch long, brownish, with the head bent down under the globose thorax, the elytra faintly punctured. The male is only about half as large and is easily recognized by his prominent red antennæ (which give the species its name), the outer joints of which have long leaf-like projections.

LUCANIDÆ.



FIG. 75.

14. *Platycerus quercus*, Web. This beetle and the two following belong to the stag-beetle family, in the males of which the mandibles, or jaws, are sometimes wonderfully developed. In this species they are as long as the head and turned up and irregularly toothed at the point (Fig. 75.) The beetle is about half an inch long, rather flattened, bronzy black in colour, shiny and feebly punctured. The female is lighter in colour, being nearly brown above; the legs and under surface reddish. The larvæ like those of the following species live in decaying wood of various trees.

15. *Platycerus depressus*, Lec. This species differs from the foregoing in being slightly larger, blacker and with the elytra more coarsely striate and punctured. The mandibles are shorter and stouter.

16. *Ceruchus piceus*, Web. This is a very common insect in old beech logs and stumps. It is much more stoutly built, and is very variable in size; from two-fifths to three-fifths of an inch long, the males being much larger than the females. The head is large, as wide as the thorax, and with a deep frontal depression. The jaws of the male are as long as the head, and with a strong inner tooth about the middle.

SCARABÆIDÆ.

17. *Dichelonycha elongata*, Fab.—A rather cylindrical beetle; four-tenths of an inch long; the general colour testaceous or yellowish; head flattened above; thorax more or less pubescent; wing covers with a greenish reflection, more pronounced in the males; under surface hoary, with scale-like hairs; tips of hinder legs sometimes blackish. This beetle and two or three closely allied species difficult to separate from it, feed in the perfect state, on a variety of trees. They much resemble in size and general appearance the Rose beetle, *Macrodactylus subspinosus*, Fab., which belongs to the same family but is, however, smaller and less corpulent. I have found them not infrequent on beech.



Fig. 76.

18. *Osmoderma scabra*, Beauv.—This is a large stout beetle (Fig. 76) of a dark bronze, or metallic brownish colour. Its length is nearly an inch, and it is about half as wide (across the elytra). The head is small, squarish and depressed above; the thorax rounded and irregularly punctured; the elytra irregularly wrinkled and striated. When alive this beetle diffuses a strong odour, which much resembles that given off by Russian leather. The larvæ feed in the decaying wood of old trees, and are fat white grubs much like those of the May-beetles. They construct large oblong cocoons from the particles of decayed wood, in which the grub pupates and finally becomes a beetle. It is probable that the closely allied species *O. eremicola*, Knoch., also breeds in old beech cavities.

SPONDYLIDÆ.

19. *Parandra brunnea*, Fab.—The shape of this beetle and its large mandibles give it a great resemblance to some members of the Lucanidæ (Stag-beetle family), but it is at once distinguished by having the antennæ straight and tapering to the tip, instead of terminating in a leafed club. It is variable in size, from five-tenths to eight-tenths of an inch in length, and of an almost uniform reddish or yellowish brown colour. The grubs live in the wood of stumps and old trunks of various trees, the beetles being found under the loose bark, although they are seldom numerous.

CERAMBYCIDÆ.

20. *Smodicum cucujiforme*, Say.—This beetle I have not seen, but it is one of the smaller species of the longicorns, being only three-tenths of an inch long. The following is part of the original description of the species: "Body depressed; head with a slight

rufous tinge, antennæ than broad, obtusely punctured, with the bark of beech

21. *Dryobius* 139) finding five stated by Dr. F. Oliv., but larger. about three quarters bands.

22. *Xylotrechus* colour a longicorn. That species, however, different. *X. quadricornis* thorax globose with the hinder margin legs slender and from Ottawa was found

23. *Cyrtophorus* lance, which occurs on goldenrods, etc. It is considerably larger in size, but the elytra are small and sunken and very slender, humped above, with white shoulders, and each with a white line, behind times the beetle is with dish legs, but many have a white line) r

24. *Centroderus* taken one example the elytra and abdomen narrowed behind the front and strong twice as wide as the tured at base, and except basal joint.

25. *Toxotus* S examples was taken and shape the prece taper more. With

26. *Anthophilus* by me in an old beech about three-quarters and reddish; elytra

27. *Leptura* su also taken in an old half an inch in length a neck; antennæ long thorax is black, but yellowish with a black

rufous tinge, antennæ rather shorter than the body, tinged with rufous; thorax longer than broad, obtusely contracted each side, rather before the middle; elytra irregularly punctured, without elevated lines; thighs dilated." Mr. Schwarz records finding it under the bark of beech. (Packard l. c. p. 79).

21. *Dryobius sexfasciata*, Say.—Mr. C. G. Siewers records (Can. Ent. vol. XII, p. 139) finding five examples of this handsome beetle under the bark of beech. The grub is stated by Dr. Fitch to be much like that of the common elm-borer, *Saperda tridentata*, Oliv., but larger. The beetle is also of nearly similar form to that species, the length about three-quarters of an inch; colour black, and each elytron with four oblique yellow bands.

22. *Xylotrechus quadrimaculatus*, Hald.—This beetle much resembles in shape and colour a longicorn, *Neoclytus erythrocephalus*, Fab., which is often found on hickory. That species, however, is smaller, and has longer legs; the yellow markings are also different. *X. quadrimaculatus* is half an inch long, and of a reddish colour; head small; thorax globose with two bright yellow spots on front margin and less distinct markings on the hinder margin; elytra with somewhat yellowish tinge and faint oblique yellow lines; legs slender and pale reddish. The only specimen of this beetle which I have taken at Ottawa was found resting on the branch of a beech in June.

23. *Cyrtophorus verrucosus*, Oliv.—This is a common beetle, very ant like in appearance, which occurs upon various trees, and very frequently upon flowers, such as spiræa, goldenrods, etc. Mr. Chittenden has bred examples from beechwood. It varies considerably in size, but average examples are four-tenths of an inch in length. The head is small and sunken to the eyes in the thorax; the antennæ are nearly as long as the body and very slender, the third joint having a strong spine at the tip. Thorax rounded and humped above, very closely and finely sculptured. The elytra are angulated at the shoulders, and each has an elevation near the base, along which runs diagonally a narrow white line, behind which are two less oblique lines, the last being almost transverse. Sometimes the beetle is all black, with the exception of these white lines, and the partly reddish legs, but many specimens have the basal half of elytra (between the thorax and transverse white line) reddish, as also the corresponding under surface and the legs.

24. *Centrodera decolorata*, Harr.—This is a much larger longicorn of which I have taken one example on beech. It is about an inch long, of a chestnut red colour, except the elytra and abdomen, which have a more yellowish tinge. Head moderate in size, and narrowed behind the large, coarsely granulated eyes into a neck. Thorax small, narrowed in front and strongly angulated, or subspinose, in the middle. Elytra at base nearly twice as wide as thorax, and tapering very little toward the rounded tips; coarsely punctured at base, and more finely toward tips, Antennæ reaching to middle of elytra, dusky except basal joint. Legs moderately long and stout.

25. *Toxotus Schaumi*, Lec.—A very handsome longicorn of which one of my examples was taken on a small beech, in a beech grove, in July. It much resembles in size and shape the preceding species, but the thorax is less strongly angulated, and the elytra taper more. With the exception of a wide red band on all the thighs it is entirely black.

26. *Anthophilax attenuatus*, Hald.—One example of this rare longicorn was taken by me in an old beech log in May. It is in general shape much like the foregoing and about three-quarters of an inch long. Head and thorax black; antennæ and legs slender and reddish; elytra brownish and mottled with whitish pubescence.

27. *Leptura subhamata*, Rand.—An example of this pretty and variable species was also taken in an old beech log, and I have taken it likewise on oak. It averages about half an inch in length, and is of rather slender build. The head is small and narrowed to a neck; antennæ long and slender, the joints partly yellow at base. In the male the thorax is black, but in the female it may be either black with a yellowish side stripe, or yellowish with a black central stripe. The elytra of the male are black, with a yellow

stripe on each reaching from the shoulder to beyond the middle, and crossed by a black band so as to form a cross. In the female they may have the same pattern, only the yellowish stripes are larger, or the elytra may be yellowish with a narrow black rim and a band across the middle. Under surface of male, and most of legs, black; under surface of female and legs mostly yellowish.

28. *Goes pulverulentus*, Hald.—This beetle has been recorded by Dr. Horn as very destructive to living beech trees, in the larger branches of which it bores tunnels several inches in length. It may, therefore, be considered one of the most injurious insects infesting this tree, and, as I have previously recorded (Ann. Rept., xiv p. 48), there is little doubt that it also inhabits the hickory. It is a rather large beetle, and in shape closely resembling the female of the common pine-borer, *Monohammus confusor*, Kirby, the smaller specimens of which it equals in size. Length from three-quarters of an inch to about an inch; antennæ slender and slightly longer than body; thorax cylindrical, with a sharp spine on each side; elytra wider than thorax; legs moderately long and stout; colour brownish, but having a hoary appearance, especially beneath, from short white pubescence.

29. *Acanthoderes quadrigibbus*, Say.—This species has been recorded by Mr. Schwarz as boring in the dry twigs of beech and oak. It is a pretty little beetle, quite different in shape from the preceding. Its length is about three-fifths of an inch, and it is rather broad and flattened in proportion to its length; thorax tuberculate above; legs short; the thighs rather stout; elytra with mottled whitish and brownish pubescence and with a sinuate whitish band before the middle.

30. *Leptostylus macula*, Say.—This species which infests the butternut and chestnut has also been observed by Mr. Chittenden to inhabit the beech. I have found it upon butternut, maple and balm-of-gilead, but more frequently upon hickory. It does not differ very greatly in appearance from the preceding beetle, but is smaller and less tuberculate. Individuals vary in length from one-fifth to three-eighths of an inch, colour brownish; thorax with a white stripe on each side, bordered above by an interrupted brown line; legs banded with white and brown; elytra coarsely punctured and immaculate with brown spots, and banded with white behind the middle; antennæ long and slender.

31. *Hoplosia nubila*, Lec.—This species, according to Mr. Schwarz, also bores in the twigs of beech. It is longer and narrower than the preceding insect. Length three-eighths to one-half of an inch; thorax with lateral spines; antennæ longer than body and slender; elytra longer and almost parallel sided, truncate at tips instead of rounded; colour brown, with mottling of whitish pubescence, giving a spotted appearance, and leaving irregular bands on the elytra.

RHIPIPHORIDÆ.

32. *Pelecotoma flavipes*, Melsh.—A small, slender beetle which on one occasion I found quite abundantly on an old beech tree. As the members of this family are parasitic in their habits, it may probably be considered as a beneficial species, preying perhaps, upon some of the inhabitants of the tree.

OTIORHYNCHIDÆ.

33. *Pandeletegus hilaris*, Hbst.—This beetle belongs to a family of weevils, or snout-beetles, which contains some well-known injurious insects. Harris records it as boring in oak, and occurring on all trees from May to September; while Mr. Chittenden notes it as common upon the beech. I have not found it at Ottawa yet, but have received specimens from Mr. Johnston, of Hamilton. It is quite small, being only from one-eighth to one-fifth of an inch long; colour pale-brown, with some greyish and black stripes; beak short and broad; thorax coarsely granulose; elytra with rows of deep punctures.

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Fig. 77

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CURCULIONIDÆ.

34. *Ithycerus noveboracensis*, Forst.—This species is the largest representative of the family which occurs with us. It has been found at times a serious pest in orchards, injuring apple, peach, pear, plum and cherry (see *Insects Injurious to Fruits*, Saunders, p. 196.) According to Riley it infests the oak, in the twigs of which the larva tunnels. With us it seems to inhabit the beech, upon which I have frequently taken it, in the month of June. At Chelsea, a few miles from this city, it was very abundant one season, individuals being observed on every tree examined in a grove of beech. It may be readily recognized among our snout-beetles by its greater size, being five-eighths of an inch long, and robust. Beak, broad and stout with a ridge down the centre; thorax cylindrical, a little narrowed in front; elytra twice as wide as thorax, and declivous or pinched in at the apex to fit the corpulent body; colour greyish; the thorax with three indistinct pale stripes, and each elytron also with three whitish lines, interrupted with black spots, lower surface and legs whitish. Fig. 77.

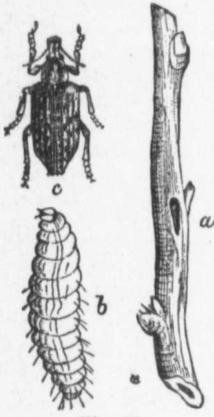


Fig. 77.

35. *Cryptorhynchus bisignatus*, Say.—A pretty little brownish weevil, with an oblique white dash on each elytron, much resembling in shape the Plum Curculio but smaller and not tuberculated. Mr. Chittenden has found it upon both oak and beech trees and believes that it lives under the bark of these trees.

36. *Acoptus suturalis*, Lec.—Mr. Chittenden has taken specimens of this beetle from beech wood. It has been recorded by me (*Ann. Rept. xiv.*, p. 50) as boring in hickory, and the following description was there given of it. A small, black beetle (length one-eighth of an inch), densely clothed beneath and more sparsely above with short yellowish hairs. The elytra are striated and in unrubbed specimens have a wide band of yellowish pubescence across the base, and a narrow one near the tips, which are black, as is also the space between the bands; a white line along the suture interrupts the basal band.

CALANDRIDÆ.

37. *Phlæophagus apionoides*, Horn.—This is a very small and narrow blackish weevil about an eighth of an inch long, with punctured thorax and striated elytra, which Mr. Chittenden found to occur upon the beech with the species just mentioned, and which he believes to breed in the wood likewise.

38. *Phlæophagus minor*, Horn.—As its name indicates this species is smaller than the preceding, but otherwise closely resembles it, except in being of a paler colour, a reddish brown. Mr. Chittenden states that it breeds in the beech and also occurs on the elm.

38. *Stenoscelis brevis*.—This species which is stated to breed in the wood of beech has been found by me also infesting oak, hickory, maple and poplar. It is a black cylindrical beetle, one-eighth of an inch long, with faintly punctured thorax and striated elytra; beak short and smooth, giving it much the appearance of some of the bark-borers which belong to the next family.

SCOLITIDÆ.

39. *Monarthrum fasciatum*, Say. This little species bores in the living tree in the same manner as the Apple Bark-borer (*M. mali*, Fitch) which infests the apple, and which it much resembles.

40. *Xyleborus obesus*, Lec.—This is also a small insect which bores in the living tree, and which much resembles a destructive species (*X. pyri*, Peck) which attacks the pear and which has been named the Pear Blight Beetle.

NOTES ON THE SEASON OF 1896.

By J. ALSTON MOFFAT, LONDON, ONTARIO.

The season commenced early and gave promise of being a good one for the collector, but soon showed symptoms of failing to fulfil its promise. The conditions here were unusually favorable for the production of luxuriant vegetation, and might have been considered equally so for the maturing of insect life, and yet the season was marked by a noticeable absence of that profusion usually seen in the early part of the summer particularly. And this seemed to be the experience of all the regular collectors I met with. When asked as to their success, the unvarying reply was, "There is nothing to be got." And yet, on the other hand, Mr. Bryce, an electric light trimmer, made during the season a large and varied collection of moths; not damaged ones taken out of lamps, but fresh specimens in good order, taken mostly at rest in the vicinity of the lights. When looking at that collection one felt like saying that there could have been no scarcity of good material, but it only proved the value of electric light as a means of concentrating them at particular places for observation, and also, that insects have to be somewhat abundant to become conspicuous. The only moths that attracted my attention about the lights were species of *Crambidae*.

The climatic conditions in the southern portion of Ontario were remarkably diverse within short distances, the western section having a superabundance of moisture, whilst the eastern section was proportionately dry, vegetation of all kinds there suffering severely from want of rain; yet there were two injurious insects that seemed to prosper equally well under either condition, namely, the Colorado potato beetle and the imported cabbage butterfly, both being unusually plentiful.

The newspapers reported grasshoppers as causing considerable damage in specified localities, but within the range of personal observation, they were noticeable mostly for their absence. Even in the driest localities visited by me they could not be called abundant.

As was to be expected, after such a superabundant overflow of *Hadena arctica* last season, the next would be one of corresponding scarcity of the same species, and so it proved to be. Three specimens of it came under my observation, and three only. Many writers have a fondness for giving columns of figures that are perfectly appalling, illustrative of the natural cumulative increase of insects in a given number of generations, and the unsuspecting reader taking that as the unvarying rule in nature, reasonably concludes that if any species is particularly plentiful one season, it must necessarily be much more so in the following one, and consequently anticipates its advent with more or less alarm; but nature, which is full of surprises, has an easy method of confusing arithmetical calculations, or even of running counter to them. Long continued observation has led to the conclusion that the rule in nature is rather that an unusual outbreak of an insect in one year will be followed by a more than usual scarcity of the same species the next.

Two things are necessary for an abundance of any insect form. First, plenty of eggs; second, favorable conditions for the maturing of the same, in which must be placed an absence of living foes. A noticeable outbreak of a destructive insect is not necessarily preceded by an unusual number of producers. If all the eggs of any species of insect in any year were to come to maturity, there would undoubtedly be a noticeable increase of that species. But as a rule, it is a very small percentage of the ova of any insect that reaches maturity, many natural causes combining to reduce their numbers all along the line of their advance towards that consummation, and thus the balance is maintained between contending interests. This is what is known in scientific phraseology as "the struggle for existence," a delightfully brief but vague expression that covers much ground but explains nothing.

It would be a great satisfaction to be able to give a direct answer to the question so frequently put as to the cause of the abundance or scarcity of some insects at particular

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times, but with creatures that work so much in secret as insects do, it is probable that it can never be done. When an unusual outbreak of any injurious insect occurs we can say positively that the conditions for its coming to maturity had been particularly favorable, but that includes all the climatic conditions, whether these were wet or dry, cold or hot, steady or fluctuating, and as these influence different species in different ways, the uncertainty is the greater; then there is food supply in the past as well as the present; the absence of predacious enemies, parasitic fungi and such like; they may also cover the character of the cultivation of that locality, as that may form a harbor and encouragement to the increase of pests,—an extent of varied knowledge which no one is likely to be in a position to possess. And so with their absence or great scarcity in other years, we can say positively that the conditions were not favorable, but just what these were it may be impossible to specify, especially by one who was not in the locality and had no opportunity of observing the conditions.

The first really serious and wide-spread outbreak of the army-worm, *Leucania unipuncta*, Haworth, in Canada, having occurred the last season, was the means of directing general attention to that destructive insect; and was productive of much newspaper correspondence. I had an opportunity of seeing the worm in the flesh, for the first time to my knowledge, and inspecting its work; and this is how it was obtained:

Being on a visit to Hamilton in July, I was invited to spend the evening of the 22nd, at Boulderwood, the charming summer residence of Mr. and Mrs. B. E. Charlton. It is situated on the brow of the mountain, adjoining the north or city side of the asylum grounds. On our way up, Mr. Charlton informed me that the army worm had invaded the asylum grounds, and was destroying the crops; and he proposed that after dinner we should visit the locality, and survey the invading army; which we accordingly did. We obtained the guidance of the farmer of the grounds, who led us to the infested field, which was at the extreme southern end of the asylum farm. He said they were first noticed in a field of oats, and on the other, or southern side of the road from his, and that the owner as soon as he knew they were there, cut his oats and shocked them in the field. The next day when he examined his shocks he found the ground under them a mass of worms mingled with oats. The asylum farmer at once ordered his to be cut, but had them carted to a far distant field and there put up in shocks.

The crop next north of the oats that had been cut and removed, was spring wheat. There we had evidence of what the worms could do. Not a loose leaf was to be seen in the field; the straw standing quite naked. It had begun to ripen, which probably had saved it and the heads from attack, as some of the short and greener ones showed signs of having been nibbled at. We found a number of the worms under clods, but the farmer expressed surprise at their being so scarce, as compared with the previous day, when a pint or more of them had been taken in a very short time, which had been wanted for exhibition purposes. Probably the bulk of them had gone to seek fresh pasture, as there was not a green leaf in that field left for them to eat. Some of those taken seemed to be full grown, and may have been preparing to pupate, as chrysalids were found. During the search Mr. Charlton found a creature which was to us of doubtful parentage. I thought I recognized it as something I ought to know, but could not say what at the time. Having surveyed the situation to our satisfaction; and Mr. Charlton having secured three of the largest worms in a box, the unnameable creature and a chrysalid; we returned to his residence. After these had been looked at by the residents and visitors assembled, the time came when I had to leave; Mr. Charlton kindly said I might take the box and its contents, which I was very pleased to do; so I put it in my vest pocket, which it just fitted. Upon reaching my place of abode, I took out the box to show my friends the army worms; when I opened it, I found the largest one had disappeared, except the head and shrivelled skin, which was about the size of a grain of wheat, whilst the unnameable creature had another one by the middle, and was quietly engaged in absorbing its internal economy with unmistakable satisfaction. This disclosure of its habits at once suggested to me that it was the larva of some predaceous beetle, probably an *Harpalus*, and that I had seen an illustration of it somewhere. Upon

returning to London and making search, I found its exact counterpart on an enlarged scale in "Saunders's Insects Injurious to Fruit," page 185, which is here reproduced, Fig. 78.

During the next day, the *Harpalus* larva rested quietly, two worms seemingly being enough to satisfy its cravings for one day; whilst the remaining worm was very restless, no doubt from want of food. In the evening, being in company the army worm was introduced in the conversation, when I remembered that I had the box in my pocket, I took it out to show the worm, but there was not the vestige of a worm left, and the *Harpalus* larva was rushing frantically round in the box in search of more. I kept it that night to see if it would attack the chrysalid, but it did not, so I gave it its liberty next morning in consideration of the good it might do.



FIG. 78.

A great deal of romance has been written upon the army worm. Its sudden appearance in vast and destructive hordes is well calculated to arouse the imagination of those who are usually totally indifferent to, and wholly ignorant of the habits of insects; consequently the movements of the army are to them perfectly mysterious. We read of their coming, no one knows how, or from where, of their always travelling to one particular point of the compass. Of their following a leader who directs their movements; and who gives the signal for their advance by a wag of his head; and much more of the same sort. The army worms come from eggs, like all other insects, which in this case are laid near the roots of grasses by the moth *Leucania unipuncta*; and may be feeding there in great numbers when young, without attracting the slightest attention. It is not until they are well grown that they acquire their great powers of destruction, and then the field in which they were born may not be able to sustain all of them; when the necessity to travel to other localities in search of food is forced upon them. The only really mysterious thing about their movements is, that they should keep together in a body, and go in the same direction in search of food, instead of, as is usual with caterpillars, each going in the direction that its fancy leads, independently of the others of its kind. This gregarious habit is indeed very wonderful. But food is their objective point of travel, not any particular one of the compass.

There is another destructive insect that is endowed with this peculiar habit of travelling all together in one direction in search of food, namely, the migratory locust in its mature state; and a consideration of its mode of progress in desolating a region, may assist us in forming an idea concerning that of the army worm. When we read of an invasion of locusts into a locality where there were none before, they are always represented to us as coming down from the air above, ravenously hungry, as if it had been their first stopping place for food on a long journey, a few at first, then a dense mass, sufficient at times to obscure the light of the sun, gradually becoming thinner, then passing over, not leaving any living green thing behind them. This appearance, although it may be misunderstood by the onlooker, is nevertheless quite in harmony with the actual facts of their progression. Supposing a field well stocked with locusts who have just developed mature wings and a prodigious appetite, find their food supply exhausted, and it has become needful for them to go elsewhere for more. The field next to them is untouched, those close to it enter, those behind them follow, whilst those at a distance who are as eager for food and in as great a hurry to obtain it, rise on the wing and fly over the feeders and alight just beyond them, their peculiar gregarious instinct compelling them to feed in crowds, so that those that entered the fresh field first, find themselves surrounded by a multitude which has devoured everything before they get enough; hence they in turn find it necessary to rise on the wing and make for the front again to obtain more and so having started they proceed; and the deeper and denser the advancing host, the further they have to fly to reach the front, and the more of them there are on the wing at one time, the higher some of them have to rise in the air to get over the others; and when we read of their coming down in such numbers and such

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force, as to remind the beholder of a hailstorm, and make him glad to seek shelter from their contact, it is in perfect accord with their mode of progress and their eager haste to obtain food; and this mass, to a beholder who could take it all in at once, would appear like a huge rolling crowd of living particles, descending in front but ascending at the rear, whilst the impelling force that keeps it going is the necessity for something to eat. And when we consider the meagreness of the supply in some localities, compared with the enormousness of the demand that always exists, we get the reason for the differences of time that they take on the way. If food is abundant, they linger; if it is scarce they pass rapidly on. When we turn our attention again to the army worm, we see that the principle and the motive are the same in both; but the one proceeds on the wing, through the air, whilst the other has to keep on the ground and go afoot; yet the front ranks will be constantly changing places with the rear, for as those in front stay to eat, those behind have to pass beyond them to obtain a share; and as the feeders are so numerous in one place, none of them get all they want, so they are compelled to move on to get some more; which completely disposes of the "leadership" theory.

Amongst the captures here of rare forms during the past season, I may mention a specimen of *Papilio Marcellus* by one person, and one of *P. Philenor* by another. *P. Cresphontes* again paid us a visit, after an absence of two years. It appears as if this southern butterfly must be either periodical in its habits, or has not yet succeeded in firmly establishing itself in more northerly localities; and is depending upon additional migrations to maintain an appearance. In the year 1893 it was more abundant, and reported from a greater number of localities, and some of these further north than ever before. In 1894 I saw a few in the early part of the season, but none later on. In 1895 I did not see a single specimen on the wing, nor was there one reported to me as having been seen. In the latter part of August, 1896, I saw a fine fresh specimen, but did not secure it, I also saw one that was taken later in the season in a damaged condition; which would seem to give promise of its being more plentiful again next year.

A specimen of *Erebus odora* was taken by Mr. Kyle, at Dundas.

The things new to this locality, recognized in Mr. Bryce's collection, were the true Carolina Sphinx, as distinguished from *quinquemaculata*. Large in size, dark in colour, and in fine condition. *Cisthene uifascia*, Grote, bright and fresh. Mr. Bryce has kindly donated a specimen of each to the Society's collection. He has also taken a single specimen of *Aspila virescens*, Hub. Also many choice varieties of less rare things, as well as several species not yet determined. Never did I see the webs of *Hyphantria cunea*, the fall web worm, so offensively obtrusive as during the past season.

In the early part of October the males of *Hybernia tiliaria*, Fig. 79, the Lime-tree

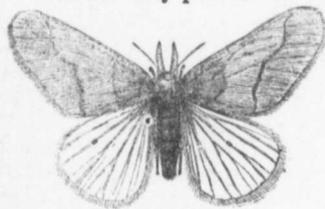


FIG. 79.

Winter Moth, were in great profusion around the city. They could be seen even on frosty nights, fluttering about the lighted shop windows, and in daytime resting in sheltered places, or being driven along the street by the wind; their large sail-like wings affording ample space for catching every breeze, and being carried helplessly away by it. There was a wonderful, and particularly interesting diversity in the shade and pattern of the colour and ornamentation of their wings, which their abundance gave one a good opportunity to observe. The females I did not see; as these are wingless they would require to be sought for upon the trees.

WARNING COLORS, PROTECTIVE MIMICRY AND PROTECTIVE COLORATION.*

By F. M. WEBSTER, WOOSTER, OHIO.

In "Memoires de la Societe Zoologique de France," Professor Felix Plateau has recently given the results of some experiments carried on by himself, to determine whether, as has often been stated, the Magpie moth is really an example of what is termed "warning color." In order to solve the problem, the Professor ate several of the caterpillars, and found them to possess something of the flavor of almonds, and not unpleasant to him, but rather the reverse. Unfortunately, this experiment only proves that as against a person to whom the flavor of almonds is not distasteful, the larvæ of the Magpie moth are not warningly colored, but the real question regarding protective coloration, as against bird enemies, does not appear to be nearer a solution than it was before. Men do not feed upon the larvæ of this moth, or the moth itself, nor have we good reasons to suspect that they have ever done so, and there is no reason why these caterpillars should be, to them, distasteful, as no material protection would in any case result. The two following incidents will illustrate my point.

Species belonging to the genus *Danais* are, rarely, if ever, to any extent attacked by birds, and in the tropics even monkeys are said to

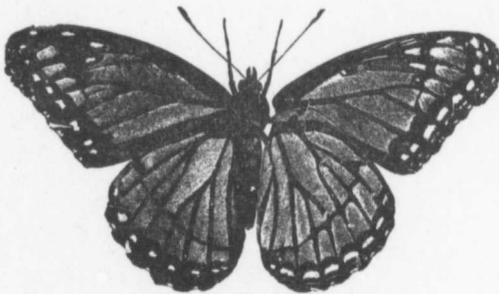


Fig. 80.

reject them. In the United States, *Danais archippus*, (see Fig. 27, page 31), is mimicked by *Limenitis dissippus*, (Fig. 80), and in other parts of the world other species of the former genus are mimicked by still other species of butterflies, some very interesting illustrations being given by Mr. Roland Trimen in his paper on "Some Remarkable Mimetic Analogies among South African Butterflies"† In the United States, *D. archippus* breeds in the north, and in autumn migrates in immense swarms to the south, where it hibernates through the winter. In "Insect Life," it is stated‡ that these butterflies are sometimes attacked in their winter quarters, and great numbers of them eaten, by a mouse belonging to the genus *Onychomys*; one of the grasshopper and scorpion mice. On an island in Aransas Bay, on the gulf coast of Texas, the remains of at least twenty-seven individuals were found in one place by Mr. Attwater, thus showing that the species is not distasteful to this mouse, but by no means disproving that to other animals, and to birds, it is distasteful, and for this reason mimicked by other species of butterflies. This mouse is not a persistent and perpetual enemy, and unrestrained does not threaten the extermination of the species, and protection from it has never become necessary, and is not now essential. The Harlequin cabbage bug, *Murgantia histrionica*, (Fig. 81), is a conspicuously colored, tropical species, that has made its way northward as far as Lat. 40° 48', even the egg being white banded with black. Not only does the species feed during its entire life, in all stages of development, in the most exposed positions, but the eggs are placed in clusters equally exposed, every habit, in fact, indicating a total disregard of the presence of natural enemies of any description, thereby implying, though not proving that it is distasteful if not warningly colored. Some time since I had



Fig. 81.

*Read before Section F, Zoology, of the American Association for the Advancement of Science, at the Buffalo, N. Y., meeting, August 25th, 1896.

†Linn. Soc. Trans. Vol. XXVI., pp. 497, et seq.

‡Vol. V., p. 270.

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occasion to confine a number of these bugs in a greenhouse upon cabbage plants over which a breeding cage without a bottom was placed, earth being banked up about the base of the cage. The bugs had been thus confined for a short time when during the night, mice worked their way under the side of the cage, and in the morning all that remained of the bugs consisted of a confused lot of heads, legs and fore wings, the mice having clearly eaten the confined bugs during a single night. Still, as against persistent and continual enemies these bugs may be and probably are distasteful, mice being only occasional or accidental enemies.

In commenting on the experiments of Professor Plateau, "Science Gossip," perhaps somewhat overestimating the value of the results obtained, says:—"It would indeed be well if all the examples of 'warning coloration' were subjected to as careful an examination. Equally cautious also should naturalists be before accepting examples of 'mimicry' among animals and plants. In some cases the so-called 'advantageous mimicry' falls to the ground, for the insect which is supposed to imitate one of its fellows appears at quite a different time of year from it."

Now, caution is a grand virtue, and should be, always, the investigators watchword, but to be over cautious is to cheat ourselves and each other out of the truth, which practically amounts to little less than carelessness. He who cautiously winnows the grain, will be as careful that none is blown over with the chaff as he will be to keep the latter from falling back into the cleaned grain, as, in either case, his work will be but poorly done.

By the way, has it ever been settled, beyond question, that both the species protected and the one protecting must occur, interspersed together, over the same area, and at the same time of year? Would either the ornithologist or entomologist be greatly upset if he were to find that birds which had learned, by experience, in spring and while yet very young, to shun insects of certain peculiarities of colour and movement, or which appear to them to possess such characteristics, should continue to follow the same course in late summer or autumn? How soon do birds forget past experiences, and cease to profit by them? After having learned that certain insects, having certain peculiarities of color or of action are not fitted for food, will they not rather continue to profit by such experience, and avoid such at whatever time of year and wherever they encountered them? Besides, does all of this education have to be acquired by experience, or does heredity not exert an influence more or less important?

The adult of the Hickory tree-borer, *Cyrtus pictus*, develops chiefly in *Carya*, and emerges in spring, being almost exactly reproduced, so far as form and colour are concerned, in the Locust tree-borer, *Cyrtus robinia*, which develops in *Robinia pseudacacia*, and emerges in late summer. Both of these species are supposed to mimic wasps, but we will suppose that both wasps and borer have disappeared before the latter species of borer has emerged; would it not gain some protection from its close resemblance to the borer that had preceded it, several months earlier? Would entomologists be very much astounded if such conditions should be found to obtain among other species?

Adults of our *Podotesia syringae*, resemble, very closely, both of our common species of *Polistes*, *P. annularis* and *P. metricus*, especially on the wing, and when at rest the abdomen of the moth is bent downward posteriorly and kept in constant motion, precisely as with the *Polistes*. If the moth is on the ground it does not readily take flight, or, like many other moths remain quiet, but moves about in precisely the same manner as the wasps. In this case a defenceless moth is not only, in all probability, protectively colored, thereby resembling an entirely different insect, armed with a formidable weapon of defence, but its movements are equally like those of the armed species, so that it must gain protection thereby, to greater or less degree. But if one were to hunt for *Polistes*, he would hardly select for his collecting ground a lilac bush long since out of bloom. He would be far more likely to search for them on flowers, where he would seldom if ever find *Podotesia*.

Do we not here have grounds for doubting the necessity for the mimicking and mimicked forms occurring together over the same area, and if so, how far may they not

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be separated, and the former gain more or less protection from its enemies? Is it not more probable that birds and other natural enemies will avoid species having a close resemblance to armed or distasteful species, during their entire life, and wherever they may go? Will not birds that have hatched and reached maturity in the north, and there learned to avoid armed or inedible species of insects, or such as closely resemble them continue to follow the same policy respecting the latter, after they have migrated far to the southward, and may not the recollections of *Polistes annularis* offer protection to species resembling it, like the *Podosesia syringæ*, for instance, far beyond the geographical distribution of the former species itself? Unless birds are continually forgetting and having to relearn past lessons, we must certainly admit that protective mimicry and protective coloration may be in effect, over the entire area of distribution of the species deceived, even though this extend far beyond the area occupied by either the mimicking or mimicked species, though, as a matter of course, this influence must decrease as the deceived species are displaced by those new and untried. It would certainly seem that we might here find a solution of some of the very many perplexing problems of form, movements and coloration, that are constantly confronting the student of animal life.

That at least birds and animals do not readily forget old habits and former experience, especially if the lesson has been emphasized by pain, I will give two illustrations, one borrowed, the other my own, and doubtless many others will readily occur to anyone who will take the trouble to recall them.

In his exceptionally valuable work, "The Naturalist in La Plata," all the more valuable because of the author studying life in living forms, and speaking only of what he observed, Mr. W. H. Hudson, informs us that in that treeless country some species of woodpeckers have, through necessity, acquired the habit of seeking their food on the ground, and even nesting in the banks of streams, yet where this change of environment and consequent alterations in their way of living, have, in some cases, resulted in structural modifications, thereby showing their antiquity, they still retain their primitive habit of clinging, vertically, to the trunks of trees (presumably introduced) though the habit has long since lost its use. We thus have evidence, not only of the permanency of established food habits, but that habits of this sort are transmitted through long periods of time through the influence of heredity.

Years ago, when sparsely settled and therefore in a nearly primitive condition, the prairies of Illinois, where the greater part of my childhood was passed, were inhabited by various species of snakes. My father owned a pair of oxen, one of which had, when a calf, been bitten by a snake; an experience that he never forgot. So long as he was retained on the farm, he could seemingly not only detect the presence of these reptiles by sight, but if out of sight and near at hand he appeared to scent them as unerringly; and once he detected the presence of a snake, of any kind or dimensions, he would give a snort and with a deep bellow break for home, whether attached to plow, harrow or waggon. On one occasion, with my father, I was crossing a track of prairie in early spring. The dry grass of the previous year had been burned and the ashes had disappeared, leaving the surface bare and brown, as the young grass had not yet put forth. I, at the time a very small lad, was in the waggon, while my father walked along beside the oxen. Suddenly "Old Star" gave a snort, and with a bellow that seemed to frighten his mate also, started off on a mad run, taking a bee line for home, not stopping until their stable had been reached. After assuring himself of my safety, my father returned to the place where the oxen had started on their wild run, and near by found a group of snakes that he had not before observed, belonging to a harmless species, collected in a confused mass, as is their habit at this season, enjoying the warm rays of the early spring sun. It does not seem probable that the sting of an insect would have a less lasting effect on a smaller animal or bird, or the recollections of a particularly distasteful morsel in the mouth soon become extinct, and besides, my father's ox would probably not have acted differently, or any sooner forgotten the pain of the snake bite received on the prairies of Illinois, had he been transferred to New England or California.

Along the Say, and *S. in* Say stated that to so many at and along Lal closely resemble beetles found *Bembidium*, t representative of th been found al not only close places elsewhere this deception ities of color a whether they learned by the tant inland str ities of form, n problem, becau into it?

On the ex where these ob *amœnus*,† which ous family, *Cer* locality, though about among th active, erratic r numbers, the C all of this decep it would have b of these pine tw against these pr brate enemies a particular situa the ground, as investigator wo but rather in se only are here pe rays of light in s verse white fasc motion, appears life, but it does r both together mi where but two of

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Along the south shore of Lake Erie I find two species of Hemiptera,* *Salda ligata*, Say, and *S. interstitialis*, Say, the latter and smaller, when skipping nimbly about, as Mr. Say stated that it did on the shores of the Missouri River, have a deceptive resemblance to so many stranded *Hydrophorus*, which I believe prefers such places to sandy beaches; and along Lake Erie at least they are far outnumbered by this species of *Salda*, which so closely resembles them. *Salda ligata* is larger and does not resemble any of the aquatic beetles found along the lake, but simulates to a remarkable degree some of the species of *Bembidium*, though at the time of my observation it was impossible to find a single representative of this genus in that immediate locality, whereas, they were most surely to have been found along the shores of almost any stream. Now, these two species of Hemiptera not only closely resemble species of beetles not present, but inhabiting quite similar places elsewhere, but also the movements of one species of Hemiptera add much more to this deception than does its color, thus raising the question as to whether these peculiarities of color and movement are mere coincidences, and of no service to the possessors, or whether they do receive benefit from such simulations by taking advantage of the lessons learned by the sand piper, or other birds of similar habits, along the shores of some distant inland stream, and which lessons caused them to shun insects having these peculiarities of form, movement and color. Is the investigator justified in casting aside the whole problem, because he does not happen to look far enough to see all of the factors entering into it?

On the extreme tips of the new growth of pine, a tree not indigenous in the locality where these observations were made, I find during June and July, a *Capsid*, *Pilophorus amœnus*,† which while at rest has much the appearance of some species of the Coleopterous family, *Cerambycidae*, no species, however, being at all common on this tree, in this locality, though *Eudercos pini*, is said to occur elsewhere on the pine. While moving about among the pine needles, however, the *Pilophorus* has almost exactly the quick, active, erratic movements of ants which frequent the same situations in considerable numbers, the *Capsid*, except when at rest, being almost indistinguishable from them. If all of this deception was for the purpose of misleading the ants, it would seem as though it would have been carried further, and obtained while the *Capsid* was at rest. The tips of these pine twigs are practically inaccessible to even the smaller arboreal birds, and against these protection is here unnecessary, while except an occasional spider, invertebrate enemies are equally wanting. In fact, so far as the need for protection in this particular situation is concerned, the whole matter of protective mimicry would fall to the ground, as no protection appears necessary, yet, it seems to me, that the careful investigator would not be justified in dismissing the whole matter as a mere coincidence, but rather in searching elsewhere for the causes of a phenomenon of which the effects only are here perceivable. The polished surface of the abdomen of an ant reflects the rays of light in such a manner as to appear like a narrow band of white, of which the transverse white fascia on the wing covers of *Pilophorus amœnus*, when that insect is in motion, appears almost the exact counterpart. I have never observed *Eudercos pini* in life, but it does not seem impossible that it too may move about in a similar way, and both together mimic the ant where protection is necessary, my observations being made where but two of the three actors are present, and no protection necessary.

Another diminutive *Capsid*, *Halticus bractatus*,‡ is found in Ohio, and among other plants affects Red Clover, *Trifolium pratense*, feeding in all stages upon the upper side of the leaves. The effect upon the plant is to discolor the leaves, but this really affords protection to the young, as the changed color more nearly harmonizes with that of their bodies. The adults are black with antennæ and legs, except the femora, yellow, the femora being also black, both sexes being saltatorial. The male has the normal form of an Hemipter, but the female differs entirely in appearance, and simulates to a remarkable

*Kindly determined for me at the Department of Agriculture.

†Kindly determined by Professor Herbert Osborn.

‡ Also determined by Prof. Osborn, who, with my assistant Mr. C. W. Mally, found the species quite abundant in Iowa, the latter gentleman observing it also in Northern Ohio.

degree, a beetle, *Chaetocnema parcepunctata*, also very common on clover and other plants. Curiously enough, where I find the former in greatest abundance, there are almost none at all of the beetles, while in a clover field not over one-fourth of a mile away, the beetles are very abundant and none at all of *Halticus bractatus*. That we have here a well defined case of simulation can hardly be doubted, yet the simulating form and the form simulated avoid each others company as if mortal enemies, there being no other forms present that at all resemble them.

I have made no experiments with any of these insects in order to determine whether or not they are distasteful, for the reason that any results obtained with the facilities at hand would have added to instead of reducing the complication. I might, like Professor Plateau, have eaten some of these insects, and learned whether or not they were distasteful to me, or I might have fed them to domestic fowls, or wild birds in confinement, but failed entirely of securing the data required. It seems to me that the only testimony in these matters, worthy of consideration, is to be found in the stomachs of insectivorous birds, and other vertebrate enemies if any, shot while feeding in the exact locality and under perfectly free and natural conditions. Giving a bird perfect freedom and allowing it to make its own selections and discoveries is one thing, while confining it, and doing these things for it, is quite another. It is what these natural enemies actually do, under perfectly natural conditions, that we must learn, and not what they can be induced to do.*

Over a large portion of the United States, and to a less extent in Canada, primitive conditions no longer obtain, while modern conditions are undergoing a constant change, the plow and axe of the husbandman having exterminated many forms, both vertebrate and invertebrate, if not entirely, over large tracts of country, and we may and probably do have cases of peculiar coloration and movements that were once protective, but now remain only as vestiges of a former state of affairs, the forces that brought them into existence no longer existing, except locally.

One phase in the radical changing of the natural flora and fauna over areas of greater or less extent, whereby both plants and insects are entirely displaced by others, emphatically different, is shown by the two accompanying illustrations, showing the bed of a small lake just prior to and after being brought under cultivation, and an aquatic insect fauna displayed by another, terrestrial, and more or less connected with the introduced flora. (See plate preceding, page 65).

In Northern Illinois a species of willow, *Salix discolor*, the leaves of which are nearly white on the under side, grows in wet places, on hummocks, and to the height of from one to six feet, forming a regular compact cluster. The foliage is fed upon by a hard, heavy bodied beetle, an inch or more in length, and often nearly a half inch across the shoulders, in color ebony black with white pubescence, which on the elytra is arranged in irregular transverse fasciæ, with more or less parallel markings, all of which combine to give the insect the appearance of a white surface, irregularly tessellated with black. This beetle, *Plectrodera sculator*, fig 82 feeds by eating holes in the leaves, or irregular notches, leaving the mid and lateral veins, with irregular borders of the leaf along these nearly intact. The beetle remains on the under side of the leaf, the eaten portions of which, against the background formed by the interior of the thicket, appear black, while the uneaten portions appear nearly white. In this way a beetle stationed on an uneaten leaf has almost the exact appearance of a leaf partly eaten, and so perfect is the deception that a fairly good collector may pass some years in a locality where the species is very common, without seeing a single specimen, until he detects the deception. Aside from its considerable dimensions and hard body, this beetle is armed with a rather formidable spine on each side of the thorax, thus rendering it rather an undesirable sort of prey for any of the smaller birds, and altogether too much so for any invertebrate enemies. In



Fig 82.

* I may be permitted to state that, in Ohio, birds cannot be shot for the purpose of making scientific investigations, without running the risk of being arrested and heavily fined therefor.

the locality said to exist of which are by mere accident where the d

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*Trans. Ent Jour. N.Y.

the locality in Illinois, where I studied this species, only two vertebrate enemies can be said to exist, one the Shunk, *Mephitis mephitis*, and an occasional entomologist, neither of which are at present abundant. Does it appear likely that all of this is brought about by mere accident, or is it not far more probable that protection was once gained, and elsewhere the deception may continue to give protection?

There are still other points in this problem that seem well worthy of careful consideration. We hear the terms, warning colors, protective mimicry and protective coloration, etc., used, as a rule, in the sense of a finality. Just as though these particular workshop^s of nature had finished their mission, and were now closed indefinitely; and while we have ample supplies of the finished product, there is none at all in process of construction. Have we here no transition stages? We are dealing with some of the forces that go to make what we term evolution, a process going on, as is believed, continually and everywhere about us, and if this is true might we not confidently look for species and varieties that are in the process of becoming protectively, or even warningly colored, or the condition which we term protective simulation not quite obtained? If perfect protection is never quite reached, does not this of itself presuppose progressiveness and, therefore, instability? May we not, in fact, in the future come to measure the antiquity of some of our species by the degree of perfection with which they are mimicked by others? It would probably necessitate remaining together through a long period of time in order to enable an unprotected, younger and therefore less stable form to gain protection from a distasteful form, especially as the advance in that direction must necessarily come from the weaker, unprotected and younger form. To illustrate, our *Danais archippus* is supposed to be a very old species, while *Limenitis disippus* is supposed to be a much younger species. What is true here would also obtain in the case of *Podossia* and *Polistes*, thus indicating the greater antiquity of the latter, though probably belonging to a younger order than the former. Mr. Gahan has shown* that there is a remarkably close resemblance between seventeen species of *Diabrotica*, inhabiting Mexico and Central America, and an equal number of species of the genus *Lema* occurring in the same section of country. Among the species of *Diabrotica* given, but one, *D. vittata*, is known to occur north of Mexico, and none of the species of *Lema* here sufficiently resemble any of the species of *Diabrotica* to lead to the suspicion of protective mimicry. In fact, it is only along the Mexican border that we have any striking resemblance between any of our species and those of the latter genus. In the states bordering on Mexico, Professor Wickham tells me that *Andrector 6-punctata* bears a striking resemblance to *Diabrotica 12 punctata*, and another species of *Andrector* is very much like *D. tricineta*. There is no positive proof that these are cases of protective mimicry, and Mr. Gahan does not claim this for the cases of close resemblance to which he calls attention, but in all of these there are certainly strong grounds for suspecting that such will ultimately prove to be the case. I have elsewhere † shown that there is every probability that the ancient home of the genus *Diabrotica* was in northern South America, many North American species originating in Central America and Mexico. It would seem, then, that *D. vittata*, *D. 12 punctata* and *D. tricineta*, having spread northward from Mexico, and being the oldest northern forms of the genus, might be mimicked in Mexico and the adjacent portion of the United States, because of having occurred there a sufficient length of time for such conditions to be brought about, while farther north they, with the rest of the genus, are comparatively recent comers, and sufficient time has not elapsed to develop cases of protective mimicry.

In conclusion, I desire that nothing in this paper shall be so construed as to, in the remotest degree, favor hasty or unwarranted conclusions in studies of warning colors, protective mimicry or protective coloration, but I do wish to urge that the same caution and painstaking labor should characterize our action in rejecting, finally, possible cases of these phenomena that would be exercised before accepting such, were the possibilities

*Trans. Ent. Soc. Lond. 1891. pp. 367-374.

†Jour. N.Y., Ent. Soc. Vol. III, pp. 158-166.

greater or amounting to probabilities, that we shall lean no more or less to the pessimistic than to the optimistic, but weigh every fragment of information, be it negative or affirmative, with equal care and discretion.

The points that I have tried to emphasize are:—(1) That a form of animal life may be distasteful to other forms, and so far as these are concerned, warningly colored; but neither the one or the other, where the form to be protected from is not a persistent and perpetual enemy, that, unrestrained, would threaten the extinction of the form preyed upon; (2) That a mimicking form may profit by a protective resemblance, not only where both it and the form mimicked occur together, but throughout the area of distribution of the deceived form, whether the mimicked form be present or not; (3) That a form, closely resembling in appearance a mimicking form, though occurring at a different time of year, or in a different locality, may profit to a greater or less degree by such resemblance, even though both mimicked and mimicking forms are absent, provided, however, the form protected from has somewhere come in contact with the distasteful form and learned by experience that it is inedible; (4) That we may and probably do have cases of partial-deception, and, therefore, partial protection; (5) That cases of mimicry may occur where, owing to the fact of the enemies having become exterminated, or the mimicked and mimicking forms drifted into places inaccessible to such enemies, no protection is given or required; (6) That these problems are most far reaching, and we have as yet scarcely begun to study them in their entirety, hence the fragment here over among the rubbish may yet prove to be the keystone of the archway through which we are to make our way into one of the grandest and most sublime of nature's many temples.

THE SAN JOSE SCALE.*

By F. M. WEBSTER, WOOSTER, OHIO.

My topic is not of my own choosing, but the one assigned me by the Vice-President and also by the Secretary of the American Association of Nurserymen. I mention this fact, not in the way of compliment, but because so much has been said in public print regarding this pest during the last year or two, that I may not be able to present much that is new. About all that I shall attempt to do will be to bring together all the facts in our possession and point out to this association, for its consideration, some lessons that the past has taught us, and the possibility of profiting by such lessons in the future. To me, though not a nurseryman but one whose business it is to protect some of their interests, the introduction of the San José scale into the country lying to the east of the one hundredth meridian, and its suppression, so far as this has been accomplished, has meant something more than the mere study and investigation of the pest; more even than the overcoming of it and preventing its further diffusion. It has appeared to me as though, in the last half of the last decade of the nineteenth century, there had been presented to our people a test case, as it were, as well as a reminder that the coming twentieth century would bring to us problems which we had not previously been called upon to solve. The question that seemed to me to be involved was this: Can a republican government, composed of nearly half a hundred minor governments, protect its people from the ravages of a diminutive insect pest that has been introduced among them to devastate their orchards and fruit farms? What will be done under such circumstances, and who will be the ones to do it? This scale is a serious pest, but is it not, besides this, the straw that denotes the direction toward which the wind is blowing? We have but to cast our eyes toward the State of Massachusetts where a fierce battle is being carried on against another imported pest of our orchards

* This valuable paper, read at the Twentieth Annual Meeting of the American Association of Nurserymen, at Indianapolis, Ind., June 12th and 13th, 1895, has been kindly furnished us by the writer, and will be found well worthy of perusal in view of the fact that this insect may at any time be found in Ontario.

—Ed.

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Mealy-bugs. We peach, plum, pear

and forests, solely by one member of this republic, while the others are simply spectators looking on with a disinterestedness that amounts almost, if not quite, to a total indifference. These are the two at present, most important introductions of foreign insect pests, but no one can for a moment suppose that others will not follow, coming as with the San José scale, from we know not where. You, gentlemen, are engaged in a business that necessitates the exchange of scions, grafts, trees and shrubs, but may also be disseminators of these pests not alone to your customers, but to each other. And, whether you will or no, you cannot escape being foremost in the settlement of a problem that half a century ago was unthought of. Hence, while I address you on the subject of the San José scale, it will be to view it as a factor in what seems to me to be a great and difficult problem in the future of your business; and with this explanation I will proceed to consider that factor.

The San José scale was first observed in this country in the locality in California from which it derives its name, coming from we know not where, but probably from either some of the islands of the Pacific or else some of the Asiatic countries beyond. This introduction is thought to have taken place about the year 1870, and began to attract the attention of fruit growers about three years later, but so far as known only in the locality above indicated. In 1880 Prof. J. H. Comstock described the species, and wrote as follows: "It is said to infest all the deciduous fruits grown in California, excepting the peach, apricot, and black Tartarian cherry. It attacks the bark of the limbs as well as the leaves and fruit. I have seen many plum and apple trees upon which the fruit was so badly infested that it was unmarketable. In other instances I have seen the bark of all the small limbs completely covered by the scales. I think it is the most pernicious scale insect known in this country." For the reason here given, Prof. Comstock gave it the name of *Aspidiotus perniciosus*, and I may here add that it has since been found to occur on both the peach and apricot, and fully merits the name given it by the describer. It appears to have spread quite rapidly, for in 1882, nine years later, it had extended over all of the fruit growing regions of California and across Oregon into Washington. As late as 1893, the Los Angeles Horticultural Commission, in their report for that year, stated that the pest, if not speedily destroyed, would utterly ruin the deciduous fruit interests of the Pacific coast; that it not only checks the growth of the trees, but covers them literally entirely, and the fruit nearly as much so, and, if left unchecked, the tree is killed within three years' time. This will serve to show you the serious nature of this little pest, as demonstrated by its twenty five years' residence on the Pacific coast.

I will occupy a few moments here to consider its probable origin, though, as before stated, we do not as yet know the land of its nativity. It is found in Chili, but was clearly introduced to that country from California. It also is found in Hawaiian Islands, having been introduced from California on prune and peach trees, and also in Australia. But nowhere in these countries has it been found inhabiting indigenous vegetation, which we entomologists claim, must be done in order to prove the nativity of the pest. Quite recently, Professor Cook has sent it from California on the Loquat, *Photinia japonica*, and, as will be observed, there are several of our forest trees included in Dr. Lintner's list, but this proves nothing as it would be surprising if, in its twenty-five years' residence in this country, it had not begun to adapt itself to our native flora, precisely as some of our native parasitic insects are beginning to learn that they can add it to their bill of fare. Considerable of the nursery stock required in California is grown on some of the smaller islands of the Pacific, as for instance, Tahiti, and it seems at least possible that we may in this way have acquired a pest that may be an inhabitant of an obscure island, and, for aught we know, it may be so inconspicuous there as to require the trained eye of the naturalist to detect it.

The insect itself, Fig. 83, belongs to a group known as armored scale insects, their nearest allies being the Oyster-shell Bark-louse, while still farther removed are the Mealy-bugs. We have here in the east a somewhat similar species that I have found on peach, plum, pear and maple. This is known as the Putnam scale, *Aspidiotus ancylus*,

having been first described by the late J. Duncan Putnam, from Iowa. It is known to occur on the following plants also, ash, beech, bladder-nut, hackberry, linden, oak, osage-orange and water locust. This is often mistaken for the San Jose scale, even by those

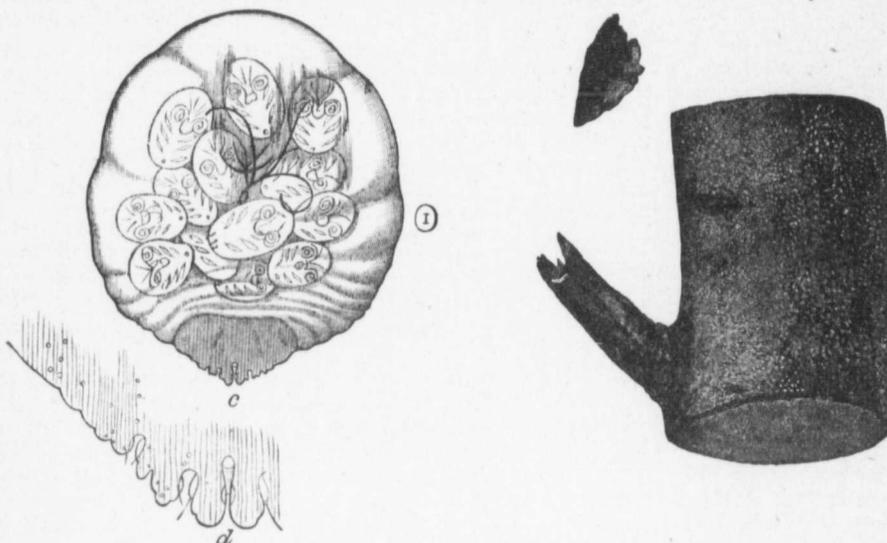


Fig. 83.—San José Scale, female enlarged and part of infested branch (life size.)

who are quite familiar with the latter. My own manner of distinguishing between these two scales is to first observe if the disc is circularly wrinkled and the elevation in the centre surrounded by a depressed ring; if the scale is very flat, or if it appears to rise

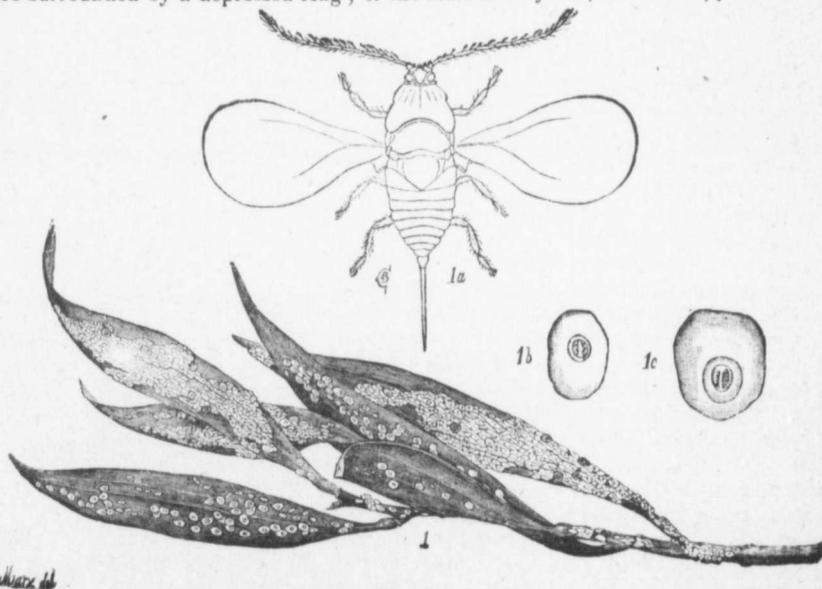


Fig. 84.

gradually from the outer edge to the base of the elevation; if the scales are disposed to crowd in compact patches. If the disc is circularly wrinkled with a deeper ring about the base of the elevation; if the scales crowd each other closely and give the tree a gray

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appearance, it is the San Jose scale. If the disc is smooth, and the central point rises out of a smooth area, it is probably the Putnam scale. Another scale that has come to me several times as the San Jose scale, is the Oleander scale, *Aspidiotus nerii*, Fig. 83, which also attacks ivy. But this is of a lighter color, flatter and longer.

The Rose scale, *Diaspis rosea*, has been sent me, both on the rose and raspberry, with the query as to whether or not it was the San José scale. But this is also larger, more depressed and of a lighter color. In short, we have nothing that clusters so thickly together on the host plant, and gives it that peculiar gray color, which once seen will never be mistaken for anything else.

In regard to the life history of the species now under consideration, it appears to differ from that of many of our scale insects in that instead of reproducing by laying eggs, the mother gives birth to her young. As by far the most careful studies made on this species have been carried on at the Department of Agriculture, under the direction of U. S. Entomologist, Dr. L. O. Howard, I take the liberty of giving Mr. Howard's statement in his own words. He says: "Although this insect has been known in California for about twenty years, its life-history has not been carefully worked out by California writers. Professor Comstock described simply the male and female scales and the body of the adult female. The male was unknown to him. In his work on the Injurious Insects of the Orchard, Vineyard, etc., published at Sacramento in 1883, Mr. Matthew Cooke briefly described the male insect and published a crude figure of it. He further stated that the species produces three broods in California, the first "about the time the cherries begin to color, the second in July, and the third in October." The statement is made by Comstock that the eggs are white," and Cooke further says that "each female produces from thirty-five to fifty eggs."

"Upon the appearance of the insect in the east, potted pear trees were secured for the Insectary of this division, and colonies of the scale were established on them. Their life-history has been followed with more or less care throughout the season, and the following brief statement of the life cycle of the insect is based upon daily observations made during the summer by Mr. Pergande.

"It has already been ascertained during the late summer and fall of 1893 that the insect is viviparous, that is, gives birth to living young, and that it does not lay eggs. We are unable to reconcile this condition of affairs with the statements just quoted from Comstock and Cooke, but it occurred to us that, as with certain of the plant-lice, there might be winter eggs, with viviparous females in summer. When winter came on, however, it was found that the insect hibernated in the nearly full grown female condition, and that these females, about the middle of May, began to give birth to living young as their ancestors did the previous fall. In no instance, therefore, have we observed the egg (unless the young still in the body of the female and enveloped in the embryonic membrane may be so called). Over-wintered females continued to give birth to living young day after day for six weeks. This condition of affairs produces, early in the season, a confusion of generations, which makes observations upon the life-history of the insect extremely difficult and only to be accomplished by isolation of individuals. It also seriously complicates the matter of remedies, since, as numbers of the larvæ are hatching every day, and as they begin to form their almost impervious scales in two or three days, a spraying operation at any given time will destroy only those larvæ which happen to be at that time less than three days old, while on the day after the spraying new larvæ will be born to take the place of those just killed.

"Observations upon isolated individuals show that the newly hatched larvæ, after crawling about for a few hours, settle down and commence at once to form a scale. The secretion is white and fibrous. In two days the insect becomes invisible, being covered by a pale, grayish-yellow shield, with a projecting nipple at the centre. This nipple is at first white in color. Twelve days after hatching, the first skin is cast. The males at this time are rather larger than the females, and have large purple eyes, while the females have lost their eyes entirely. The legs and antennæ have disappeared in both cases. Six days later the males begin to change to pupæ, while the females have not yet cast the

second skin. At this time the females are so tightly cemented to the scale that they cannot be moved without crushing. In two or three days more, or twenty to twenty-one days after hatching, the females cast their second skin, which splits around the margin of the body. At twenty-four days the males begin to issue, emerging from their scales, as a general thing at night. At thirty days the females are about full grown, and embryonic young can be seen within their bodies; and at from thirty-three to forty days the larvæ begin to make their appearance.

"These observations were made upon young which were born of over-wintered mothers late in June; but it must be remembered that similar larvæ had been hatching since the middle of May. The period of thirty-eight to forty days may be accepted as the length of time occupied by a single generation; but, while this particular generation came out in the insectary about the 1st of August, the adults of the second generation from the earliest born individuals would have made their appearance toward the end of June. Full grown females which began to give birth to the second generation of young on August 1 were kept in view. Three weeks later they were seen still to contain numerous embryos. Young larvæ were running about, while others of the same generation were in all stages of development. The male scales were fully formed, and some contained mature pupæ. The small trees upon which these insects were colonized the third week in June were almost completely covered with the scale. The larvæ evidently made no effort to crawl away from the tree, and none, in fact, reached the rim of the flower pot. The greatest distance away from the tree at which larvæ were noticed was about two inches. Up to this time the insects had confined themselves almost entirely to the branches, and the leaves were still quite free. The first males of the second generation were noticed on August 27. By September 7, or five weeks and a half after the adult females of the first brood began to give birth to young, some of them were still living and giving birth to occasional young. The majority of them, however, were dead or nearly exhausted, while their first larvæ were almost ready to reproduce. Five days later a few of them were still giving birth to an occasional young, while their offspring were also rapidly reproducing.

"At the rate of development observed, between May 15 and October 15 four generations from the over-wintered females developed. The larvæ continued to issue until after the first frost in October, at Washington, and on October 24, at Lewisburg, Pa., the writer saw recently-settled larvæ of not more than five days of age.

"There seem to be five generations in the latitude of Washington. Owing to the method of reproduction, these generations immediately become inextricably confused, and the insect after the middle of June may be found at any time in almost any condition. The females which over-winter have, in the great majority of cases, reached a sufficient degree of maturity to have become impregnated by late issuing males. It seems probable that the male rarely hibernates in any stage, although we received on April 3, from Charlottesville, Va., twigs which carried a few male scales containing males in the pupa state. These probably hibernated as full grown male larvæ. Whether unfertilized females over-winter we are not certain; if they do, these occasional over-wintering males will fertilize them.

"The San José scale differs from all others in the peculiar reddening effect which it produces upon the skin of the fruit and of tender twigs. This very characteristic feature of the insect's work renders it easy to distinguish. Around the margin of each female scale is a circular band of this reddish discoloration, and the cambium layer of a young twig where the scales are massed together frequently becomes deep red or purplish. Small spots on fruit produced by a common fungus *Entomosporium maculatum*, Lev., sometimes so closely resemble the spots made by the scale as to require close examination with a lens. When occurring in winter upon the bark of a twig in large numbers, the scales lie close together, frequently overlapping, and are at such times difficult to distinguish without a magnifying glass. The general appearance which they present is of a grayish, very slightly roughened, scurfy deposit. The rich natural reddish color of the twigs of peach and apple is quite obscured when these trees are thickly infested, and they have then every appear-

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ance of being thickly coated with lime or ashes. Even without a magnifying glass, however, their presence can be readily noted if the twig be scraped with the finger nail, when a yellowish, oily, liquid will appear, resulting from the crushing of the bodies of the insects."

The female scale is flat, almost circular in outline, dark mottled with gray color, with a small elevated spot at or near its centre which is black or yellowish; it measures about one sixteenth of an inch in diameter, but under favorable conditions may attain to the size of one-eighth of an inch. The fully developed female can only be observed by removing the scale with which it is covered at a time when she is just about to give birth to her young. She will have then lost both her legs and antennæ, being now only provided with a long delicate proboscis consisting of four thread-like bristles encased in a two jointed sheath. The body is almost transparent, and the young can be clearly distinguished within.

The male scale is black and somewhat elongated when fully formed. It is often oval in shape, smaller than the female, and more abundant. The larval skin is covered with a secretion, and its position is indicated by a single nipple-like elevation between the centre and anterior margin of the scale. The fully developed male only has wings. The body is of a light amber color with dark brownish markings, and terminates in a slender stylet as long as the body. It is, however, too minute to be of interest to any but naturalists, having to be always examined with a microscope.

Such was the pest that was, as we supposed, lurking only along the Pacific coast, with a vast width of mountain and desert lying between it and the fair lands and thrifty orchards of the Mississippi valley and beyond. We did not for a moment dream that the pest had gained a foothold along our eastern coast as well, and was each year being sent into the heart of our land, and even the entomologists were in blissful ignorance of its presence. In 1892, Professor Townsend had reported it at Las Cruces, New Mexico, but that was almost as far off and isolated as California, and we still slept on in our supposed security. Early in August, 1893, there came to the Division of Entomology at the Department of Agriculture at Washington, a small bundle of pear and peach twigs from Charlottesville, Va., the sight of which fairly raised the First Assistant Entomologist, who examined them, out of his chair, for he at once recognized the San José scale. But even yet it was thought to be only an accidental occurrence. Later investigations of another outbreak indicated that the pest had come from a prominent nursery in New Jersey, and on being inspected the insect was found to have become thoroughly established and probably had been for several years, as the trees whereby the insect had been traced to this nursery had been sent out in 1888. I shall here follow a policy that has always appeared to me to be the only just one for an entomologist to follow, and give the name of the nursery, which is that of Mr. John R. Parry, of Parry, New Jersey. This was the first intimation that this firm had of the seriousness of a pest that they failed to recognize, though on referring to their books they found that in 1887 they had ordered from John Rock, of San José, California, a quantity of Kelsey's Japan plum trees, and that these trees had been shipped by Mr. Rock's order from the nursery of the Stark Brothers, of Louisiana, Missouri.*

*Mr. Stark, of this firm, made the following explanation at the close of the reading of the paper:—

As Prof. Webster mentions our name, we wish to state the circumstances in full as we now recall them: In 1885, we had the pleasure of visiting the nursery of John Rock, at San José, California. Mr. Rock is well known as one of the principal California nurserymen, and it is needless to say that the visit was interesting, and instructive as well. Among other things particularly noted, was his method of treating trees before shipment to destroy the San José scale. This method he supposed to be entirely effective, and, remembering this, in the spring of '87, the Kelsey plum being then a scarce novelty, we ordered a lot of first-class Kelsey plum trees from Mr. Rock; but as a good many of us have learned "first-class" trees on the Pacific coast mean a very different thing from first-class trees in the east. On the coast, it seems they sometimes go into rows of one year trees and dig about everything clean that is thrifty and two or three feet in height, or even less; so when the trees arrived and the lid was removed from the box, showing one year trees running from about eighteen inches in height upwards, it was apparent we could not accept nor use the grade and we so wired Mr. Rock, who wired in reply to express them to the New Jersey parties, and the trees accordingly were immediately expressed to Messrs. Parry and to J. T. Lovett, thus quickly removing every one of these Kelsey trees from our grounds—a most fortunate circumstance for us, as it has since appeared.

The Parry people were as much astounded at the revelation as were the Government Entomologists, and promptly destroyed over \$1,000 worth of stock, and as promptly stopped shipping anything from their nursery, buying from localities that are even now beyond the area of infection, the trees whereby to fill their orders. From this time on this firm has followed this policy and bent their whole efforts on stamping out the pest on their premises, sparing no expense in the accomplishment of their purpose. I cannot myself find words to express my own commendation of the course of this firm, and I do not believe that the American people will overlook or underestimate the public spirited acts of the Messrs. Parry. Had all of those who are engaged in your vocation, and were similarly unfortunate, followed this course, the entomologist and the agricultural press might have been spared the unenviable task of exposing their disgrace. The introduction of the San José scale from California was a sad piece of carelessness on the part of at least four firms of nurserymen, as either one, had they applied to the Department of Agriculture, might have learned and avoided the danger, as the Division of Entomology had, at the time the introduction took place, two of its special field agents in California, and would most certainly have pointed out the danger had an opportunity been presented. Up to the time that the proprietors were notified of the presence of the pest, then, carelessness only can be charged against them, and they should be judged according to their acts since that time. The Parry Brothers, when the pest was found established on their premises, asked that the fact be withheld from publication, as it would otherwise ruin their business. Considering the efforts being made by them, it was certainly no more than just to give them an opportunity to show what they could and would do, and as we yet have no reason to suspect that they have betrayed the confidence placed in them by the Government and State Entomologists, and, besides, they have willingly furnished entomologists with a list of purchasers who were liable to have received the pest with trees sold from their nursery, prior to this discovery of its presence among their nursery stock. What more could they have done to undo the wrong, or prevent its continuation?

Soon after the foregoing outbreaks of this pest had been investigated, another badly infested nursery was located in New Jersey, that of the Lovett Company, at Little Silver, and which, as we now know, was infested in precisely the same way and at the same time as the first. This nursery was known to be infested as early as September, 1894, when it was visited by the entomologist of the Experiment Station of that State, and the fact pointed out to the officers of the company, who promised to destroy and disinfect their trees before sending them out to their customers. The New Jersey entomologist took upon himself the responsibility of stating in public print that these precautions were being taken, and that everything possible was being done by the company, whose name he did not give, probably supposing that he was dealing with men who would readily see that their own interest would lead to such a course, and was not as active in holding them to their promise as he would have been justified in doing. It was late in December—over three months later—that I received twigs of apple infested by this scale from Clermont county, Ohio, and on promptly visiting the orchard found some twenty-five trees literally covered with the pest, and three times as many more infested to a large degree, but all in such a condition that sixty of them have since been dug up and burned. These trees had been purchased from the Lovett Company and planted out in spring of 1890. In a note given to the daily press on the discovery of this serious outbreak, I stated the fact that the trees had been purchased from this firm, but did not accuse them of having, at that time, the scale among their trees, though the fact was not unknown to me. Promptly on the appearance of my note came a letter to the Director of the Ohio Experiment Station, which ran as follows:

LITTLE SILVER, N.J., December 28, 1894.

Director Experiment Station, Columbus, Ohio:

DEAR SIR,—One of our customers has sent us a clipping from a Columbus paper, in which is stated that trees owned by one Mr. Nicolis have been found infested with the San José scale. You will please give us all the information you can in regard to this matter. We would like very much, indeed, to have some branches from the trees referred to for examination ourselves. We have made a critical examination of our trees here in the nursery and also fruiting trees, using the microscope, and can find no trace whatever upon any of them of the San José or other scale. Having read reports upon the San José scale, we are confident that we could detect this insect if it existed upon our trees.

Yours truly,

(Signed)

THE LOVETT COMPANY.

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Now here was a serious state of affairs indeed. An official entomologist, whom I had known for years, had given the information, and here was a firm assuming their innocence, and being compelled to go over a whole nursery with a microscope, in fruitless search after the San José scale. Gentlemen, did any of you ever attempt to go over a tree with a microscope? And do you remember how much time it required to accomplish the task; how tiresome it was and how weary you were long before you had finished? Yet here were men compelled to go over a whole nursery, because of an unjust accusation. I promptly sent a copy of the letter of the Lovett people to the New Jersey Experiment Station and asked them to explain the matter. They were able to explain everything except the conduct of the firm, but at that were as much astounded as I was, and again reiterated the statement in regard to the examination with the President and Secretary of the company the preceding September. A month later, in February of the present year, Dr. Lintner, State Entomologist of New York, asked them to furnish a list of their sales in his State—such as had been freely and gladly done by the Parry Brothers—explaining at the time its character and the value it would possess in undoing the wrong that they had unintentionally done. After much delay and dickering, the Entomologist of the New Jersey Station received the following modest proposition: "If he (Prof. Lintner) will send us, or you either, a remittance of \$250, we will attempt to make the examination desired. But we want a clear understanding before we begin as to the settlement of cost of sending the list he requires." I need hardly say that the money was never sent for there is little doubt but that the list would have been as "scaley" as their trees. Public indignation, however, had been rapidly increasing, and on February 22nd, the Entomologist of the Experiment Station accompanied by a member of the editorial staff of the Rural New Yorker, paid this nursery a visit of investigation, and found that while some more or less effective means had been employed to destroy the scale, there was ample evidence of a carelessness that in many countries would have been considered criminal and cost the firm their plant, if, indeed, imprisonment were not added. I can only repeat here what I said of the action of the first-mentioned firm: it will be a long time before the people will forget these things, and all statements of the Lovett Company will be taken on probation, which probation will, if I mistake not, be a protracted one.

Even while the foregoing developments were proceeding, we became aware that there was another locality of distribution of this pest; viz, Long Island, N.Y.; and it was toward this part of his State that Dr. J. A. Lintner, State Entomologist, turned his attention, with the hope of protecting his people from having the scale distributed among their orchards and farms by Long Island nurserymen.

Dr. Lintner was only faithfully carrying out the duties of his office, and went about doing that duty in a moderate, conscientious manner, that ought to have received the unqualified support of every fruit grower and nurseryman in his State. But he soon found that he had the same diversity of character to deal with as had been revealed in New Jersey. Of the nine nurseries located on the island, but three were found to have become infested, and these, as given in a recent bulletin from the New York State Museum (Vol. 3, No. 13) are owned and operated by Fred. Boulon, S. a. Oliff; Keene & Foulk, Bloodgood Nursery, Flushing; and Parsons & Son, also of Flushing. The first named, though moving in a somewhat dilatory way, finally destroyed his worst infested trees and sprayed so that it is hoped that no infested stock will be distributed. Of the actions taken by the second named firm, Dr. Lintner, in his bulletin above referred to, speaks in terms of highest praise. As soon as this firm learned of the presence of the scale on their premises they promptly burned the worst infested trees and sprayed the remainder, besides asking for instructions and directions in regard to methods of suppression, they have promptly carried out every one of these, making every effort possible to protect their customers, offering on request to replace at half price all trees sold from their nursery, during previous years, that were found infested by the San José scale. There seems to be no reason why this firm should not continue to enjoy the confidence and patronage of the public. The last firm mentioned, Messrs Parsons & Sons, chose an opposite course, and I may add, deserve opposite treatment. From the first,

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this firm paid no attention whatever to the evil, when it was pointed out to them, and when asked to disinfect their stock before shipping it to their customers, stated that they would if they had time; and, later, said they did not have time. There is very strong evidence in the hands of entomologists going to show that this firm made both their last fall and spring shipments, knowing that they were unloading their scale infested trees on the public and scattering this pest, the serious nature of which they could not help knowing, far and wide over the country. Failing in every attempt to secure satisfactory replies to his communications, or even a list of the patrons who were likely to suffer from their impositions, and after your humble servant had pointed out to him that he was only being imposed upon and his moderation toward this firm only being used to further their scheme of unloading their infested trees on the unsuspecting public, that he was forced to call upon the "Rural New Yorker" to expose them. In the issue of that publication for May 4, 1895, the editors, after exposing the Parsons Company, say that the Company made a plea of ignorance of the serious nature of the pest, and supposed it was only one of the many scales that they had known for the last fifty years. No wonder that the "Rural New Yorker" people were boiling over with indignation over a course that was alike unprincipled and un-American, and ask why it was necessary for them to come forward and make business men attend to their duty, telling the company that it was no excuse at all for them to plead ignorance of the dangerous character of the pest and neglect the repeated warnings that have been given. To plead ignorance was a direct insult to State Entomologist Lintner, who had again and again warned them of it and urged them to take immediate steps to prevent distributing it all over the country. These people now, after being publicly exposed, promise to do all in their power to prevent sending out infested stock, and if the public deal with them as they deserve, it will be some time before they will distribute their trees at all, for who will expect them to keep any promise after such evasions as they have attempted? If the entomologists and the press are not again called upon to expose them a second time, it will be a pleasant surprise.

Now, gentlemen, I have criticised harshly, but I sincerely believe not unjustly. I have exposed these people before you, not in order to taunt you with the disgrace of some who follow your calling, but because they threaten interests of yours that I am employed to protect. It is my business and duty to do so. You do not need to deal with these people yourselves to suffer contamination. Let me explain, and this I will do by illustration. Last winter a man came to me in high dudgeon and wanted me to show up a prominent firm of nurserymen in Ohio. He said that he had gone to them in the fall to buy trees. He did not appear to care much what the trees were so long as they were fruit trees and cheap. He said that he had gone to this nursery and found what he thought would answer his purpose, provided the price was right. The trees were poor and expected the price to correspond, "but do you believe," he said, "them galoots wouldn't sell me them trees at any price and said they were going to burn them up, I suppose just to make me pay a big price for others. But I won't do it. I'll buy where I can get what I want and at a reasonable price of eastern nurseries." Now, we all know what sort of a fruit grower such a man would make. One of the sort that sets out his trees and then lets the pigs, cattle, sheep and horses take care of them, and who, if he were to buy scale-infested trees would not find it out until the whole neighborhood was endangered. Suppose such a man buys scale-infested trees and plants them out in your neighborhood, thereby threatening your business, what will you do about it? If he furnishes scale enough to destroy a thousand dollars worth of your stock and ruin your trade for several years, you cannot help yourselves, in the present condition of our laws. You cannot reach the man who sold the trees, and to destroy them on your neighbor's premises without his permission, is to criminate yourself. I have no fears of the pushing, up-to-date fruit grower or the honorable nurseryman, for if they have the misfortune to get this pest, they will stamp it out without compulsion. But I am afraid of the nurseryman who will knowingly or carelessly distribute this pest to careless or indifferent purchasers; and this is precisely where we entomologists are

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It seems well in every to send their responsible fo other than tl legal protecti from insect (shipments.] peddler, and an objection, from these pe your own acc nurseryman w and fungicide him well for tl scab begins to is true to some duce a greater your land and problem of dis little or no rea the suggestion, nursery is four of his more for This will also d obliged to, mys right to give a customers, but occurrence of su nection with su obliged to follow against areas in the most deserv State and liable stop all shipmen This is the rank a recurrence of of the San José sey and Long Is help, simply bees our people. I ha some action not named, but indic the same time the so far as we kno with other countr for transporting y It is now possible Europe or Asia, a country. Destru

expected to protect you. In order to protect the people of Ohio, I have felt from the start that it was necessary to first prevent this pest being continually shipped in from infested nurseries, and then use every means to find out infested localities and stamp it out. This is the only way that I can protect the people of my State, both nurserymen and fruit-growers. What is true of Ohio is true in other States, and of other entomologists.

It seems to me that what we need is a United States law, that shall apply equally well in every State in the Union, that will enable those nurserymen who wish to do so, to send their authorized agents into any State to do business, each firm being thus responsible for the acts of their agents. If nurseries desire to sell stock in States other than their own, or the people desire to purchase such stock, they should have legal protection. Then let every nurseryman be obliged to warrant his stock free from insect or fungus pests before transportation companies can accept the same for shipments. This will do away both with the disreputable nurseryman and the tree-peddler, and place your business in the hands of honorable men. You may think it an objection, and possibly a hardship to thus be obliged to guarantee your stock free from these pests, but I fully believe it is precisely what you are coming to and of your own accord. I am fully convinced that within the next ten years every reputable nurseryman will spray his nursery stock several times each year with both insecticides and fungicides, not because he is obliged by law to do so, but because it will pay him well for the extra time and expense. We are beginning to learn that the apple scab begins to weaken the vitality of a tree from the first year onward, and the same is true to some extent with insect pests, that by spraying the nursery rows you can produce a greater number of first class trees to the acre, and so derive a larger profit from your land and the labor bestowed upon it. Now, this is only a suggestion whereby this problem of distributing such pests as the one under consideration can be prevented, at little or no real expense, and those more competent than myself can no doubt improve on the suggestion, and you will readily see that when another case like this comes up, and a nursery is found to be infested the owner has only to purchase his stock for a year or so of his more fortunate neighbor, until he can cleanse his premises and use his product. This will also do away with an injustice that I have seen all along, and, in fact, been obliged to, myself, make use of. I stated at the beginning of this paper that it was but right to give a reputable firm time in which to show what they would do to protect their customers, but it is a rank injustice to others of his profession to publish the fact of the occurrence of such a pest as this in a certain locality or State, and not give names in connection with such information. I am bitterly opposed to the policy that I have been obliged to follow during the last year, knowing, as everyone must, that to quarantine against areas instead of individuals, must work an injustice upon the very ones that are the most deserving of justice. When the word goes forth that this pest is in a certain State and liable to be distributed from it to others, the only protection for the others is to stop all shipments from the whole State, when there may be but a single nursery infested. This is the rankest kind of injustice, and I hope some measures will be devised to prevent a recurrence of such a condition of affairs as we have had with regard to the suppression of the San José scale. I have been obliged to warn the people of Ohio against New Jersey and Long Island, when I knew it was a wrong to the very men that I was trying to help, simply because I could not get the names of the guilty ones, and indicate them to our people. I hope, gentlemen, before you adjourn from your deliberations, you will take some action not only denouncing the course taken by the two nursery firms that I have named, but indicating some policy whereby this problem can be met in a judicious and at the same time thoroughly efficient manner. The San José scale is the latest importation, so far as we know, but it is not at all likely to be the last. Our commercial relations with other countries are not only increasing rapidly and broadening, but the time required for transporting your goods from place to place has been diminishing much more rapidly. It is now possible to remove plants from their native homes in Australia, South Africa, Europe or Asia, and in the short space of a month's time scatter them over the whole country. Destructive insects may thus go into their dormant stage in one country and

emerge in another without having been disturbed or discommoded, something that would have been impossible twenty-five years ago. With such strides, such progress in these factors in your business, it will be absolutely necessary for you to bring your business methods up to date, and change to meet your changed conditions. By necessity, you are foremost in the diffusion of these pests of your trees and plants, and it would appear to naturally follow that you should be foremost in taking steps to prevent this diffusion—should lead instead of follow—and I hope you may begin to recognize the situation, and with past experience to guide you, look into the future and prepare to meet these emergencies and overcome them.

Returning for a moment to the San José scale, before closing, I will say that the insect does not appear to spread rapidly, at least not at the start, and is not so difficult to overcome, if given prompt and careful attention. At present it would seem as though it might be wholly eradicated from the orchard or nursery within a year after being discovered. Whale-oil soap, one pound to each gallon of water, makes a wash that is most fatal in its effects, when applied during autumn and again just before the buds start in the spring, followed by a similar treatment in autumn. The use of hydro-cyanic acid gas is thoroughly effective, and though rather expensive to use in an orchard, is not so much so where trees can be treated in bundles. Full instructions for using this may be had on application to the United States Department of Agriculture at Washington. It is true that this scale is now established at several points in most of the States east of the Mississippi river, but I am satisfied that all such can be stamped out, provided proper attention is given the matter now while it is yet confined to the orchards into which it was originally introduced. For the present this is the only protection that the nurseryman and orchardist have against this pest, or rather, I might say, against a disreputable fellow of his calling, or a shiftless neighbor; and I would caution you all to keep close watch of orchards in your respective neighborhoods, especially such as have been planted out within the last five years with other than home-grown trees. I find that in some quarters there is a disinclination to let the matter of infection become known. So far as the farmer and orchardist is concerned this is folly, as to have acquired this pest is no disgrace, but a misfortune, and I find that the statement that it has been discovered in a certain locality and promptly eradicated, is an incentive for others to look more closely to their trees and, in case the scale is found, follow the example of their neighbors.

In closing, I wish to call the attention of nurserymen to the fact that the entomologist is working for their interests, both in the matter of protecting them from getting such pests established in their nurseries, and aiding them to get rid of them in case they have been unfortunate enough to have done this. To prevent sending out infested trees from any nursery is a part of the duty of an entomologist, however disagreeable it may be to do so. So long as men are human, it will be necessary to resort to disagreeable methods of preventing them from wronging each other, and the best that can be done is to deal with strict justice toward all.

At the conclusion of Prof. Webster's paper, the following appreciative motion was put to the meeting and carried unanimously:

Col. WATROUS: "I think that the paper that comes out and deals with our interests as fairly and as wisely and intelligently as this one deserves a vote of thanks, and I move that a vote of thanks of this Association be tendered Prof. Webster for his paper and that we approve his course."

The CHAIR: If any of you have any questions to ask of Prof. Webster, he will be happy to answer them; or if any of you have any statements to make we shall be glad to hear them. It is certainly the most interesting subject that could come up in a convention, for it is a matter of dollars and cents for us.

Col. WATROUS asked what would be the proper course to pursue should a nurseryman be so unfortunate as to receive a bundle of trees from another nurseryman which were found to be infested by this pernicious insect.

Prof. WEBSTER: Send them back to the original nursery.

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Col. WATROUS inquired further if there were any way by which the insects could be killed on imported stock so that it would be safe to plant the trees and propagate from them. I want to know if it is absolutely necessary that they be burned or reshipped.

Prof. WEBSTER: They could be disinfected by using hydrocyanic acid gas, the management of which you can get by applying to the Department of Agriculture at Washington. It is a very expensive treatment.* One receiving infested stock, if he did not send them back, could hold the trees at the order of the shipper. I do not see that the nurseryman should be called upon to take them at all or to take the responsibility and expense of disinfecting them.

Mr. JEWETT asked what had been done in California. I have heard that they have exterminated it in some localities.

Prof. WEBSTER: They have practically exterminated it in some localities; but they seem to have handled it very carelessly, and it may be said to cover the whole state more or less. They have used the lime, salt and sulphur wash. This has not been fully effective, and further than that we have found in the East that a treatment of great value in California is not so here. They have a resin wash there which it is claimed is fatal. With us it will not kill twenty-five per cent.

A MEMBER asked if there was danger of the San José Scale spreading rapidly unless infested trees were taken up.

Prof. WEBSTER: It is not the travelling of the insect itself, the spread in that way is not rapid; but it may be carried by the wind or by the young insects crawling on to birds which frequent the trees and being by them carried to other trees—so that it is dangerous to have it anywhere. It does not spread very rapidly, and if carefully sprayed it can be controlled and even stamped out. There are four or five places where I know it has been stamped out in Ohio. I would take up and burn any very badly infested trees.

A MEMBER: Could the Scale be carried from California on fruit shipped to us.

Prof. WEBSTER: Yes, it is carried all over the East; but how great the danger may be I do not know. The greater part of the fruit is consumed in towns and cities, and unless the infested fruit is thrown down so close to the trees that the young insects can make their way from the waste peeling to the tree, then there is no danger. I do not look upon this as a serious feature of the case, although it would be well to watch it.

LEPIDOPTEROUS PESTS OF THE MEADOW AND THE LAWN.

BY THE REV. THOMAS W. FYLES, F.L.S., SOUTH QUEBEC.

I very much doubt whether I shall ever see again what was no uncommon sight on the older farms in the "flats" and "intervalles" of Brome, Shefford and Missisquoi counties thirty years ago, viz:—a field of Herd's grass (*Phleum pratense*, L.), clean and tall, unspoked with Ox-eye (*Leucanthemum vulgare*, Lam.), Cone-flower (*Rudbeckia hirta*, L.), and Charlock (*Sinapis arvensis*, L.).

I perfectly remember the first appearance of the Ox-eye daisy in Brome. A hot, dry season or two had made a scarcity of fodder, and men had gone down to the "French country" around St. Cesaire, St. Pie and St. Marie to buy hay. In the spring, a year or two years afterwards, an old-country farmer, Mr. Terence Courtney, of Iron Hill, pointed out to me, here and there by the wayside, along the line of travel, tufts of "the daisy" which had no doubt grown from seeds shaken from the loads brought in from the low country. He cut up those on his own farm, but his neighbors were not so careful, and now, in hay time, all the meadows round are white with the troublesome weed.

* NOTE.—It has since been discovered that this treatment is not effective against the San José Scale unless applied for a longer time than can safely be done without injuring the trees treated. Dr. Howard, in a recent publication, "Some Scale Insects of the Orchard," says: "With the San José Scale the most satisfactory work can be done only with a winter wash." . . . "Up to the present writing, but one absolutely satisfactory winter wash against this insect in this locality has been found. This is whale-oil soap, a pound and a half or two pounds to the gallon of water."—J. Fletcher.

In those days there was much clearing of land on the hillsides and burning of brush heaps and log-piles, and the frequent fires and eddying smoke kept down the numbers of the insect pests of the meadow and the lawn.

The arable land, on which hardwood timber had formerly grown and which was free from stumps, was, in many districts, comparatively of small extent and was well worked. On the newly burnt land Indian corn, turnips and potatoes were grown for a season or two, and then Herd's grass seed was freely scattered to convert it into pasture.

In the neighborhood of South Quebec we have at the present day much slovenly farming. Last June I noticed a meadow in which the grass stood tall and rank and uniform, but it was a meadow of Couch (*Triticum repens*, L.). A meadow golden with that very handsome but most objectionable plant, the Hawkweed (*Hieracium Canadense*, Michx.), or blue with the Succory (*Cichorium intybus*, L.) is often seen. A really good meadow of Herd's grass or clover is not common, and what an Englishman would call a fine lawn is hardly to be found in the province. The moist, salt air of the old country seems to be necessary to bring a lawn into perfect condition. It is not my present purpose to tell of the agricultural remedies for this state of things. I have alluded to it because I wish to say that good tillage has a decided tendency to keep down the numbers of pernicious insects, and that in a well-considered and worked out succession of crops the meadow is likely to thrive. Fall plowing will expose many grubs and pupæ to the attacks of birds and the action of the frost; and cross-ploughing in the spring will give the birds further opportunities that they will be sure to profit by. The occasional removal of rail fences and the rooting out of the growth that springs up about them, will destroy the harborage of numerous foes; and frequent mowing and the free use of the roller will not only beautify the lawn but crush out of existence many of its insect spoilers.

Of the Lepidoptera certain groups are especially *graminivorous*. They belong to the *Satyrinæ* and the *Hesperidæ* in the *Rhopalocera*; the *Ctenuchidæ*, the *Arctiidæ*, and the *Noctuidæ* in the *Heterocera*; and the *Crambidæ* in the *Pyralidina*.

SATYRINÆ

The Quebec Satyrinæ are:—*Debis Portlandia*, Fabr., *Neonympha Cantius*, Bd.-Lec., *Neonympha Eurytris*, Fabr., *Satyrus Nephela*, Kirby, *Chionobas Jutta*, Hübner.

The most common of them is *Satyrus Nephela*, Kirby, "The dull-eyed Grayling." It appears in July, and frequents the open fields and the borders of woods and copses. Around Montreal it is abundant, in its season, on thistle heads, in neglected spots.

It is brown, with a broad paler brown band near the outer edge of the fore-wings. In this band are two conspicuous eye-like spots. These consist of a bluish white central spot, surrounded by a black circle and a very pale outer circle. The under side of the wings has numerous dark brown cross markings. It lays its eggs in August, and the young larvæ hibernate in the first stage.

In colour the full grown larva is yellowish green, with a dark green dorsal line and a yellow stigmatic line. It has a reddish fork at the extremity of the body.

Neonympha Canthus (Fig. 85) is smaller than *Nephela*, and is of a light sandy brown.

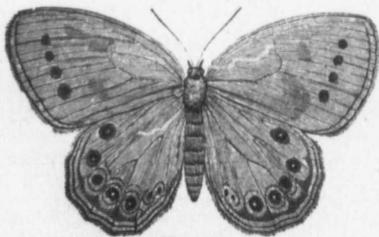


FIG. 85.

Its spots are more numerous, and each spot on the under side of the hind wings has two pale rings around the black one. NOTE.—*At the anal angle there are twin spots close together and thus encircled.* *Canthus* frequents upland meadows, and appears in July. The female lays her eggs in the end of that month.

The larva is green, with darker green and yellow longitudinal lines, and it has cephalic and terminal horns. It hibernates in the last stage of its growth.

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HESPERIDÆ.

They belong to the genus *Pamphila* in the Hesperidæ, and are commonly called "Skippers (Fig. 86). The most common of the Quebec species are:—*Pamphila Hobomok*, Harris; *P. Manitoba*, Scudder; *P. Peckius*, Kirby; *P. Mystic*, Scudder, and *P. Cernes*, Edwards. The three last may be seen in June and July scudding about the meadows in droves.



FIG. 86.

Mr. W. Saunders, of London, Ontario, succeeded in raising *P. Mystic* from the egg to the pupa, and has described the changes of the larva in the *Canadian Entomologist*, Vol. I., p. 65. The larva was full-grown in August. It was an inch long, onisciform, downy, with a dull reddish-brown head and a dull brownish-green body. It had many dots of a darker hue and a dark dorsal line. The second segment was whitish with a dark line across the upper surface.

Mr. Fletcher, of Ottawa, raised *P. Cernes* from the egg to the pupa. The eggs were laid on grass on the 10th of July, and hatched on the 23rd of that month. The larva was full grown in September. It was an inch long, of a purplish-brown color, mottled with grey and dark purplish-brown, and it was covered with fine, short, black hairs. It had a black head and a thoracic shield on a white collar. The spiracles were black.

Both *Mystic* and *Cernes* hibernate in the chrysalis.

P. Metacomet, Harris, hibernates as a larva (Fletcher, *25th Rep. Ent. Soc. Ont.*, p. 4).

P. Manitoba, Scudder, spends eight months, or two-thirds of its existence, in the egg. The young larvæ appear in April and are full grown in July. The butterflies come forth in August, and lay their eggs in the same month. For the life history of the species see *Canadian Entomologist*, Vol. XXVII., p. 346.

CTENUCHIDÆ.

Of this family two species are common at Quebec, *Scopsis fulvicollis*, Hubner, and *Ctenucha virginica*.

The imago of *S. fulvicollis* appears in the beginning of June. Its expanse of wings is about an inch and two-tenths. Its head and body are of a deep velvety purple. The antennæ are pectinated in the male, and dentated in the female. The striking feature in the insect is the broad yellow collar from which it derives its specific name. The forewings are of a somewhat bronzy black with the costa obscurely yellow. The secondaries are semi-transparent with black veins, and with the inner and hind margins clouded with purplish black.

The full-grown larva of this species is one inch long. Its head is glossy yellow, and its body is slate colored, striped with green, pink and pale yellow, and it has a number of small warts set with white hairs. At the end of July or the beginning of August it spins its cocoon.

Ctenucha virginica, in general appearance, resembles *Fulvicollis*, but it is a larger insect; its expanse of wings is an inch and a half. The secondaries are of a deep blue-black, with whitish edges.

The larva of this species, when full-grown, forms a cocoon of the spinulated hairs from its body; it plucks them out and arranges them, and they adhere firmly in the required shape. (*Packard's Guide*, p. 239.)

ARCTIIDÆ.

The Arctic larvæ that have been found injurious to the meadows are chiefly those of *Pyrharrctia Isabella*, Smith and Abbott, and *Leucarctia acraea*, Drury; both are well

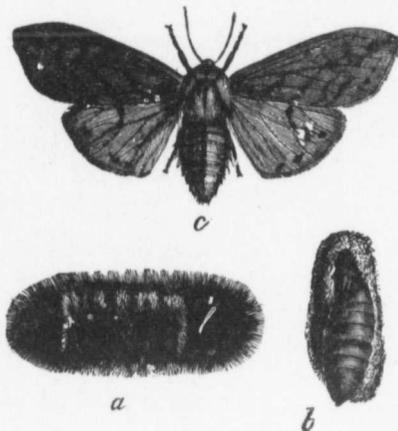


Fig. 87.

known. The former is that brush-like caterpillar, Fig. 87 a, black at the ends and chestnut red in the middle, that so often is found under boards and in out-buildings late in the fall and in the early spring. When disturbed, it rolls itself up hedge-hog fashion. It forms its cocoon, Fig. 87 b, in May, and the perfect insect, Fig. 87 c, appears in June. This last is two inches and a quarter in expanse of wings. Its colour is yellow, with indistinct wavy lines on the primaries and with dark brown spots on all the wings, and also on the abdomen. The secondaries are sometimes tinged with red.

The larva of *L. acraea* is the "salt-marsh caterpillar," the ravages of which have been so well described by Harris in his *Insects Injurious to Vegetation*, pp. 351-355. It is about an inch and three-quarters in length and is clothed with long hairs, which are dark brown on the back

and lighter brown on the sides. Its spiracles are white. This caterpillar appears in June and attains its growth in the end of August, when it spins its cocoon. Of late years the numbers of the "Woolly Bears," as they are commonly called, have been greatly reduced by a fungus which spreads among them and destroys their vitality.

NOCTUIDÆ.

The Noctuids are the night-flying or owl moths. Their name is derived from the Latin *Noctua*, an owl. These moths, on warm, moist evenings, often beat at the windows of our country houses, attracted by the light. In dress they are a sober "people"—browns and drabs prevail amongst them. But innocent as they are in appearance, they, through their larvæ, work incalculable harm. Amongst these larvæ are the various species commonly classed as "cut-worms." Amongst them, too, is the dreaded "army worm."

Of the cut-worms, one that has been particularly marked as injurious to the hay crop is *Peridroma saucia*, Hübner. Of this there are two broods in the year (*Lintner's 5th Report*, p. 64). The eggs of the first hatch in the beginning of May, and the larvæ attain their growth in the beginning of June. The full grown caterpillar is about an inch and a half long. It is of a dirty greyish brown, with spots and markings of yellow and dark brown. The moth leaves the chrysalis in about twenty days, *i. e.*, in the end of June. It is an insect of considerable size, the wings expanding about an inch and three-quarters. Its colour is brownish or ochreous grey, clouded and spotted with brown and with stigmata outlined with brown. The second brood appears in the fall.

Nothing in the vegetable line seems to come amiss to the caterpillars of this species. In the meadows they strip the clover and cut off the heads of the timothy; and even the roots of the grasses are devoured by them.

The larva of *Noctua fennica*, Tausch, is another of the grass eating cut-worms. When full-grown it is about an inch and a quarter long. In colour it is velvety black, with two irregular and broken yellowish stripes on each side. Its head is brown, with a black stripe down the front, and it has a black, horny shield on the second segment. In May, 1884, Mr. Fletcher found it exceedingly destructive in meadows around Ottawa; and in the same year it abounded in the meadows of Michigan to such an extent that, to use the words of Professor Cook, of the Agricultural College of that State: "There were meadows through which one could not walk without crushing from a dozen to a hundred at each step."

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Figure represents the ear of wheat

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L. unipuncta

The moth is not quite as large as *P. saucia*. Its head and thorax are dark brown; the fore-wings are dark brownish grey, with a purple blush; the stigmata are clay-yellow. The renal stigma often takes the form of the letter R; near the hind margin are two small, angulated, black marks.

Another very mischievous insect of the kind we are considering is the "glassy cut-worm," *Hadena devastatrix*, Brace. It bites away the roots in the sod till the grass comes off in patches. I have seen considerable spots in the pastures and meadows of Brome laid bare by this pest.

The eggs of the species hatch early in May; and the larvæ attain their growth in about four weeks. They are glossy green in colour, with the head red, and the thoracic shield dark brown.

The moth has dark ash-grey fore-wings, with several white lines across them and some angulated black spots near the hind margin. The stigmata are black, outlined with white.

These cut-worms have been very destructive to meadows in the past, and may be again; and it is possible that other species may become so.

Another group of the noctuidæ injurious to meadows belongs to the genus *Leucania*. A very common species in the group is *Leucania pallens*, Linn., the "Wainscot moth." It may be known by its sandy fore-wings finely lined with a little darker colour, and by the three tiny black dots arranged in a triangle beyond the middle of the wing. It has white satiny hind-wings with a few brown streaks.

Leucania Henrici, Grote has dull white fore-wings with pale brown streaks. It has no black dots, and the hind-wings are clear satiny white.

Leucania commoides, Gn. is a much darker species, and may be known by the white line in the middle of the fore-wing thrown out by dark brown on either side, and branching into white lines with dark brown streaks between them. The hind-wings are dark with dark brown veins.

Leucania albilinea, Hubner is the smallest of the Canadian species known to me. It is not so dark as *commoides*, and the white central streak is branchless. This streak is

thrown out by a brown one on the inner side, and, on the outer, by another which widens as it approaches the hind margin where it spreads on both sides. There is also a paler brown stripe along the costa. The secondaries are clouded towards the hind margins and have brown veins. Fig. 89 represents the eggs much magnified, and the caterpillars on an ear of wheat.

The two largest of our Quebec Leucanians are *L. unipuncta* Harv. (the Army-worm moth), and *L. pseudargyria* Guen. They somewhat resemble each other, but *Unipuncta* is of a pale reddish brown, or russet hue. *Pseudargyria* is of the tint known in the old country as "whity-brown." Moreover *Unipuncta* has a small but conspicuous milk-white dot in the middle of the fore-wing—hence its name. In place of it *Pseudargyria* has a pale circle, sometimes imperfect, enclosing a black dot.

When I went to live in Montreal in 1861, ("the Army-worm year"), I noticed, on the Cote-des-Neiges' road, on the wall enclosing the "Priests' Farm," a broad black line, about two feet from the ground, extending the whole length of the wall. I found it was of tar; and, on enquiring as to its purpose, I was told that it was intended to stop the Army-worm in its march from the mountain.

L. unipuncta the One-spotted Leucanian lays its small,



Fig. 88.



Fig. 89.

round, white eggs at the base of the stems and within the folds of the blades of grass. They hatch in eight or ten days, making their appearance in May. In a month the larva is full grown. It is dull black lined with white, yellow, and pink. It buries itself, forms a cyst, and then turns to a mahogany brown chrysalis. The moth appears in about a fortnight.

The Army-worm in its strength is indeed a formidable foe—"The land is as the garden of Eden before it, but behind it a desolate wilderness." A correspondent of the *American Entomologist* told of the creatures coming down upon his lands in a phalanx half-a-mile wide.

Happily for the farmer there are two powerful natural checks to the increase of these troublesome pests; and often when he is at his wit's end they are most effective in his service. One is a fungus which spreads from larva to larva and speedily paralyzes and consumes them: the other is the Red-tailed Tachina fly, *Nemoræa leucanice*, Kirkpatrick, which lays its eggs upon the living larva in parts where it cannot dislodge them. The maggots that burst from the eggs destroy their victims by thousands.

CRAMBIDÆ.

A very elegant, but very mischievous group of moths are the Crambidæ or "Grass moths," of which we have many species. Their larvæ form silken tunnels at the roots of grasses and work unseen. Their retiring habits make it difficult to follow them in their career; and but little is known of the life histories of most of the species. Dr. Lintner has given us a good account of *C. vulgivagellus*: and other writers have afforded us glimpses of a few of the rest. In the dearth of information the following particulars concerning *C. Girardellus* may be of interest.

NOTES ON CRAMBUS GIRARDELLUS.

Eggs.—Laid dispersedly, pale yellow, melon-shaped, ribbed and cross-lined; hatched the first week in August.

Young larva.—One-twentieth of an inch long; head and second segment dark brown, rest of body amber coloured; formed dirty silken tunnels at the roots of the grass; moulted August 20th.

Larva after first moult.—Length, one-sixth of an inch; head and horny plate on second segment dark brown, polished; body pale amber beautifully spotted with sienna-coloured warts, and sparingly set with bristles; moulted September 1st.

Larva after second moult.—Head of a dirty amber colour, marked with brown patches; body amber-coloured, dotted with large brown tubercles.

At this stage I lost my specimens—the frequent disturbances necessary to the observation of their habits proving destructive to them.

The following is a table of the Quebec specimens of this interesting group:

CHARACTERISTICS OF THE GROUP.

Antennæ filiform; labial palpi long and beak-like, porrected; wings in repose folded round the body; fore-wing usually oblong and, in most instances, bluntly terminated, but sometimes, as in *C. minimellus*, with a produced tip. Hind-wings ample.

Larva with sixteen legs; head and thoracic shield usually black or brown; body whitish or straw-coloured, somewhat hairy, and sometimes having glassy tubercles. It forms silken galleries at the roots of grasses.

TABLE OF SPECIES.

A.—*Fore-wings white.*

- a. Pure silvery white.
C. perlellus, Scop.
- b. Satiny white with several dark brown dots.
C. turbatellus, Walker.
- c. Satiny white with a reddish brown dot in the middle of the inner margin, and a reddish brown terminal line.
Argyria nivalis, Drury.
- d. Satiny white with an orange band across the wing.
A. auratella, Clemens.
- e. Satiny white, with a longitudinal orange stripe bordered with brown and widened into a foot near the hind margin.
C. Girardellus, Clem.
- f. White with brown patches and cross-lines.
C. elegans, Clem.

B.—*Fore-wings golden.*

- g. Golden with a silvery stripe running throughout and widened at the hind margin.
C. unistriatellus, Packard.
- h. Golden with a silvery stripe ending in a point near the sub-terminal line.
C. Leachellus, Zincken.
- i. Golden with a very broad silvery stripe ending in a point and having a conspicuous tooth on the inner side.
C. bidens, Zeller.

C.—*Fore-wings ochreous.*

- j. Brownish ochreous, with a short, broad and pointed, silvery dash followed by a silvery stroke.
C. alboclavellus, Zeller.
- k. Pale ochreous, with a silvery dash divided by a yellow streak.
C. agitatellus, Clemens.
- l. Ochreous, with two silvery parallel streaks, the second longer than the first.
C. laqueatellus, Clemens.
- m. Pale ochreous, with brown lines and an angulated silvery line bordered with brown near the hind margin.
C. hortuellus, Hübner.
- n. Pale ochreous, with fuscous longitudinal lines, and two fuscous transverse curved lines.
C. ruricoellus, Zeller.
- o. Pale brownish ochreous with brown lines and two darker brown transverse curved lines.
C. trisectus, Walker.
- p. Reddish ochreous with two wavy, somewhat indistinct cross-lines.
C. luteoellus, Clemens.
- q. Brownish ochreous with numerous brown streaks.
C. vulgivagellus, Clemens.

D.—*Fore-wings brown.*

- r. Glossy reddish brown, with a broad silvery stripe divided into three parts of diminishing length.
C. myellus, Hubner.
- s. Dark brown with white markings and black spots.
C. Labradoriensis, Christoph.

E.—*Fore-wings brownish lilac.*

- t. Brownish lilac (fugacious) with stripe and other markings white.
C. minimellus, Robs.

Note.—*A. nivalis* is taken at Sherbrooke; *A. auratella* and *C. laqueatellus*, in the Island of Montreal; *C. Labradoriensis* and *C. minimellus* at Bergerville; *C. myellus* at Levis.

The foregoing information as to the times of appearance, habits, etc., of the different species of the grass eating larvæ will have prepared the way for this declaration:

THE VERY BEST PREVENTIVE TO INJURY FROM THE LEPIDOPTEROUS PESTS OF THE MEADOW AND THE LAWN IS THE USE OF THE IRON ROLLER.

The best form of roller for field use is the toothed roller formed in sections. This should be passed over the meadows in spring when the grass begins to shoot, and, if possible, at night, for then both the hibernated and the newly-hatched larvæ will have left their retreats and be at work.

Again the roller should be used after the hay-crop has been taken from the fields, for it will then kill such larvæ and pupæ as have been shaken into the under-growth.

Of course in the use of the roller as in other things, judgment needs to be exercised. *It would not do to pass it over heavy clay-lands in wet weather.*

When an assault of the Army-worm upon standing crops is anticipated, a deep furrow should be run around the meadow. This would disconcert and entrap the foe; and a suitable log attached by a chain to a whiffle-tree should be in readiness, to draw along the trench, as often as may be necessary, for the purpose of crushing the assailants.

The use of Paris green about the meadows and pasture lands cannot—under ordinary circumstances—be recommended. It is far too dangerous.

RARE CAPTURES DURING THE SEASON OF 1896.

BY ARTHUR GIBSON, TORONTO.

It is my intention here to give the benefit, if any, of a few notes I made, and to briefly describe some of the rarer captures and observations in Lepidoptera, which have personally come under my notice during the collecting season just closed.

The present year has been a most remarkable one for the appearance and capture of interesting and rare specimens of Lepidoptera, in and about the neighborhood of Toronto. Butterflies which have never been recorded as having been taken in this part of Ontario, previous to this year, have been collected in considerable numbers during the past summer, while others which were seldom seen on the wing here have been observed and taken again and again. It is something very unusual for this locality to see so many strangers in the butterfly line, as have paid a visit to Toronto throughout last summer. Whether we shall see the same insects here again next year remains to be seen.

The very first specimen which I met with this last season proved to be a good one, and one which I was exceedingly pleased to get. While out on Saturday afternoon, the 11th April, getting some larvæ of *Arzama obliquata*, I took my first specimen of *Brephos infans*. This beautiful moth I found lying in a small pool of water, where the ice had

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melted, close to the bank leading down to the marsh. It was a perfect specimen and I presume had probably just emerged from the pupæ, and fallen into the water, where it had ended its short existence.

Argynnis Atlantis.—This butterfly was very common at the Forks of the Credit, on the 1st July, especially on the milk weed, where it could have been taken in any numbers.

Argynnis Bellona.—Appeared to be fairly common at Lorne Park. Took two specimens on the 11th July. Saw several more.

Argynnis Myrina.—To me this insect was very rare this last summer. Only saw one specimen during the whole season, and that I took in the early part of the summer.

Libythea Bachmani.—This very pretty butterfly, Fig. 90, so easily recognized by its long palpi and angled forewings is seldom met with in Canada. I had the pleasure of taking a perfect specimen at Caesarea, Lake Scugog, on the 12th August last. The only previous Canadian captures of this insect, which have been recorded up to August, of this year, have been made at Toronto, Port Stanley, London and Hamilton.



FIG. 90.

Chrysophanus Thoe—(Fig. 91 the male; Fig. 92 the female.) Although this insect has often been met with in Toronto, I have never taken it here. While

away on my holidays, I took my first specimen at Caesarea, on the 12th August. Only saw the one specimen.



FIG. 91.



FIG. 92.

Pieris Napi—Summer form *Oleracea aestiva*.—This butterfly was very common at the Forks of the Credit, on the 1st July. I could have taken any number of specimens but confined myself to about 30. I also took this insect at Caesarea, Ont., on the 12th August, where it also appeared to be fairly common. I might add that I took one specimen at Lorne Park, on the 11th July.

Meganostoma Caesonia.—(Fig. 93) As has been previously mentioned this insect

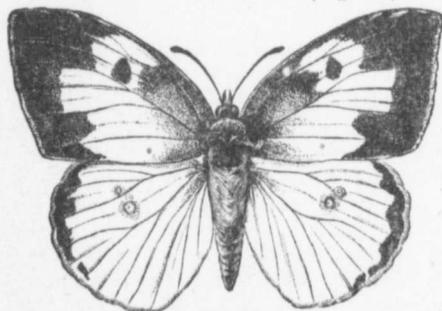


FIG. 93.

made its first appearance in this neighborhood during the past season, and was fairly common. The first time I noticed it was on the 13th June, when I took three specimens, and also observed it several times later in the same month, and on the first of July at the Forks of the Credit.

Papilio Ajax.—While strolling through High Park, on the afternoon of the 14th June, I observed, to me, the first living representative of this *Papilio* flying very slowly over some small bushes. On June 20th I succeeded in taking a worn specimen and on the 23rd of the same month saw another specimen which looked to be perfect, but as I did not have any appliances handy, did not take it. I also observed this butterfly on the 1st and 11th July.

Papilio Philenor.—(Fig. 94.) I should not like to say for sure, but I am pretty well satisfied that I saw a specimen of this butterfly in High Park, on the 20th June. Gave chase to it but to no effect. I do not know whether this *Papilio* has ever been taken in Toronto or not.

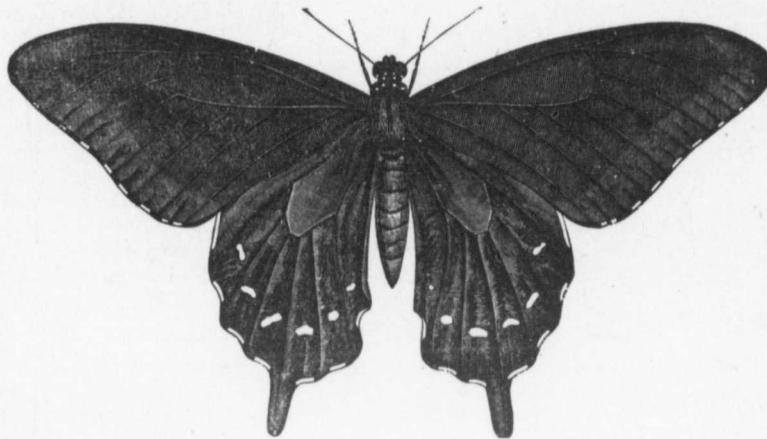


FIG. 94.

Catocala cerogama.—This was one of our commonest *Catocalas* here this year. One night alone over twenty specimens were taken. It is usually a rather uncommon moth, and of late years has not been met with very often.

Catocala ilia.—This beautiful moth was quite plentiful at "sugar" during the past season. I took my first specimen on the 20th July and also secured it several times later.

Catocala neogama.—I took one specimen of this insect on the 3rd August. This is considered to be a rather rare *Catocala* in this locality.

Catocala resecta.—The black underwings are always eagerly sought after. Several *resectas* were taken here this year. I took my first one on the 24th August.

Catocalas were unusually early this year, most of them being taken in July and August, while in other years I have always taken them towards the end of August and beginning of September.

THE BUTTERFLIES OF THE EASTERN PROVINCES OF CANADA.

BY REV. C. J. S. BETHUNE, PORT HOPE, ONT.

In our 25th Annual Report for 1894, pages 29-44, I gave a list of the Butterflies of the Eastern Provinces of Canada, so far as known to me, with localities and other observations. So many interesting records and rare captures have been made since its publication, in addition to those given in the preceding paper by Mr. Arthur Gibson, that it seems desirable to publish them here. For convenience of reference, I prefix to the name of the species the number given in the 1894 list.

1. DANAI'S ARCHIPPUS, *Fabr.*—Halifax, N. S., rare: Mr. Harry Piers (*Proc. Nova Scotia Institute of Natural Science*, vol. ix., part I., page xix.)

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2. *EUPTOIETA CLAUDIA*, *Cram.*—This rare butterfly (Fig. 95) was taken in High Park, Toronto, by Mr. Arthur Gibson, in July, 1893.

3. *ARGYNNIS CYBELE*, *Fabr.*—Taken at Sudbury (J. D. Evans); Orillia, common June 16 to August 31 (C. E. Grant). Miss Eaton mentions its capture at Truro, N. S., but Mr. Piers considers that there is some doubt about its identification. (*Proc. N. S. Institute—loc cit.*)

4. *ARGYNNIS APHRODITE*, *Fabr.*—Orillia, June 23 to August (C. E. Grant); Halifax, N. S., abundant (H. Piers).

5. *ARGYNNIS ATLANTIS*, *Edw.*—This northern species has greatly extended its range and is now recorded from Orillia, common June 4 to August (C. E. Grant); Toronto and Port Credit, June, July, and August, 1896 (C. T. Hills); London, Sarnia, and Windsor, June and July, 1895 (J. A. Moffat); Truro, N. S., very common (Miss Eaton).

8. *ARGYNNIS MYRINA*, *Cram.*—Orillia, common, two broods, June and August, C. E. Grant); Truro, N. S., (Miss Eaton); Halifax (H. Piers).

9. *ARGYNNIS CHARICLEA*, *Ochs.*—“Ranges from Labrador, Hudson Bay and Gulf of St. Lawrence on the east to probably about lat. 51° 25' on the Pacific Coast, nowhere extending into the United States.” (F. M. Webster, *Can. Ent.* xxvi. 119.)

10. *ARGYNNIS FREIJA*, *Thunb.*—“Alaska to Labrador and westward to the Rocky Mountains, which range it follows southward to Colorado, about lat. 39°.” (F. N. Webster); Calgary (Wolley Dod).

118. *ARGYNNIS IDALIA*, *Drury.*—This lovely addition to the list of Canadian Butterflies was taken at Windsor, Ontario, last year, by Mr. W. S. Gody, who kindly presented a specimen to the Society's cabinet. St. John, N. B. (H. E. Goold)

13. *MELITEA PHAETON* *Drury*—Very rare at Truro, N. S. (Miss Eaton); Halifax, (H. Piers).

15. *PHYCIODES NYCTEIS*, *Doubl-Hew.*—Orillia, fairly common in June (C. E. Grant); Port Hope, second week in June, 1896. Fig. 96.

17. *PHYCIODES BATESII*, *Reak.*—Mr. C. E. Grant has taken one specimen of this rare butterfly in July, at Orillia, Ont.

18. *PHYCIODES THAROS*, *Drury.*—Orillia, common May 24th to July, (C. E. Grant); Truro, N. S. (Miss Eaton); Halifax; “very common throughout the Eastern Provinces” (H. Piers).

19. *GRAPTA INTERROGATIONIS*, *Fabr.*—Has usually been considered a rare butterfly in the Province of Quebec, but this year it has been found in great abundance, the larvæ feeding on elm, in the neighbourhood of Montreal. The form *Umbrosa* was abundant at Port Hope in May and June, and *Fabricii* was taken July 29, and as late as November 16, 1896.

20. *GRAPTA COMMA*, *Harr.*—Sudbury (J. D. Evans); both forms fairly common at Orillia, (C. E. Grant).

22. *GRAPTA FAUNUS*, *Edw.*—Sudbury (J. D. Evans); Orillia, rare (C. E. Grant); Truro, N. S. (Miss Eaton).

23. *GRAPTA PROGNE*, *Cram.*—Orillia (C. E. Grant); Truro, N. S., not common (Miss Eaton).

24. *GRAPTA GRACILIS*, *Grote and Rob.*—Orillia, two specimens in July (C. E. Grant).

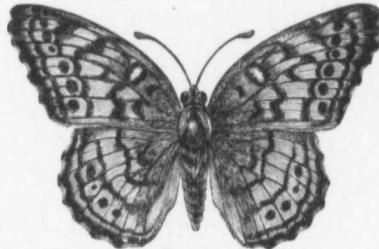


FIG. 95.

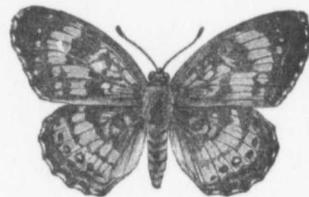


FIG. 96.

25. *GRAPTA J. ALBUM*, *Boisd.-Lec.*—Sudbury (J. D. Evans); Orillia, common in September (C. E. Grant); Truro, N. S., very rare (Miss Eaton).
26. *VANESSA ANTIOPA*, *Linn.*—Truro, N. S. (Miss Eaton).
27. *VANESSA MILBERTI*, *Godt.*—Sudbury and Orillia, Ont.; Truro, N. S.
28. *PYRAMEIS ATALANTA*, *Linn.*—Sudbury and Orillia, Ont.; Halifax, common (H. Piers).
30. *PYRAMEIS HUNTERA*, *Fabr.*—Orillia (C. E. Grant); Halifax, occasionally abundant (H. Piers).
31. *JUNONIA CÆNIA*, *Hüb.*—Don River Valley Toronto, May 23, 1896 (C. T. Hills); two specimens at Toronto in 1895 (C. H. Tyriss).
32. *LIMENITIS ARTHEMIS*, *Drury.*—Sudbury and Orillia, Ont.; Truro, N. S.
34. *LIMENITIS URSULA*, *Fabr.*—Fig. 97.—Taken at Niagara Falls, Ont., June 25, 1895, and at Port Credit by Mr. C. T. Hills.
35. *LIMENITIS DISIPPUS*, *Godt.*—Orillia, second brood in July and August in low lands (C. E. Grant); Truro N. S. (Miss Eaton).
36. *DEBIS PORTLANDIA*, *Fabr.*—Sudbury (J. D. Evans); two specimens were taken at Matchedash Bay, near Coldwater, County of Simcoe, Ont., August, 1883 (C. E. Grant). Fig. 98.

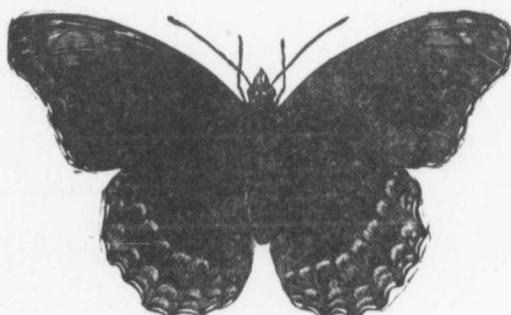


FIG. 97.

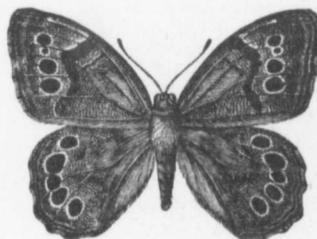


FIG. 98.

37. *NEONYMPHA CANTHUS*, *Boisd.-Lec.*—Sudbury; Orillia, common in low meadows in July (C. E. Grant); Truro, N. S.; and Lower Stewiacke, N. S. (H. Piers).
38. *NEONYMPHA EURYTRIS*, *Fabr.*—Orillia, common in open woods in June (C. E. Grant).
42. *SATYRUS ALOPE*, *Fabr.*—Niagara Falls, Ont., July 14, 1896 (A. Gibson); Truro, N. S., rare (Miss Eaton).
45. *LIBYTHEA BACHMANI*, *Kirtl.*—Taken in Toronto in 1895, and June 7, 1896, by Mr. McDonagh. Fig. 90.
46. *THECLA ACADICA*, *Edw.*—Orillia, usually rare, but very abundant in July, 1896, when forty specimens were taken by Mr. Grant; Toronto, June and July (C. T. Hills).
48. *THECLA EDWARDSII*, *Saund.*—Toronto, June and July (C. T. Hills).
49. *THECLA CALANUS*, *Hüb.*—Sudbury (J. D. Evans); Orillia, rare, taken in July (C. E. Grant).
50. *THECLA ONTARIO*, *Edw.*—A specimen of this extremely rare butterfly was taken near Grimbsy on the 24th of June, 1894, by Mr. Wm. Metcalfe of Port Hope. The only specimen previously known was taken twenty-six years before at Port Stanley by Mr. E. Baynes Reed.

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51. *THECLA STRIGOSA*, *Harr.*—This rare butterfly, Fig. 99, was taken at Orillia in July by Mr. Grant, and at Toronto in June and July by Mr. C. T. Hills.

119. *THECLA HUMULI*, *Harr.*—This is another addition to the list of Canadian butterflies; it was taken at Sudbury by Mr. Evans.

58. *FENISECA VIRGINIUS*, *Fabr.*—Orillia, moderately common in one locality (C. E. Grant).

63. *CHRYSOPTERUS HYPOPHLEAS*, *Boisd.*—Orillia (Grant); Truro, N. S., very common (Miss Eaton)

67. *LYCENA PSEUDARGIOLUS*, *Boisd.-Lec.*—Orillia; the form *Lucia* is very common in April and May; *Neglecta* is not so abundant in July and August (C. E. Grant); Truro, N. S., rare (Miss Eaton); Halifax, "abundant in the spring and familiar to trout fishermen under the common name of 'Jenny Lind'" (H. Piers).

68. *LYCENA COMYNTAS*, *Godt.*—Toronto in June (C. T. Hills).

69. *PIERIS PROTODICE*, *Boisd.-Lec.*—Orillia, formerly common; one male was taken in August, 1895 (C. E. Grant)

70. *PIERIS NAPI*, *Esper.*—Orillia, the spring and summer forms are common; *Virginensis* has also been taken (C. E. Grant); Truro, N. S., not very common (Miss Eaton).

71. *COLIAS CAESONIA*, *Stoll.*—Fig. 93.—The sudden appearance of this butterfly in considerable numbers in several localities in Ontario during the summer of 1896, is very remarkable. It was taken at Orillia by Mr. James Walker on July 13, and by Mr. Grant from June 6 to July 13; at Toronto by Messrs. C. T. Hills, C. H. Tyriss and A. Gibson from June 11 to the end of the month; Little York, near Toronto, June 14. It was also taken at Cartwright, Manitoba, on June 19 by Mr. E. Firmstone Heath.

72. *COLIAS EURYTHEME*, *Boisd.*—Sudbury (J. D. Evans); Orillia, common in 1872, not seen since (C. E. Grant).

78. *TERIAS MEXICANA*, *Boisd.*—No further record, but a cut is given, Fig. 100, to aid in its identification should it again make its appearance in south-western Ontario.

79. *PAPILIO AJAX*, *Linn.*—Port Hope at the end of May and on June 18, 1896; Toronto, four specimens during June (C. T. Hills), in addition to those observed by Mr. Gibson.

81. *PAPILIO CRESPHONTES*, *Cram.*—Taken at Orillia by Mr. Grant. In 1894 we gave a figure of this splendid butterfly and are now able to present pictures of the caterpillar, Fig. 101, and the chrysalis, Fig. 102.

85. *PAPILIO PHILENOR*, *Linn.*—A specimen was taken at Port Hope, on the 5th of August, 1896; this is the first time it has been observed east of Toronto in this Province. Fig. 94.

87. *ANCYLOXYPHA NUMITOR*, *Fabr.*—Humber River, near Toronto, and at Port Credit, in June, July and August (C. T. Hills).

89. *PAMPHILA ZABULON*, *Boisd.-Lec.*—The form *Hobomok* was abundant in sunny places in the woods near Port Hope during the first and second weeks in June, 1896; both forms common at Orillia in May and June (C. E. Grant).

94. *PAMPHILA MYSTIC*, *Scud.*—Orillia, common in June and August, two broods (C. E. Grant); Truro, N. S. (Miss Eaton).



FIG. 99.

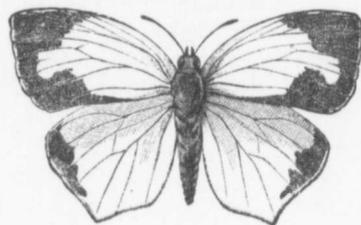


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95. PAMPHILA OERNES, *Boisd.-Lec.*—Sudbury (Evans); Orillia (Grant); Truro, N. S. (Miss Eaton).

97. PAMPHILA METACOMET, *Harris.*—Toronto in July (C. T. Hills); Orillia, scarce, in July (C. E. Grant)

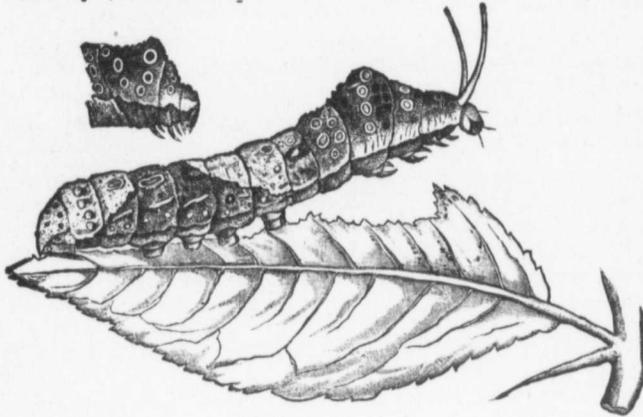


FIG. 101.



FIG. 102.

104. PYRGUS TESSELLATA, *Scud.*—This rare butterfly, Fig. 103, which has only been recorded in Canada as having been taken in Essex County, Ontario, many years ago, was taken in the early part of October, 1895, by Mr. Anderson, at London, Ont.

106.—NISONIADES BRIZO, *Boisd.-Lec.*—Orillia, scarce (C. E. Grant).

107. NISONIADES ICELUS, *Lint.*—Orillia, not uncommon in May, June and July (C. E. Grant).

108. NISONIADES LUCILIUS, *Lint.*—Orillia, scarce C. E. Grant).

109. NISONIADES JUVENALIS, *Fabr.*—Sudbury (J. D. Evans); Orillia, not uncommon in May and June (C. E. Grant).

112. PHOLISORA CATULLUS, *Fabr.*—Orillia, rare, June (C. E. Grant).

114. EUDAMUS PYLADES, *Scud.*—Port Hope, abundant in sunny places in the woods during the first two weeks of June, 1896; Orillia, abundant at the end of May and in June (C. E. Grant).



FIG. 103.

OBITUARY.

JOHN M. DENTON.

It is with profound regret that we record the death of our old friend and highly esteemed colleague Mr. John M. Denton, of London, Ontario, who was one of the early members of the Entomological Society and always took a very lively interest in its welfare. For some months he had been in poor health owing to an affection of the liver, but was able to attend his place of business from time to time and to take part in the proceedings of our annual meeting in November 1895, when many of us saw him for the last time. In January, his illness assumed a more acute form and confined him to the house. On Tuesday, March 24th, he was seized with paralysis and before midnight passed peacefully away.

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Mr. Denton was born in Northampton, England, on the 19th of September, 1829. His father was a farmer by occupation, and he was consequently brought up in the country amidst rural scenes and learnt there to love and observe the beauties of nature. At the age of fourteen he was apprenticed to a woollen draper and tailor, and spent seven years in thoroughly learning the trade and becoming proficient in all its details. For a few years he was engaged in business on his own account, and in 1855 married Miss Ann Walker, of Somersetshire, England, who survives him. He then emigrated to Canada and settled in London and at once resumed his occupation as a tailor, having but little to begin upon, except a hopeful heart and a thoroughly practical English training. By patient industry, unflinching courtesy and unswerving integrity, he built up by degrees a most successful business as a merchant tailor, and won the respect and esteem of the whole community.

Living on a farm in his boyhood and apprenticed at so early an age, he had but little opportunity of acquiring a literary education, but by constant application and careful reading he overcame these disadvantages, and attained a more than ordinary knowledge of the subjects that interested him. Foremost among these was Entomology, which he studied especially in its economic aspects as affecting live stock, fruit trees, garden and field crops. He became an authority on these topics and was frequently called upon to address meetings of farmers and fruit growers and give them the benefit of his knowledge and experience. His love of the farm continued throughout his life and he devoted much of the time that he could spare from business to the cultivation of a fruit farm a few miles from London. He was no mean authority upon horses and cattle and had a considerable knowledge of their diseases and most satisfactory treatment. He was also an adept with the microscope and took great delight in searching into the hidden beauties of nature.

When the London branch of the Entomological Society was formed in July, 1864, he was one of the original members, and took a most active interest in it and the parent Society to the close of his life. He was elected Vice-President of the London branch in 1872, and President in 1878 and several years following. In 1871, he became a member of the Council of the parent Society and continued to hold office for five and twenty years; in 1892 he was elected Vice-President, but he would never allow himself to be nominated for the Presidency, though urged to do so more than once. He was also an active member of the Ontario Fruit Growers' Association and gave much assistance to its work.

He was a man of deep religious feelings and of earnest but unobtrusive piety. Though a leader of the Plymouth Brethren, he never obtruded his views upon those who differed from him. The writer knew him well for a great number of years, and during his visits to London often enjoyed his hospitality, but never did he hear a word fall from his lips that could wound in the slightest degree the susceptibilities of those who did not accept the theological opinions that were so dear to him. He was a good, honest, sterling man, whom all respected and whom his friends loved; kind, charitable and generous; courteous in manner, most hospitable in his home, above reproach in business; a man who is a distinct loss to the city in which he lived, and whose death creates a blank in the hearts of his friends which can never in this life be filled. To his childless, sorrowing widow we tender our deepest, sincerest sympathy.

C. J. S. B.

CAPTAIN J. GAMBLE GEDDES.

It is our painful duty to record the loss of another active member of the Entomological Society of Ontario. A 2 o'clock on Good Friday morning, April the 3rd, Captain J. Gamble Geddes died after a few days' illness brought on by a severe cold. He was born in Montreal in 1850 and educated there. When a young man he entered the service of the Molsons Bank and was for some time attached to the office in London. He at once joined the Society and became an enthusiastic member. In 1874 he was elected Secretary-Treasurer of the London Branch; in 1875 Vice-President; and in 1876 Presi-

dent. He left London on his appointment as Manager of the agency of Molsons Bank at Millbrook. Here living in the country he devoted most of his leisure time to the collection and study of insects, applying himself especially to the Lepidoptera. In 1880 he left the bank and was appointed aide-de camp and private secretary to the Hon. John Beverley Robinson during his term of office as Lieutenant-Governor of Ontario. Being fond of society, of handsome presence and devoted to music, he became a great favourite among the social circles of Toronto, among whom much of his time was accordingly spent. He did not, however, abandon the pursuit of Entomology, but succeeded by correspondence and exchange, in addition to the captures of his own net, in forming a large and valuable collection of butterflies from all parts of the world. This he subsequently sold to the Dominion Government and it now forms the nucleus of the collection in the Geological Museum at Ottawa. He made expeditions in 1883 and 1884 to Manitoba and the Northwest Territories as far as the Rocky Mountains in quest of butterflies and added much to the knowledge of their geographical distribution and habits. On several occasions he visited England, and spent some time in Germany, and also in Bermuda. Wherever he went he made the acquaintance of the leading Entomologists and added to his stock of knowledge.

His first contribution to the *Canadian Entomologist* was in 1874, when he wrote No. 14 of a series of articles on "Some Common Insects"—"The Common Cockchafer," C. E. vol. vi. p. 67. His subsequent papers were the following: "List of Diurnal Lepidoptera collected in the Northwest Territories and the Rocky Mountains in 1883," C. E. xv., 221; xvii., 56, 224; xvii., 120; one hundred and twenty-six species were enumerated.

"Euptoieta Claudia," C. E. xvii., 60 (1885).

"Notes on three small collections of Diurnal Lepidoptera made in 1886." (These were made in Newfoundland, the Kamanistiquia River, Lake Superior, and Hudson Straits.) [C. E. xviii., 204.

"Some notes on the genera *Colias* and *Argynnis* whilst alive in the imago state," C. E. xix., 166 and 230 (1887).

"Notes for collectors visiting the Prairies and Rocky Mountains," C. E. xxi., 57 (1889).

"*Colias Ohione*," C. E. xxi, 59.

He also contributed the following articles to the Annual Reports of the Society:—

"Some remarkable captures in Ontario," 18th Report, 1877, p. 21.

"On some of the collections in England and the German Empire," 22nd Report, 1891, p. 31.

"Insects collected in Bermuda during the winter of 1894," 25th Report, 1894, p. 25.

In addition to his love for Entomology, he took a great interest in philatelics, and formed a large and valuable collection of postage stamps. He was an accomplished musician and usually sang in the choir of the church that he attended; he was also a member of the Philharmonic Society of Toronto. He belonged to the Masonic Order, in politics was a strong Conservative, and in religion a member of the Church of England. His wife, who was a daughter of the late Edward C. Jones, of Toronto, died a little more than a year ago. The untimely death of Captain Geddes was no doubt hastened by her loss. They have left two little orphan girls, aged three and five years respectively.

The writer, who knew him intimately from his boyhood, deeply deploras his loss, and his grief is shared in by a very large circle of relatives and friends.

C. J. S. B.

MISS G. E. ORMEROD.

It is with deep regret that we record the death of Miss Georgiana Elizabeth Ormerod, of Torrington House, St. Alban's England, the elder sister of Miss Eleanor A. Ormerod, whose name as a distinguished Entomologist is known throughout the scientific world. After several months' of patiently borne illness, she passed away on the 19th of August

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last, full of piety and good works, and justly esteemed and loved by all who knew her. She and her sister were each other's constant companions and fellow workers, and each sought the other's counsel and aid in carrying out any plan of work in which she was engaged. Miss G. E. Ormerod's special studies were botany and conchology, and in the latter department she formed a large and valuable collection of shells which she presented a few years ago, to the Natural History Museum at Huddersfield. She was highly gifted as a linguist, and acquired an excellent knowledge of French, Italian, Spanish and German, and was thus enabled to be of the greatest assistance to her sister in correspondence and the translation of foreign works of science. She is most widely known, however, by her remarkable talents as an artist, which were employed in the illustration of her sister's works, and in the production of a splendid series of diagrams in which are depicted a large number of the most important injurious insects in all their life-stages.

In addition to her scientific and artistic work she devoted much of her time and means to benevolent objects, and carried out for many years at her own expense a system of distributing books of an entertaining and instructive character amongst the working classes.

Women of such a type are rare, and we cannot but deeply deplore the loss of this eminent Christian lady, who died at an advanced age, full of good works, performed in a most unobtrusive manner; richly endowed with intellectual and artistic talents which she largely used for the benefit of others; always happy and cheerful in her daily domestic life; kind, hospitable and sympathetic; ready to help all who deserved her aid, and to give wise counsels to those who sought them from her.

To her sister—her life-long colleague—the loss is beyond what words can express. We can only venture to offer to her our heart-felt sympathy and our earnest wish that she may have grace and strength to endure so heavy a blow.

C. J. S. B.

ENTOMOLOGICAL LITERATURE.

THE GYPSY MOTH.—A report of the work of destroying the insect in the Commonwealth of Massachusetts, together with an account of its history and habits both in Massachusetts and Europe. By E. H. Forbush and C. H. Fernald.

This report, a handsome volume of nearly 600 pages, well printed and most copiously illustrated with chromolithographs, photogravures and wood cuts, gives a full account of the introduction of the now notorious "Gypsy Moth" into America by Leopold Trouvelot in 1868 or 1869, traces its history, and records the efforts which have been made to exterminate it by the State of Massachusetts up to the end of 1895. The spread of this insect for the first ten years was remarkably slow in the light of what we now know of its capabilities for harm. During that period it was not noticed by anyone but the introducer. The first extensive outbreak was in 1889, but for ten years before that it had given great annoyance to the people living in the part of the town of Medford, where it was first introduced. It had also spread and had gained a foothold in thirty townships without attracting public attention. Since that time its history is well known. In 1890 the first Gypsy Moth Commission was appointed and the work of fighting the pest was inaugurated. In February of the next year this commission was removed and another one substituted. On 12th of March Mr. E. H. Forbush, the present very efficient "Director of field work," was appointed, and on 18th June Prof. C. H. Fernald began his labors as entomological adviser. Since that time the work has been pushed on with great energy and the present valuable report is an outcome of the combined efforts of a practical, energetic manager and a careful, scientific entomologist. The two parts of this report prepared by the above named officers are quite distinct and form together a very complete treatise, not only upon the Gypsy moth, but upon the general principles which it is necessary to study when combatting any injurious insect. This carefully prepared report, therefore, cannot but be for a long time an indispensable book of reference for economic entomologists.

8—EN.

There are in this volume many things which will attract the attention of entomologists. Indeed, it is so full and there are so many different subjects treated of, that even to give the titles would take more space than is at my disposal. The first thing which will be noticed is the adoption of the generic name *Porthetria*. Articles of particular note deal with the studies made as to the methods of distribution of the Gypsy moth and the measures practised for the destruction of the insect in its different stages; spraying apparatus, and particularly the care of spraying machinery; methods of pruning, and some charming observations upon insect-eating birds.

The scientific work contained in Professor Fernald's report is of great value and contains a record of most painstaking and patient work. Probably one of the most interesting sections is that which deals with Natural Enemies, in which most excellent work has been done. Prof. Fernald has been aided in this work by efficient assistants, and the whole information so gained has been pieced together by a master hand.

With regard to spraying, some surprising results have been obtained. In the first place the caterpillar of the Gypsy moth seems to be little affected by applications of Paris green when applied of the strength ordinarily used for other mandibulate insects. Mr. Forbush says: "It became evident before the end of the season of 1891 that spraying, while reducing the numbers of the moth, could not be relied upon as a means of extermination, for many caterpillars survived its effects."

The following conclusion on page 139 will show entomologists that the matter of controlling mandibulate insects, by means of active poisons, is still a fertile field for careful work, in which useful and laurel-bearing results are still to be reaped:

"Every effort was made during the spraying season to determine why the results of spraying were not uniform and satisfactory. The feeding caterpillars were watched day and night by many observers. The spraying was most carefully superintended and the conclusion finally arrived at was that, under ordinary conditions, spraying with Paris green for the Gypsy moth was ineffective and unsatisfactory."

Paris green was on the whole the most fatal insecticide, and when used in the proportion of one pound to 150 gals. of water did not burn foliage, but with larger proportions did considerable harm. The injury developed so rapidly that within a short time the leaves were all killed and the surviving larvæ had to go elsewhere to feed. "Therefore, a strong Paris green mixture had little better effect than a weak one. Lime was then used with the Paris green with a view of neutralizing the burning, but considerable injury to the foliage still continued."

Probably one of the most remarkable facts discovered by the entomologists is related by Professor Fernald on page 476, where he says: "One interesting result obtained from the analysis of the different stages of the Gypsy moth, made in 1893 and 1894, is that pupæ and imagoes from caterpillars which have been reared on leaves sprayed with Paris green or arsenate of lead, may contain arsenic in recognizable quantities. Several pupæ and a few female imagoes obtained under these conditions, when subjected to chemical analysis gave ample evidence of the presence of arsenic in their bodies. This shows that the presence of arsenic in the pupa may not materially interfere with the processes involved in the development of the imago. Since, as has been repeatedly demonstrated, moths reared from poisoned larvæ are capable of reproduction, it is also evident that the arsenic contained in their bodies does not injure the reproductive function."

With reference to the amount of arsenic which could be consumed by some of these caterpillars, and yet leave them "normally active and healthy," it was found that some of them had in their bodies in proportion to their weight, an amount equivalent to $12\frac{1}{2}$ times the fatal dose for an adult human being, in proportion to the weight of the latter.

The work of the Gypsy Moth Committee has been criticized, examined and studied by practical men who were entomologists and others who were not. As far as I can learn, the general verdict is that excellent work, and, under the circumstances, remarkably so, has been done. The insect is not exterminated, it is true; but there seems every reason to hope, judging from what has been done and the behaviour of the species in other countries

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where it was once alarmingly abundant, that this is possible, if money is supplied and if it is given at the time when it can be made use of to the best advantage. On pages 38 to 93 of the report will be found an instructive account of the constant efforts of the Committee to get funds to carry on the work properly, and year after year it was the same story of reduced, and what was almost worse, delayed appropriations, resulting in the necessity of modifying the whole plan of work arranged for the year, so that instead of making vigorous efforts for the extermination of the insect, and fighting it at the time this could be most effectively done—early in the season, when the caterpillars were small—all that could be done was to try and prevent the further spread of the enemy from the localities known to be infested. The appropriations which have been made for this work are considerable, about \$525,000 up to the present time, and this amount would certainly have produced far better results, could the Committee have obtained the grants at the time they required them, so that they could have begun the work early in the season and continued employing, from year to year, those assistants who had been taught, at an expense of much time and trouble, what was required of them. J. F.

REPORT OF OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS DURING THE YEAR 1895, WITH METHODS OF PREVENTION AND REMEDY. Nineteenth Report, by Eleanor A. Ormerod, F. R. Met. Soc., etc.

This splendid report fully sustains the high standard of excellence which has characterized Miss Ormerod's previous publications. The preface shows that the unusual and prolonged low temperature of the winter of 1894-95 had apparently but little affected the insects which it might be supposed to destroy.

The following pests are treated of in separate chapters: Apple, *Smerinthus ocellatus*; bean, *Bruchus rufimanus* and *B. fabæ*; cabbage, *Ceutorhynchus sulcicollis*; corn and grass, *Charceas graminis*, *Cetonia aurata*, *Phyllopertha horticola*, *Melolontha vulgaris*, *Rhizotrogus solstitialis*, *Tipula muculosa* and *Oscinis frit*; gooseberry, *Bryobia praetiosa*, *B. ribis* and *Nematus ribesii*; mangolds, *Aphis rumicis*, *Silpha opaca* and *Atomaria linearis*; orchard caterpillars, *Cheimatobia brumata*; pine, *Astynomus cedilis* and *Retinia buoliana*; plum, *Scolytus rugulosus*; strawberry, *Harpalus ruficornis*, *Pterostichus madidus* and *P. vulgaris*; turnip, *Helophorus rugosus*.

The ravages of the bean weevil appear to have been serious, and those of the ground beetles, upon the strawberry, have been more extensive than in previous years. Ninety-three pages are occupied with the discussion of the above mentioned insects, while fifty are allotted to "Flies injurious to horses, cattle," etc. These chapters are exceedingly interesting, and several species of Hippoboscidae, Tabanidae, and Cestridae, which are very annoying and injurious to domestic animals, are fully and clearly discussed. In connection with the account of the attacks of the Forest Fly, *Hippobosca equina*, are given two magnificent plates showing upper and side views of the foot of this fly, the tarsi of which are so modified as to enable it to secure a most firm grip on the hairs of the animal upon which it alights. The report concludes with a chapter on Deer and Dog Ticks, very troublesome mites belonging to the Ixodidae W. H. H.

BRITISH BUTTERFLIES, by J. W. Tutt, F.E.S., London: George Gill & Sons, 1896. Pp. 469. (Price 5s.)

It is only a few months since we spoke in terms of commendation of Mr. Tutt's Manual of the British Moths, and now we have before us an even better work on the butterflies by the same industrious author. About one-fourth of the book is taken up with the general subject, presenting a series of chapters on the four life stages of butterflies, their variation and its causes, hibernation and æstivation, classification, collecting, arranging and preserving specimens, and the inflation of larvæ. These are written in the author's pleasant, easy style, with which his previous works have made us familiar, and convey much information of interest to butterfly-hunters everywhere. We are glad to observe that he insists very strongly upon the importance of labelling specimens with the place and date of capture, though the English mode of using short pins and setting the specimens low down makes this a matter of difficulty.

The descriptive portion of the work is excellent and much more complete than that of any manual of British butterflies that we have met with. In the case of each species there are given the English and scientific names, reference to the plate where it is figured, synonymy and bibliography, a concise description of the imago, a paragraph on "variation" in which are mentioned any known aberrations, forms of varieties, as well as sexual distinctions, descriptions of the egg, larva, pupa, notes on the time of appearance, habitat and geographical distribution. Thus it will be seen that proper regard is paid to the whole life history of the insect and that the author does not confine his attention to the imago alone. The plates (uncolored) on which each species is depicted are admirable, and should enable any collector to identify his specimens without difficulty; there are also a considerable number of wood cuts throughout the text.

In the arrangement of species the author begins with the "lowest"—the Skippers, Hesperidae—and proceeds upwards to the Satyridae, among which he strangely places "the Purple Emperor," *Apatura iris*. His classification, a thorny subject which we do not propose to discuss here, may thus be considered fully "up to date."

To our readers in the British Isles and to those who have collections of British butterflies, we heartily commend this excellent manual. We only hope that it may not be very long before we have some hand-book equally good dealing with the butterflies of Canada.—C. J. S. B.

PRELIMINARY NOTES ON THE ORTHOPTERA OF NOVA SCOTIA, by Harry Piers. Transactions of the N. S. Institute of Science, vol. ix., 1896.

So little attention is paid to Entomology in the Maritime Provinces that we gladly welcome this contribution to the subject and are much pleased that Mr. Piers intends to devote some years to the study of the order Orthoptera. The paper before us gives some very interesting notes on the habits and range of fourteen common species of cockroaches, crickets and locusts, and describes more at length the ravages committed by *Melanoplus atlantis* on Sable Island, a hundred miles off the coast of Nova Scotia in the Atlantic Ocean.—C. J. S. B.

INSECT LIFE.—A short account of the classification and habits of insects, by F. V. Theobald, M.A., F.E.S. London: Methuen & Co. Pp. 235. (2s. 6d.)

Under the title of the "University Extension Series" the publishers are issuing a number of books on historical, literary and scientific subjects, which are intended to be both popular and scholarly. We have not seen any of the other works of the series and cannot, therefore, comment upon them, but the book before us seems hardly to come up to the expectations one would naturally form of a manual intended for use in preparation for "University Extension" lectures. The descriptive portion is meagre and will afford a student a very vague idea of the insects belonging to the different orders. It is satisfactory, however, to find in an English publication some attention paid to Economic Entomology and the application of the insecticides, which are in common use here. The book is neatly printed (though we have noticed several misprints in the spelling of names) and is illustrated with over fifty wood cuts.—C. J. S. B.

CRITICAL REVIEW OF THE SESIIDAE FOUND IN AMERICA NORTH OF MEXICO, by William Beutenmüller, pp. 111-148, Bull. Am. Mus. Nat. Hist., VIII., 1896.

The writer of the present brief notice of this excellent paper on the *Sesiidae* desires to call attention to the very careful work of Beutenmüller on the clear-wings and the necessity for this work which has arisen from the uncritical publications of preceding authors. It appears, for instance, that our *S. lustrans*, a species well distinguished by antennal peculiarities, has been five times the subject of new descriptions by the late Mr. Hy. Edwards, whose species are very properly reduced, as appears from Beutenmüller's studies. The name hitherto used for this species itself must, it seems, give way to *bassiformis*, Walk., described from a type in poor condition. Beutenmülle-

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is quite correct in calling attention to the particular necessity in this group for good material from which to describe. The want, perhaps, of such material led Mr. Edwards to describe *S. rutilans* six times over. A large number of sexual determinations by Mr. Edwards are corrected by Mr. Beutenmuller, so it seems hardly possible for anyone to have worked with less judgment. The list of the clear-wings in the New York Check List was drawn up, with the rest of the list, by the writer of the present lines, who at the time merely sent the last proof to the late Mr. Hy. Edwards for his revision. Mr. Edwards added, in explanation, the two foot notes on page 12 and signed these, and made one or two changes in his names for genera on page 11. The writer is also responsible for the list of the clear-wings, since he originally wrote the same, and not Mr. Edwards. The explanation is here given, as the list has been erroneously alluded to as the work of Mr. Edwards. In the Philadelphia list the New York list is generally copied, but *lustrans* is wrongly given to Mr. Hy. Edwards, and an implication is conveyed in the preface that Mr. Hy. Edwards was the author of the lists of the clear-wings, which is here corrected. The writer trusts that Mr. Beutenmuller will continue his studies and that lepidopterists generally will help him in every possible manner. It is a matter of great satisfaction that Mr. Beutenmuller's timely work is also of such good quality. The writer would merely reclaim his *Sesia pictipes*, which is also given to Mr. Hy. Edwards, on p. 134, and draw attention to the excellent description of the habits of this species given by the late Dr. Bailey in the pages of the American Entomologist.

A. RADCLIFFE GROTE, A. M.

A LIST OF THE BUTTERFLIES OF SUMATRA, with special reference to the species occurring in the north-east of the Island. By L. de Nicéville and Hofrath Dr. L. Martin. Calcutta. Reprinted from the Journal of the Asiatic Society of Bengal, 1895.

This list of seven hundred and fifty-six species of butterflies taken in a limited portion only of the great Island of Sumatra, gives one some idea of the wealth of the insect fauna in tropical regions. In a very interesting introduction the authors give a brief description of the Island, which is nearly as large as France and is bisected by the equator, and relate the difficulties that have to be surmounted in the formation of a collection of its butterflies, which can only be effected by employing natives, who have first to be taught and trained for the purpose. Dr. Martin lived for thirteen years on the Island and has thus been enabled to add very interesting notes on the distribution, scarcity or rarity, habits, season of occurrence, etc., of a large number of species. One may, therefore, open the list anywhere and find not a mere record of names, but highly interesting details regarding the butterflies. As might naturally be expected, the preparatory stages of the majority of the species are as yet unknown.

C. J. S. B.

A LIST OF THE BUTTERFLIES OF SIKHIM, by Lionel de Nicéville, F. E. S., etc. Calcutta: from the Gazetteer of Sikhim. Printed at the Bengal Secretariat Press.

Probably no part of the great British Empire of India and its tributary States has been so fully explored by the collectors of butterflies as the country of Sikhim, which includes the famous health resort of Darjeeling, about 7,000 feet above the sea, on the slopes of the Eastern Himalayas. Consequently the author is able to record in this list no less than six hundred and thirty-one species, which he considers a near approach to the maximum number that can be discovered. Certainly it is a goodly number, and one hard to be realized by a dweller in these northern and much less luxuriant regions. And what splendid creatures they are, with their gorgeous colouring and infinite variety of shapes and hues. Nearly fifty species of Papilios alone are recorded, and more than one hundred and fifty Lycænidae, the greater number of which belong to genera that are entirely unknown to us here.

C. J. S. B.

MONOGRAPH OF THE BOMBYCINE MOTHS OF AMERICA NORTH OF MEXICO, including their transformations and origin of the larval markings and armature. Part I., family 1, Notodontidæ. By ALPHEUS S. PACKARD. National Academy of Sciences, Vol. VII., 1895 (received May 11th, 1896); 292 pages, 49 plates, and 10 maps.

Dr. Packard's long promised monograph has at length appeared. The copious text is divided into ten sections: I., Introduction; II., Hints on the mode of evolution of the bristles, spines, and tubercles of Notodontian and other caterpillars; III., On certain points in the external anatomy of Bombycine larvæ; IV., On the incongruence between the larval and adult characters of Notodontians; V., Inheritance of characters acquired during the lifetime of Lepidopterous larvæ; VI., Geographical distribution of the American Notodontidæ; VII., Phylogeny of the Lepidoptera; VIII., Attempt at a new classification of the Lepidoptera; IX., A rational nomenclature of the veins of the wings of insects, especially of the Lepidoptera; X., Systematic revision of the Notodontidæ, with special reference to their transformations.

Most of these have previously appeared as separate articles, as the reader will recall. The life-histories are given as fully as our present knowledge will allow, much of this knowledge being due to Dr. Packard's own labours. The plates illustrating them are beautifully coloured, the early stages highly magnified. These plates must be seen to be appreciated.

A few remarks in criticism of the memoir will not be understood to imply a lack of appreciation of its many valuable features. In general the synoptic tables of subfamilies, genera, and species are poor and uncritical. They are no improvement over those of the author's monograph of Geometridæ, to which the same criticism applies. In all the figures of larvæ the setæ are imperfectly shown, and their number and position are not to be relied upon. I corrected for Dr. Packard a number of the plates in this respect, but the corrections were necessarily made from memory and on general principles, and there is not a figure which has the authority of a careful copy from nature. Even the special figures in the text are often grossly erroneous; e. g., figure 9, on page 63, where the back and side views of the same larva are shown as different. Dr. Packard also fails generally to describe the arrangement of the setæ in the text.

The classification of the Lepidoptera which is used is original with the author. It has been already presented in the *American Naturalist*, where I have had occasion to notice it. In rejecting the classification of Prof. Comstock, the author argues that the frenulum is of small value in classification, because both frenulum and jugum are present in some Jugate, and the frenulum is absent in some Frenatæ. While we may admit this argument for what it is worth, it seems that Dr. Packard entirely misses the great cumulative force of the evidence adduced by Prof. Comstock and others for these suborders. Classifications founded on the venation alone [Hampson], the wing scales [Kellogg], and the antennæ [Bodine] give the same suborders. I have also shown that the larval characters do not support Dr. Packard's view. But Dr. Packard gives no weight to larval characters, in spite of the implication in the title.

HARRISON G. DYAR.

MISSOURI BOTANICAL GARDEN. SEVENTH ANNUAL REPORT, 1896.

Very few reports are more eagerly looked for every year by those who are lucky enough to secure copies than Prof. Trelease's report on the Missouri Botanical Garden and the Henry Shaw School of Botany at St. Louis, Mo. This report contains not only the Director's annual statement on the condition of the Garden and its finances, but also valuable monographs on different genera of plants. In the present volume we find the following: I. *The Juglandaceæ of the United States*, by Prof. Trelease; II. *A Study of the Agaves of the United States*, by A. Isabel Mulford, and III. *The Ligulate Wolfias of the United States*, by C. H. Thompson. A feature of all these annual reports is the magnificent illustrations.

In addition to the above, there is the report of a speech delivered at the sixth annual banquet, by President Henry Wade Rogers, of the North-west University, on The Value

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of a Study of Botany, and a catalogue of the "Sturtevant Prelinnean Library" the greater part of which was presented to the Botanical Garden by Dr. E. Lewis Sturtevant in 1892.

One very notable omission from the present volume which we much regret is the printing of the Annual Flower Sermon. Last year it was delivered by the Rt. Rev. W. C. Doane, Bishop of Albany.

The first annual event provided for in his will by Henry Shaw, the good man who founded this garden for the enlightenment and happiness of his fellow men, was "The preaching of a sermon on the wisdom and godness of God, as shown in the growth of flowers, fruits and other productions of the vegetable kingdom." A lovely poem in prose for the perusal of which by his friends, the writer's copy of the 1893 report is in constant use, is a sermon preached by the Rev. Cameron Mann, from the text "Consider the lilies of the field." This sermon, from a literary standpoint, is charming, and certainly helps to carry out the wise wish of the benevolent founder to inculcate in all a thankful spirit for the many lovely things in the vegetable kingdom which we find strewn with no niggard hand along our walk through life, making our own journey more beautiful and, it is hoped, our friends happier from contact with us.

J. F.

ECONOMIC ENTOMOLOGY, for the farmer and fruit grower and for use as a text book in agricultural schools and colleges; by John B. Smith, Sc. D. Philadelphia: J. B. Lippincott Co., 1896. [Price \$2.50]

It is rather remarkable, when the self-evident importance of the science of Economic Entomology is considered, that until Prof. Smith issued his excellent manual, which has just appeared under the above title, there was no one American book which a farmer could consult to find the names and proper remedies for the common crop pests which would come regularly before him in a year's working of his land. The author in his long experience first as a member of the staff of the "United States Entomologist at Washington, and subsequently as State Entomologist of New Jersey," has had great opportunities of becoming thoroughly informed on his subject. That he has made the best use of these opportunities, is evidenced by the excellent book which he has now produced. The best way to test anything is to use it. Thus if anyone wishes for information upon anything within the limits of Economic Entomology, the subject of Prof. Smith's book, as, for instance, some one of the regularly occurring insect enemies of crops, *e. g.*, cut-worms, white grubs, canker worms, the Colorado potato beetle, plum curculio or tussock moth, etc., let him turn it up in the index of this work and he will be referred to a clear and concise account of the insect and its habits, together with recommendations as to the best remedies. The identification of the different species is made easy by a profusion of remarkably good illustrations. The whole book, including the index, consists of 481 pages, while the number of illustrations is no less than 483, all of which are unexceptionable if a mental reservation may be allowed as to the three plates of Bumble-bees and Bee flies Nos. 398, 464, and 473, taken evidently from photographs. It seems a pity that these plates should have been included in this work on Economic Entomology. The arrangement of the book, for ease of reference, is well planned and well carried out, the objects the author had in view, as explained in the introduction, being adhered to in a most satisfactory and complete manner. Part I. consists of eight short chapters on the Structure and Classification of insects. Part II. the insect world, which forms the bulk of the book, is a systematic treatment of the various common injurious insects in their natural orders. This portion is particularly well balanced, enough space being devoted to each species treated of to satisfy the inquirer, without, as is sometimes the case, giving undue importance to some at the expense of others. Part III. treats of insecticides, preventive remedies, and machinery. This work cannot fail to prove of great value to the farmer and fruit grower, as well as to the amateur gardener and student of insect life, who will find in it an authoritative book of reference of small size but comprehensive and easy to consult.

J. F.

HOUSEHOLD INSECTS, (U.S. BULLETIN No. 4. NEW SERIES.)

During the year 1896 several most useful publications were issued from the United States Division of Entomology under the direction of Dr. L. O. Howard. Of particular interest to the general public was Bulletin No. 4, entitled "The Principal Household Insects of the United States." The main part of the volume is prepared by Dr. Howard and his assistant Mr. C. L. Marlatt, and at the end is a chapter by Mr. F. H. Chittenden on "Insects affecting cereals and other dry vegetable foods." To entomologists, who know the literary and scientific work of these gentlemen, it is only necessary to say that this volume is up to, or perhaps even a little above, the usual excellent standard of the papers issued from the U.S. Division of Entomology at Washington. A very few minutes' examination of the different articles in Bulletin 4 will convince anyone of the extreme value of this concise, practical treatise on all the commoner insects which are likely to be found troublesome inside houses. It is almost impossible for one who has made a specialty of entomology to speak in moderate terms of these publications. There is nothing to compare with them published in any other country. When we consider the matter treated of, and the practical way in which it is presented, the manifest care to secure accuracy of statement, the exquisite work of the artist as well as the arrangement and general get-up of the pamphlet, one is tempted to use so many superlatives that any opinion expressed might be thought to be unduly biassed.

A special feature of value in this publication is that it is entirely made up of original American observations, most of them prosecuted in the Division of Entomology, and, as is pointed out by Dr. Howard in the introduction, the very curious but not unexpected condition of affairs was shown in the preparation of this bulletin that of some of our commonest insects the life history is not known with any degree of exactness. The insects treated of are such as are found in houses and which either annoy the occupants by their direct attacks or are injurious to household goods and provisions. These are described in eight separate chapters.

J. F.

MISS ORMEROD'S TWENTIETH ANNUAL REPORT, 1896.

One of the pleasantest events of the year for the economic entomologist is the arrival of Miss Ormerod's Annual Report. The liberality with which the distinguished authoress distributes these treasuries to students and public institutions all over the world brings them within the reach of all who may wish to profit by their perusal.*

It is seldom that any series of publications upon a single subject can show year after year such a steadily maintained, and even gradually increased, interest, as has been the case with these reports—new infestations of crops are being constantly investigated, old attacks restudied, and additions made to the previously recorded methods of treatment or prevention. It matters little in what part of the world a student may be located, he will always find something of value which may be profitably applied to his special work in fighting against the crop pests of his own country. The present report is no exception to the general rule. We congratulate our highly esteemed corresponding member on the practical and serviceable manner in which the subjects she treats of are presented to the public. As a writer in the *Queen* newspaper of late date says, "Miss Ormerod's work does not consist in playing with entomology, but is true, valuable, practical, scientific observation, and she enjoys the proud privilege of being regarded as one of the most reliable scientific observers."

On opening the report one is sadly reminded by the frontispiece, an excellent likeness of the late Miss Georgiana E. Ormerod, of the irreparable loss the authoress has suffered in the recent death of her much loved and highly talented sister, who has been her life-long companion and able assistant in the grand work she has done for economic entomology in England. The late Miss Ormerod was a naturalist of no mean

*These reports are also for sale by the publishers, Simpkin, Marshall & Co., London, at the almost nominal price of 1s. 6d.

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standing and possessed remarkable talents as an artist. She is well known as the authoress of the magnificent series of thirty colored diagrams of insects injurious to farm crops. These are thirty inches long by twenty wide, and are most suitable for use in a class room or at farmers' institute meetings. In the preface of the report the sad event referred to above is touchingly and fittingly alluded to with a reference to the obituary notice by Dr. Bethune which appeared in the *Canadian Entomologist* for November last.

Among the various short monographs contained in this report of 160 pages many are of interest to Canadian farmers and fruit-growers either from the identical species occurring both in England and Canada, or from a similarity in habits between allied forms in the two countries.

CODLING MOTH: This is one of the yearly recurring troubles of the fruit grower to which most of the damage to apples may be laid. English experimenters do not even yet seem to have mastered the spraying of apple trees for the prevention of injury by the codling moth. The remedies are given by Miss Ormerod as follows: "Our only really available remedies against this infestation appear to lie 1st in destroying infested apples; 2nd in trapping the caterpillars and destroying their shelters; and 3rd on being well on the alert at the time of the blossoming of the apple, and by careful spraying preventing the very beginning of the attack." In this country the recommendation for the best remedy would be: "Spray with 1 lb. Paris green and 1 lb. lime in 200 gallons of water within a week after all the blossoms have fallen."

BEE CARRION BEETLE: We have occasionally in the North-West Territories a rather rare attack upon vegetables such as squashes, spinach, etc., by the larvæ of one of the carrion beetles *Silpha bituberosa*. In England a very similar species has been the cause of serious damage to mangolds, and last season when other food failed attacked potatoes. The carrion beetles feed both on vegetable and decaying animal food. It is suggested by a correspondent to attract the beetles and larvæ from the crop by putting about the infested fields "a few wild pigeons, rooks, hawks or similar vermin." (*Sic.*) The ignorant farmer in England, as well as in other parts of the world, "generally shoots in spring" every hawk he can see. In this country the remedy which would first suggest itself would be dusting the crop with land plaster and Paris green (50 lbs. to 1).

LEATHER BEETLE: An interesting account is given of an attack by *Dermestes vulpinus*. Large numbers of beetles were found in a building where bones had been stored for six or nine months for the manufacture of manure, and not only the bones were honeycombed, but also the posts and floors of the building over them, which were seriously injured by the larvæ, when full-grown, boring into the wood to pupate. Reference is also given to another similar occurrence near Sheerness, in Kent, which was upon even a larger scale than the one treated of by Miss Ormerod. This article is illustrated by excellent figures of the beetle and its various stages, as well as a portion of a perforated bone and a piece of honeycombed wood.

WHITE CABBAGE BUTTERFLIES: Under the head of cabbage two species of *Pieris* are treated, and powdery dressings are recommended as fresh lime, soot and sulphur. The highly reprehensible practice of using Paris green upon cabbages is referred to, but Miss Ormerod wisely says she could not take on herself the responsibility of advising the treatment, more especially as the feeling against it might probably ruin the sale of the cabbage. There is no doubt of the truth of this last statement. There is never a season passes that instances do not come under the notice of the writer of people expressing fear of buying cabbages lest they may have been poisoned with Paris green. In addition to this the use of such a virulent poison is quite unnecessary. Pyrethrum powder mixed with three or four times its weight of common flour and kept for twenty-four hours in a tightly closed vessel is even more quickly fatal than Paris green, killing every caterpillar the powder falls upon, or upon which the infusion of the powder may run when it has been wetted by dew or rain, and further, this powder is not poisonous to the higher animals.

CROTON BUG: An occurrence of this well-known guest at hotels and other large buildings heated with steam, is spoken of. The usual remedies adopted in this country

as powdered borax and the many brands of pyrethrum powder are mentioned, and "stoving" with sulphur is given a prominent place under remedies.

DEER FOREST FLY: For some years Miss Ormerod has made a special study of the *Hippoboscidae* or Forest flies, and another chapter of her most interesting observations on these little-known insects is given in the present report, with excellent figures of the common Forest fly and the Deer Forest fly.

EARWIGS: The injuries of earwigs in hop gardens and to mangolds, swedes and turnips, likewise to apple blossoms, have been serious in 1896. The old method of trapping the insects in inverted flower pots or tin pots containing a wisp of straw has given good results; also beating them at night on to tarred boards.

THE HOUSE FLY (*Musca domestica*, L.): One of the most interesting monographs in this report, at any rate to the general public, is an account of the troubles caused by the common house fly. The life history of the insect is treated of at considerable length with quotations from the several authors who have written on the subject of "flies" and a statement as to the serious annoyance by house flies in India upon horses. Dr. Spooner Hart, V.S., of Calcutta, sent numerous specimens of a fly which was examined carefully by specialists and found to be true *Musca domestica*. He says: "March 24th. It is the worst pest the horse has here, and at this time of the year it exists in thousands especially in the suburbs. It attacks in great numbers the eyes principally, and is constantly flying off and coming back all day long to the same site. This causes great irritation and inflammation, which, being continued day after day and neglected, will lead to blindness, disfiguration of the eyes and ulceration of the face.

"Our hackney carriages (cabs) here are drawn by wretched half starved ponies fed principally on grass, out all day exposed to the sun, stabled in filthy holes and are most disgracefully treated and neglected. Dozens of these unfortunate creatures are blind from irritation set up by these flies, and present huge ulcers on either side of the face just below the eyes, the result of constant lachrymation and irritation of the flies. The eyelids are thickened and averted and the appearance is awful. The flies are dreadfully persistent, and will not be shaken off." Under the head of Prevention and Remedies it is pointed out that as house flies as far as is actually known for certain, breed wholly in horse manure, much may be done to lessen the numbers by keeping stables clean and removing as quickly as possible all horse droppings and getting them into the land as soon as convenient. Further, as many observers believe that house flies breed also in other decaying matters it is advised to pay special attention to garbage thrown into ash pits.

With regard to the attacks of flies to horses' ears, eyes, etc., Dr. Hart writes that a carbolic wash when freshly applied will keep the flies away. Horses in India are also protected by eye fringes, made of hanging white cords which cover the eyes and prevent the flies from settling. The irritation to horses described above reminds us of the distressing accounts given by travellers in Egypt of the diseased condition of the eyes of the Egyptian beggars, particularly of babies and children, from the irritation caused by flies. The prevalence of ophthalmic troubles would suggest the frequent spread of these diseases by flies, the infection being carried from person to person.

As to the manner in which these sores are made Miss Ormerod says as follows: "Several other kinds of flies are very commonly to be found in our houses, including *Stomoxys calcitrans*, sometimes called the "stinging fly," which can give a painfully sharp prick by means of a needle-like proboscis. From these the house fly can be distinguished by its having not a sharp pricker, but a soft proboscis adapted for suction, but incapable of penetrating the skin, so that when these insects trouble man and animals it is only to imbibe their perspiration. But the various other flies which commonly pass under the name of "house flies" much resemble them in many particulars of their life-history, and speaking generally of these "flies" it is obvious that even of those which do not sting, where the foot has the "pads" covered with hundreds of hollow tubes secreting a viscid fluid by which they adhere to the smoothest surface, and the organs

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used in taking food consist of minute formations called teeth by which the surface of the food is rasped, and thus new surfaces exposed to the action of the moisture of the fly's mouth, that it is not surprising that delicate parts, such as the surroundings of the eye, should suffer grievously, where, as in hot countries, they are buried under the constantly attacking masses of the pests."

Two simple devices are explained, one for catching flies, wasps, etc., out of doors in a wholesale way, the other for clearing a room in summer when flies frequently swarm into houses in annoying abundance. For the capture of flies in gardens Miss Ormerod advises the use of two square hand-lights, one set on the top of the other. The finger hole at the top of the lower one allows the flies to go up into the upper one, of which the hole is closed with moss or other material, and the lower one is raised up from the ground on bricks, with a bait of some attractive substance placed below. The flies after feeding rise up and gain access through the hole at the top to the upper light where they collect in thousands that soon die from the heat of the sun.

To keep flies out of dwelling houses Miss Ormerod tells of a plan contrived by her late sister, Miss Georgiana Ormerod. It is to close the lower sash of the window, then draw down the upper sash so as to open it about a foot at the top. Next draw down the calico rolling blind so that the flies are inclosed between the blind and the glass panes of the window, when, following their natural instinct, the flies rise, and when they arrive at the opening to the fresh air outside, out they all go.

A similar plan to the above has been practised in the dining-room of one of the hotels at Ottawa for some years, and has given great satisfaction.

LEAFAGE CATERPILLARS: In this chapter several leaf-eating caterpillars are treated of, together with the well tried insecticides, Paris green and kerosene emulsion. It is evident that through Miss Ormerod's instrumentality these valuable remedies are gradually becoming better known and more generally used by English orchardists.

MEDITERRANEAN FLOUR MOTH: We regret to read that this most injurious insect which was first noticed as mischievous in England in 1887, is now thoroughly established as a perfect pest in any roller flour mill where it once gets a footing, and also is to be found in bakeries, or the like places where the flour, on which its caterpillars feed, is present; and consequently now is in the course of unchecked spread, which has given the infestation thorough establishment. No new methods of treating the insect are spoken of; but an incidental mention is made to an important matter, *i.e.* the spoiling of flour by fumigating with sulphur, showing the necessity of knowledge and care in making use of this remedy. In Canada, even without any care on the part of millers, this infestation is of rare occurrence, the spread and increase of the insect over most of the Dominion being prevented or rendered easy of control by the low winter temperature, to which from time to time mills can be subjected.

ONION SICKNESS.—This attack due to the Stem Eel-worm (*Tylenchus devastatrix*) has never, so far as I am aware, been observed in Canada; but may at any time appear. The reasonable remedy proposed by Miss Ormerod should, however, be adopted for all vegetables showing disease. This is to destroy carefully by burning everything which shows a diseased growth, and on no account throw it on a manure pile to be put back again on to the land.

THE PEAR LYDA or Social Pear Saw-fly is of particular interest from the almost identical appearance and habits of the species with those of a Lyda found in great abundance last July in southern Manitoba on plum trees in the gardens of the Mennonites. Whole trees were seen, upon which nearly every leaf was seared and skeletonized. The foliage of large branches was frequently webbed tightly to the twigs, forming a tent containing scores of the curious false caterpillars. The remedy of spraying the trees early in June with Paris green would certainly have saved the trees.

PEAR AND CHERRY SAW-FLY (*Eriocampa limacina*)—The Pear slug every year does much harm in Canada. This is almost invariably from the fruit grower's neglect. These caterpillars can be easily controlled by spraying or dusting with Paris green.

SURFACE CATERpillars (the cutworms of this country) did much damage in 1896. The chief point of interest is a trial of a mixture of nitrate of soda and salt (proportions not given) hand sown after hoeing between the rows and between the roots—at the rate of about 3 cwt. per acre. The results of the trial seem to justify a further test of this remedy which at any rate would invigorate and help the remaining plants to make a vigorous growth.

CADDIS WORMS were troublesome in beds of watercress and did considerable damage. This plant is cultivated in shallow canals with running water and is grown in large quantities to supply the city markets. The foliage is destroyed by the encased larvæ of several species of water flies which crawl nimbly about the plants. The most successful remedy was found to be to flood the beds deeply and then disturb the Caddis worms by passing the backs of wooden rakes very thoroughly over the plants. The worms let go their hold of the plants and rise to the top of the water and are carried off down the stream past the beds.

The above brief references are merely to those articles in this valuable report which are thought to be of direct interest to us; but there are many other subjects treated which may at any time demand our attention. The great charm of Miss Ormerod's reports is that she does not theorize and when reading them there is always an overwhelming feeling of confidence that any observation or investigation recorded is put down absolutely as she saw it.

J. FLETCHER.

THE REV. THOMAS W. FYLES, F.L.S.

We have much pleasure in presenting to our readers the excellent portrait of our colleague, the Rev. Thomas W. Fyles, who has been for many years an active member of the Entomological Society of Ontario. Though living at South Quebec, he has regularly attended the annual meetings at London, travelling many hundreds of miles in order to do so, and has invariably delighted those present with his excellent papers. He was a member of the Council from 1882 to 1888, when the change in the Act of Incorporation required the directors to be resident within certain districts of the Province of Ontario. Three times he has represented the Society as their delegate to the Royal Society of Canada at Ottawa, and he has been a member of the Editing Committee of the *Canadian Entomologist* since 1889.

While filling the arduous position of Chaplain to the immigrants landing in Canada, under the auspices of the Society for Promoting Christian Knowledge, he devotes any spare moments that he can get to the study of entomology. He has succeeded, with an energy and enthusiasm worthy of admiration, in forming an extensive collection of insects and acquiring a knowledge of the science beyond what is ordinarily met with. That he may long continue to carry on his excellent work, both in his official position and in his scientific pursuits, is the hearty wish of all his friends.

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