

TWENTY-EIGHTH ANNUAL REPORT  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
ONTARIO  
1897.

*(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO*

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PRINTED BY ORDER OF  
THE LEGISLATIVE ASSEMBLY OF ONTARIO.

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1898.

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Officers for 1897-1898  
ANNUAL MEETING

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Report of the Secretary

Report of the Treasurer

Report of the Librarian

Report of the Editor

Report of the Executive Committee

Report to the Members

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**JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.**

Dominion Entomologist and Botanist, President of the Entomological Society of Ontario, 1886-88.





LIBRARY OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, LONDON, ONT.

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*To the Honore*

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*To the Honorable John Dryden, Minister of Agriculture :*

SIR,—I have the honour to transmit to you the twenty-eighth annual report of the Entomological Society of Ontario. It contains a full account of the proceedings at our thirty-fifth annual meeting, which was held in the City of London, on the 12th and 13th of October last, for the election of officers, the reading of papers and the transaction of the general business of the Society. The report includes the financial statement of the Treasurer and the reports of the various sections and departments of the Society, as well as the papers read and addresses delivered during the course of the meeting. Much attention was given to the alarming outbreak of the San Jose Scale insect in various parts of Ontario, and a valuable paper on the subject is included in this report.

The *Canadian Entomologist*, the monthly magazine issued by the Society, has now completed its twenty-ninth volume, and begun the publication of the thirtieth ; this is a record unequalled by any other monthly publication on entomology that has appeared in North America. The recently completed volume will be found to contain a large number of highly scientific and valuable papers contributed by the most eminent students of this department of science in Canada and elsewhere.

I have the honor to be, Sir,  
Your obedient servant,

CHARLES J. S. BETHUNE,  
Editor.

TRINITY COLLEGE SCHOOL,  
PORT HOPE.

## OFFICERS FOR 1897-8.

<i>President</i> .....	HENRY H. LYMAN, M.A.....	Montreal
<i>Vice-President</i> .....	PROFESSOR J. H. PANTON, M.A., F.G.S.....	Guelph.
<i>Secretary</i> .....	W. E. SAUNDERS.....	London.
<i>Treasurer</i> .....	J. BALKWILL .....	do
<i>Directors :</i>		
Division No. 1 .....	W. H. HARRINGTON, F.R.S.C.....	Ottawa
“ 2 .....	J. D. EVANS .....	Trenton.
“ 3 .....	ARTHUR GIBSON .....	Toronto.
“ 4 .....	A. H. KILMAN.....	Ridgeway.
“ 5 .....	R. W. RENNIE .....	London.
<i>Ex-Officio Directors (Ex-Presi-</i>	{ PROF. WM. SAUNDERS, LL.D., F.R.S.C., F.L.S..	Ottawa.
<i>dents of the Society)....</i>	{ REV. O.J.S. BETHUNE, M.A., D.C.L., F.R.S.C.,	Port Hope.
	{ JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.....	Ottawa.
	{ JOHN DEARNESS, I.P.S .....	London.
<i>Librarian and Curator</i> .....	J. ALSTON MOFFAT .....	do
<i>Auditors</i> .....	{ J. H. BOWMAN.....	do
	{ WM. LOCHHEAD .....	do
<i>Editor of the "Canadian</i>	{ REV. DR. BETHUNE .....	Port Hops.
<i>Entomologist" .....</i>		
<i>Editing Committee</i> .....	{ DR. JAMES FLETCHER .....	Ottawa.
	{ REV. T. W. FYLES, F.L.S.....	South Quebec.
	{ HENRY H. LYMAN.....	Montreal.
	{ W. H. HARRINGTON.....	Ottawa.
	{ JAMES WHITE .....	Snelgrove.
<i>Delegate to Royal Society</i> .....	J. D. EVANS .....	Trenton.
<i>Delegates to the Western Fair.</i>	{ JOHN DEARNESS .....	London.
	{ W. E. SAUNDERS.....	do
<i>Committee on Field Days</i> ....	{ DOCTORS WOOLVERTON AND HOTSON, MESSRS.	
	{ SPENCE, BALKWILL, RENNIE, ELLIOTT,	
	{ BOWMAN, ANDERSON, SAUNDERS AND LAW..	London.
<i>Library and Rooms Committee.</i>	{ MESSRS. MOFFAT, BETHUNE, DEARNESS, SAUN-	
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## ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1897.

The thirty-fifth annual meeting of the Entomological Society of Ontario was held in its new room in the Young Men's Christian Association Building, Wellington Street, London, on Tuesday and Wednesday, October 12th and 13th, 1897, the President, Mr. J. W. Dearness, of London, occupying the Chair.

The meeting was called to order at 2.30 p.m., on Tuesday, when the following members were present: Dr. James Fletcher and Mr. W. H. Harrington, Ottawa; Mr. H. H. Lyman, Montreal; Rev. T. W. Fyles, Quebec; Mr. J. D. Evans, Trenton; Rev. C. J. S. Bethune, Port Hope; Mr. T. Hart, Woodstock; Messrs. W. E. Saunders (Secretary), J. A. Balkwill (Treasurer), J. A. Moffat (Curator), J. H. Bowman, C. D. Anderson, and J. Law, London.

Letters of apology were read from Prof. Panton, of Guelph, who had been seriously ill for some weeks, and Mr. Arthur Gibson, of Toronto, regretting their inability to attend. The Chairman also reported that Mr. A. H. Kilman, of Ridgeway, one of the Directors of the Society, was ill in a hospital at Buffalo, N.Y.

The first paper was read by the Rev. T. W. Fyles on "An Arctian Larva—What is it?" and was illustrated by specimens of the moth from which the eggs were obtained and of some varieties of *Hyphantria cunea*. Dr. Fletcher, in commenting on the paper, said that Dr. Riley, in the Report of the Entomological Commission on Forest Insects, page 246, had figured ten varieties of this moth ranging from the common pure white, immaculate form to one profusely dotted with black and brown, and expressed his belief, founded upon the frequent breeding of specimens, that these are all varieties of one species, which should be known by Drury's name of *H. cunea* rather than *H. textor*, Harris.

Mr. Lyman said that this was an opposite case to that of *Euchotes collaris* and *egle*, which were supposed for a long time to be the same, but were found by breeding to be different species.

Mr. Lyman read a paper by Mr. Winn and himself entitled "Notes on *Grapta Interrogationis*," which will be published in the December number of "The Canadian Entomologist." This butterfly was very abundant about Montreal and other parts of the Province of Quebec during the season of 1896. Advantage was taken of this abundance by the authors of the paper to rear the insect from egg to imago in considerable numbers and in this way to settle some doubtful points in its life history. They described the various incidents that related to the rearing, egg-laying, duration of moults and of larval and pupal stages, emergence of the imago, etc. The larvæ were fed on elm and hop, in confinement and out-of-doors, and many in their natural condition were found to be severely parasitized. Out of one batch of 101 eggs laid by a single female, Mr. Lyman made a microscopical examination of fifty-two, and found that of these thirty-one had nine ribs and twenty one had ten. This year (1897) only one specimen of the butterfly was seen by Mr. Winn.

Mr. Fyles spoke of the former rarity of this butterfly in the Province of Quebec, and how for a few years it became fairly common, culminating in the remarkable abundance during 1896.

Dr. Fletcher drew attention to the fact observed by Mr. Lyman that the eggs laid by a single female had a variation in the number of ribs, though Mr. Scudder had supposed that each female would lay eggs with the same number of ribs, the number possibly varying with different individuals. The ordinary food plant is the elm, but it feeds also on nettle as well as hop. He found that the butterflies of the *Vanessa* group were very variable as regards the number of individuals from year to year. Sometimes *V. antiopa* was so abundant on the young elms at the Ottawa Experimental Farm that the larvæ had to be destroyed in order to save the trees.

Dr. Fletcher then brought up the subject of facilities for obtaining illustrations for "The Canadian Entomologist," and asked for information regarding cost, length of time required for execution, etc. Dr. Bethune in reply gave a full explanation of what was done regarding the many beautiful plates and excellent wood cuts that had appeared in the magazine during the last year or two, and pointed out the difference in the mode of preparing photo-gravures and process reproductions and their relative cost.

The meeting then adjourned till the evening, and the Council at once held a session for the transaction of business. The President remarked upon the removal of the Society's property since the last annual meeting to their new quarters, and the work done by the Curator in the moving. The local committee thought that some substantial expression of the Society's appreciation of the work that Mr. Moffat had performed should be made.

Mr. Balkwill said that there had been a great deal of extra labour involved in the moving, packing and unpacking of the cabinets and specimens, the taking down and rearranging of the library, etc., and that all had been done with so much care that no books or specimens were damaged in any way.

Mr. Fyles congratulated the members on their happy removal from the old building to the present cheerful room, and the escape from the beating of drums and other noises from the Salvation Army barracks below that often proved a serious annoyance. He thought that the thanks of the Council were fully due to the Curator, and that some substantial recognition of his careful work and extra labour should be made.

Dr. Fletcher concurred in the congratulations on the removal into so nice a room and into so fine a building, and he considered that the Society was under great obligation to Mr. Moffat for his unfailing kindness for many years to all the members of the Society in naming specimens and doing other work which could not be fairly said to be included in his duties.

Mr. Balkwill, in presenting the following resolution, said that the sum was not as large as he would like to see given, but he thought that it was all that the limited funds of the Society could afford. He then moved, seconded by Mr. W. E. Saunders, That the Council desire to place on record their appreciation of the services of the Curator, Mr. J. Alston Moffat, during the removal of the books and specimens from the former to the present room, and it is resolved that the sum of twenty-five dollars be given to Mr. Moffat in recognition of his labour on this occasion—*Carried*.

The question of the heating of the room was next discussed, and it was then stated that it was inadequate in the autumn and early winter and again in the spring. The President was authorized to bring the matter before the officials of the Y. M. C. Association in order that the difficulty might be remedied, and also to sign and execute the lease.

Dr. Bethune drew attention to a suggestion of the President that each Director of the Society should be expected to make at the annual meeting a short report on the insects in his district which had been of special note during the season; he thought it an admirable idea and one that if carried out would add much to the value and interest of the annual report. The suggestion was highly approved of by those present, and it was decided that it should be the duty of the Directors in future to make such reports.

Mr. Fyles, at the request of Dr. Fletcher, gave an interesting account of the formation of the Quebec Branch of the Society, which was already so successful and numbered about five and twenty members.

In the evening the Society held a public meeting in its new room on Wellington street, at which there was a largely increased attendance of members and friends. In addition to those who were present during the day may be mentioned Messrs. H. P. Bock, B. Green, T. Green, R. W. Rennie, W. Scarrow, W. Percival, J. B. Spencer, W. Loch-head and Drs. Woolverson and Stevenson, London. The chair was taken by the President, Mr. Dearness, at 8 o'clock, and the meeting was opened by the reading of the report of the Council for the past year by the secretary, Mr. W. E. Saunders, which was on motion adopted.

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## REPORT OF COUNCIL.

The Council of the Entomological Society of Ontario have much pleasure in presenting the following report of their proceedings during the past year :

They have great gratification in stating that the work and influence of the Society have been much extended, and its membership increased by the formation of Branches in Toronto and Quebec. "The Toronto Entomological Society" was formed in February, 1896, with Mr. E. V. Rippon as president, and Mr. Arthur Gibson as secretary; regular fortnightly meetings were held and much enthusiasm was displayed by the members. Towards the end of the year the desirability of affiliating with our Society was brought before the members, and after full deliberation it was decided to join us on the first of January, 1897, and to become a Branch of this incorporated Society in accordance with the terms of our constitution. A few months later another Branch of the Society was formed at Quebec through the exertions of our colleague, the Rev. T. W. Fyles, and twenty more names were added to our roll of membership. The old established Branch at Montreal is as vigorous as ever and continues to accomplish much good work. The Society has now four centres for holding regular meetings and promoting the welfare and extending the usefulness of the students of entomology in Canada. It is to be hoped that before long similar work may be carried on in the Maritime Provinces where little interest has yet been shown in this department of natural science, but where a great deal of important work could undoubtedly be done.

The twenty-seventh annual report on Economic and General Entomology was presented to the Minister of Agriculture for Ontario in December last, and was printed and distributed in the beginning of May. It contained one hundred and twenty-seven pages and was illustrated with one hundred and three wood cuts and six full page plates. With the exception of the first report (1870) it was the largest volume yet issued by the Society and contained more illustrations than any previous one. In addition to an account of the proceedings at the last annual meeting, the report contains the annual address of the president, Mr. John Dearness, and the following interesting and important papers: "Some insectivorous Mammals," by Mr. Robert Elliott; "Notes on the Season of 1896," by Messrs. Fyles, Fletcher, Bethune, Moffat and Gibson; "Entomology for Rural Schools," and "Two Insect pests of 1896," (the Army-worm and Tussock moth) by Prof. Panton; "The importance of Entomological Studies to an Agricultural and Fruit-Growing Community," and "Lepidopterous Pests of the Meadow and the Lawn," by the Rev. T. W. Fyles; "Some beetles occurring upon Beech," by Mr. W. H. Harrington; "The San Jose Scale" and "Warning Colours, protective mimicry and protective coloration," by Prof. F. M. Webster.

*The Canadian Entomologist*, the monthly magazine published by the Society, completed its twenty-eighth volume in December last. Ten numbers of the twenty-ninth volume have now been issued; they contain 248 pages and are illustrated with eight full page plates, several of them of great beauty, and a number of original wood cuts. Among the many valuable papers published may be mentioned the continuation of the series of illustrated articles on the Coleoptera of Canada, by Prof. H. F. Wickham, which are most useful to students of this order, and are specially designed to be of assistance to beginners of the study of our beetles. It is with profound regret that the Council have learnt from Prof. Wickham that he is obliged to abandon the study of systematic entomology on account of trouble with his eyes, and they desire to express their deep sympathy with him in this affliction which so seriously interferes with his valuable and important work.

A number of interesting specimens of moths new to the Canadian lists have been added to the Society's collection by the kindness of Mr. J. Bice who has been a diligent collector at the electric lights in the city of London.

In the latter part of November, 1896, the Society removed its head quarters from the rooms it had occupied for over sixteen years in Victoria Hall on Clarence street to more accessible, commodious and better lighted premises in the Young Men's Christian Association fine new building on Wellington street. The cases of books and insects were

safely and conveniently installed without loss or injury under the careful management of the curator, Mr. J. Alston Moffat. In the new rooms the Council believe that the valuable property of the Society will be safer from fire and more easily reached by the members and the public. (See Plate 2 which shows a part of the Library.)

The Librarian's report will show that a large number of volumes of scientific Societies' publications and pamphlets have been bound and placed for consultation on the shelves. The "Canadian Entomologist" is exchanged for the proceedings of various scientific and learned societies in all parts of the world. The number of such exchanges at present on the list is 74.

The Council desires to express its entire satisfaction with the efficient manner in which the curator, Mr. J. Alston Moffat continues to discharge his duties.

The Treasurer's report shows that the finances of the Society are in a very satisfactory condition. While the expenses have been necessarily increased, owing to the change of rooms and the cost of removal, the balance on hand will no doubt be sufficient to provide for the expenditure that will be required during the remainder of the year.

The reports of the Secretaries of the several scientific sections of the Society, printed elsewhere, show that they continue to hold regular meetings and to accomplish much useful work.

The Society was represented at the meeting of the Royal Society of Canada, held at Halifax, Nova Scotia, in the month of June last, by Mr. J. D. Evans, of Trenton, whose report is published herewith. At the meeting of the British Association for the Advancement of Science, held in Toronto in August, the Society was represented by the president, Mr. J. Dearness, and the editor, Dr. Bethune, and was attended by several other of the members.

All of which is respectfully submitted.

LONDON, October 12, 1897.

JOHN DEARNESS,  
President.

#### REPORT OF THE MONTREAL BRANCH.

The 207th regular and 24th annual meeting of the Montreal Branch of the Entomological Society of Ontario was held in the rooms of the Natural History Society of Montreal on 25th May.

The following members were present: Messrs. H. H. Lyman, President; A. F. Winn, Vice-President; G. C. Dunlop, T. Dwight Brainerd, A. Griffin, J. B. Williams, E. A. Norris, H. T. Pye, L. Reford, O. Stevenson, G. A. Moore and L. Gibb, Sec.-Treas.

The chair was taken by the President and the minutes of the previous regular meeting were read and confirmed, and the minutes of the last annual meeting were also read.

The President then submitted the following report of the Council for the past year:

#### REPORT OF COUNCIL.

In presenting their twenty-fourth annual report the Council have much pleasure in referring to the continued prosperity of the Branch.

Since our last annual meeting two new members have been added to our roll, but two others have resigned and we have also to deplore the loss by death of Mr. George Kearley, whose genial disposition and interest in the Branch and its work had won our high esteem.

During the year eight meetings have been held, at one of which we had the pleasure of the attendance of the Rev. Dr. Bethune, whom our members had thus the pleasure of meeting for the first time, and the following papers and communications were read:

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Nasturtium as a food plant of *Pieris Rapæ*. A. F. Winn.

Description of two remarkable aberrations of *Colias Philodice*. J. D. Brainerd.

Address on the past season. Rev. Dr. Bethune.

The Crambidae of the Province of Quebec. Rev. T. W. Fyles.

Notes on *Grapta Interrogationis*. A. F. Winn.

Notes on *Grapta Interrogationis*. H. H. Lyman.

A novel breeding cage. E. A. Norris.

Butterfly books. H. H. Lyman.

Description of the larva and pupa of *Aulax Nabali*. Rev. T. W. Fyles.

Notes on the past season of 1896 at Edgarstown, Mass. T. D. Brainerd.

Notes on *Colias Cæsonia*. Sent by T. E. Bean.

Notes on the occurrence of *Thyatira Rectangulata* in Canada. A. F. Winn.

Notes on the season of 1896. H. H. Lyman.

During the season several of our members again co-operated with the Natural History Society in continuing the course of short lectures to young people, on Saturday afternoons, with, it is believed, encouraging results.

Greetings have been exchanged with the newly formed Toronto Branch and we rejoice to learn that another branch has been formed in this Province, in the ancient City of Quebec, where a branch formerly flourished.

The Treasurer's report shows that the finances of the Branch are in a satisfactory condition.

Respectfully submitted on behalf of the Council.

H. H. LYMAN,  
President.

The Treasurer then submitted his report, which showed an accumulated balance on hand of \$35.46.

Upon the motion of Mr. G. C. Dunlop, seconded by Mr. O. Stevenson, the reports of the Council and Treasurer were received and adopted.

The President then read his annual address, giving a resume of the past year's work and pointing out a few lines for future guidance.

Some discussion then took place upon the suggestion to obtain a cabinet for a general collection for the Branch, the matter being finally left in the hands of the incoming council.

The following officers were then elected for the ensuing year:

*President*—HENRY H. LYMAN.

*Vice-President*—A. F. WINN.

*Secretary-Treasurer*—LACHLAN GIBB.

*Council*—G. C. DUNLOP and T. DWIGHT BRAINERD.

The meeting then adjourned.

LACHLAN GIBB,  
Secretary-Treasurer.

## REPORT OF THE QUEBEC BRANCH.

The Quebec Branch of the Entomological Society of Ontario came into existence at the close of a course of lectures on natural science given in Morrin College during the winter of 1896-97.

It was thought desirable that an interest in entomological and botanical pursuits should be continued during the summer vacation and to promote this interest the formation of an Entomological Association was determined upon.

At a meeting held in Morrin College on Wednesday, April 7th, and presided over by Reverend Principal Macrae, M.A., D.D., a constitution was adopted, officers were chosen and a resolution asking for recognition by the Ontario Society was agreed upon.

The following is the list of officers :

*President*—REV. PROFESSOR FYLES.

*Vice-President*—MISS MACDONALD, Principal of the Quebec Girls' High School.

*Secretary-Treasurer*—LIEUT.-COL. CRAWFORD LINDSAY.

*Council*—MESSRS. J. GEGGIE, RICHARD TURNER and J. EVELEIGH TREFFRY : The MISSES BICKELL and B. WINFIELD.

On the 10th of May, the members met at the house of the President to examine his extensive collections. On this occasion the equipments necessary for a working entomologist were examined, and the methods of capturing, preserving and mounting insects were noted.

A field day was held at the "Gomin" on June 12th, when a number of rare specimens were taken. The presence and help of Messrs. Winn and Brainerd, of the Montreal Branch, added greatly to the day's enjoyment.

After the summer holidays, the members again met to compare and identify specimens. The President gave an address on the condition of the insect world in the winter months; and Professor Walters one on "Entomological Experiences at Bourg Louis." *Colias interior*, *Terias lisa*, *Phyciodes Harrisii* and other rare insects were taken by Mr. Walters at that place.

By kind permission of the authorities of Morrin College, the members of the Branch enjoy the privilege of holding their regular meetings in the College Buildings and of attending the College lectures on natural history.

W. A. CRAWFORD LINDSAY,  
Secretary-Treasurer.

## REPORT OF THE TORONTO BRANCH.

The first annual general meeting of the Toronto branch was held in the Society's room, 451 Parliament street, on Friday evening, the 2nd April, 1897.

The following members were present: E. V. Rippon, President; Arthur Gibson, Secretary-Treasurer; T. G. Priddey, Librarian-Curator; C. T. Hills, R. J. Grew, C. H. Tyers, J. H. McDunnough, H. S. Austen, Arthur Cherry and H. D. Chipman.

The Secretary read the following report of the Council, which was duly adopted:

## REPORT OF COUNCIL.

The Council of the Toronto branch of the Entomological Society of Ontario take pleasure in presenting the following report of the proceedings of the Society during the past year.

While the Council feel that the organization severed their interests to hope that

A most Toronto Entomological Society took place as the Toronto

During the following list of

March 1

March 5

April 2

April 17

May 1st  
E. V. Rippon

May 15

September

October

December

January

February

March 5

The number of fifty-two papers which have been

Considered during the last year, a list of specimens, a list

The Treasurer Among the expenses of purchase of

Respectfully

The report was duly adopted

The election of

President

Vice-President

Secretary

Curator

Council.

The President congratulated the members on the first year of the

While the membership of the Society has not increased to any great extent, yet the Council feel that the first year of the Society's existence has been a success. Since organization eight new members have been added to the roll. Of these eight, five have severed their connection with the Society, while the other three are still interested in its welfare. The membership now numbers twelve, and the council have every reason to hope that these figures will be increased during the coming year.

A most important event in connection with the Society was the affiliation of the Toronto Entomological Society with the Entomological Society of Ontario. This affiliation took place on the 1st January last, since which date the Society has been known as the Toronto Branch of the Entomological Society of Ontario.

During the past year twenty-four ordinary meetings have been held, and the following list of papers, contributed by the members, added much to their success:

March 6th, 1896.—The Classification of Insects, by Mr. T. G. Priddey.

March 20th, 1896.—A Few Notes on Coleoptera, by Mr. R. J. Crew.

April 2nd, 1896.—The Sphingidae, or Hawk Moths, by Mr. Arthur Gibson.

April 17th, 1896.—Notes on the ova of Lepidoptera, by Mr. C. T. Hills.

May 1st, 1896.—A new species of Diptera, belonging to the Genus *Diopsis*, by Mr. E. V. Rippon.

May 15th, 1896.—Mysteries of Insect Life, by Mr. T. G. Priddey.

September 18th, 1896.—Notes on Toronto Sphingidae, by Mr. J. H. McDunnough.

October 2nd, 1896.—Notes on Collecting Coleoptera, by Mr. R. J. Crew.

December 4th, 1896.—Injurious Insects, by Mr. C. H. Tyers.

January 8th, 1897.—Sense of Sight in Insects, by Mr. S. R. Carter.

February 5th, 1897.—The Uses of Insects, by Mr. Arthur Gibson.

March 5th, 1897.—Obnoxious Insects, by Mr. T. G. Priddey.

The number of volumes in the library at the present date is forty-six, besides some fifty-two pamphlets, Government bulletins, etc., all relating to Entomology, and all of which have been kindly donated to the Society during the past year.

Considerable work has been done on the Society's collection of insects, especially during the last few months, and through the kindness of the members in presenting specimens, a fair number of insects are now in the Society's possession.

The Treasurer's report shows that the finances are in a satisfactory condition. Among the expenditure will be noticed that a considerable sum has been spent in the purchase of chairs, cases, etc., and also for rent of room.

Respectfully submitted on behalf of the Council.

E. V. RIPPON,  
President.

The reports of the Treasurer and Curator-Librarian were submitted and on motion duly adopted as read.

The election of officers for the ensuing year resulted as follows:

*President*.—E. V. Rippon.

*Vice-President*.—R. J. Crew.

*Secretary-Treasurer*.—Arthur Gibson.

*Curator-Librarian*.—T. G. Priddey.

*Council*.—C. T. Hills and C. H. Tyers.

The President then addressed the meeting, and in the course of his remarks congratulated the members on the work done during the year, and felt certain that the first year of the Society's existence had been a success. During the coming season he

hoped that each member would take a special interest in some particular species, working out the life history of at least one insect, and also that considerable time would be spent in the study of those insects which are beneficial or injurious to mankind. In the United States particularly economic entomology is making great strides, and Mr. Rippon advised the members to give particular attention during the coming season to those insects which are known to be injurious. Concluding, Mr. Rippon thanked the members for the honor conferred upon him in re-electing him to the position of President for the ensuing year.

The meeting then adjourned.

ARTHUR GIBSON,  
Secretary.

#### REPORT OF THE BOTANICAL SECTION.

The Botanical Section organized in April.

A paper, illustrated with a fine series of examples, on *Narcissus* was presented by Mr. J. B. Bond.

One evening was devoted to Prof. Bailey's work on Plant Breeding, led by Mr. Dearnness.

Another interesting paper by Mr. Bond on *Iris* afforded material for an evening's profitable discussion.

The other meetings were more or less informal and were occupied by examining and discussing specimens brought by the members.

Additions to the local flora were *Draba Caroliniana*, *Anthemis arvensis*, and *Specularia perfoliata*. Messrs. Bowman, Dearnness, Elliott and Balkwill were the chief collectors.

J. B. BOND, Chairman.  
ELLIOTT RICHMOND, Secretary.

#### REPORT OF THE GEOLOGICAL SECTION.

The Section in Geology beg to submit their annual report as follows:—

The meetings have been held weekly throughout the year with the exception of six weeks in midsummer.

During this interval several of our members made holiday excursions to various parts of our country, for the collection of material, and gaining useful information on subjects pertaining to our branch of science.

We have extended our trips to a greater distance from home than usual.

Mr. George Kirke spent several weeks in the northwest mineral regions in the vicinity of Rossland.

Mr. Brown spent five or six months prospecting on the north shore of Lake Superior and in the Wabigoon district.

Mr. A. Blackburn has been opening mines in the Lake of the Woods district.

Dr. Woolverton, chairman of the Section, has lately returned from collecting minerals from the north Hastings gold fields.

This shows great activity on the part of our members, and a determination to become better acquainted with the mineral resources of our country.

Our removal to the present room provided by the parent society, has not given us, as we anticipated, any more room for the display of specimens pertaining to our particular section. In other respects it is all that could be desired.

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Many specimens of ores have been received, and placed upon the table, from various mining locations throughout the country, and we are pleased to learn that a large collection of minerals and ores from British Columbia has lately been sent, as a gift to our Public Library collection, to which our members will have free access.

The subjects studied during the year were various.

We reported to the local papers the find of coal or anthraxolite in the vicinity of Sudbury. Its value as a fuel has not yet been definitely settled by geologists.

We received the borings of various wells put down for oil in the vicinity of London, viz. :—Delaware, Parkhill and Mount Brydges, only a slight trace of oil being met with so far, showing that they are not within the true oil belt.

The Section has been materially assisted by donations of some of the products of the factories at Niagara Falls—resulting from the great electrical power now generated at that point.

Dr. Hough, a resident of that place, sent a small box containing carbide of calcium from which is made acetylene gas, which is likely to prove of some importance in the near future.

We also obtained from the proprietor of the carborundum works, fine specimens of this material, which, in hardness exceeds anything in nature or art except the diamond. This may be called the first step in the manufacturing of diamonds.

By vote of the Section the chairman was asked to attend the meeting of the British Association for the Advancement of Science at Toronto and report thereon, which was satisfactorily carried out.

Papers were read by the following members of the Section :

- I. Dr. Wilson.
- II. Mr. Geo. Kirke.
- III. Mr. Goodburn.
- IV. Mr. John Law.
- V. Mr. D. G. Buchanan.

Steps are being taken to establish a public collection as a nucleus for a museum in our Public Library.

Our members are ready to assist in carrying out the project to a successful issue as this would assist them in their work and also widen the sphere of influence in the Geological Section.

Submitted on behalf of the Section.

S. WOOLVERTON, Chairman.  
JOHN LAW, Secretary.

A large and very handsome specimen of carborundum was exhibited to the meeting by Dr. Woolverton, who procured it from the works at Niagara Falls.

#### REPORT OF THE MICROSCOPICAL SECTION.

During the past season, meetings were held every two weeks after the opening meeting, until the close of the term in March. The average attendance was eight members. In addition to these meetings the Entomological Society kept open house on the first of January, 1897, this being the formal opening of the Y. M. C. A. building, in which the Society's new rooms are located, and on this occasion one of the principal attractions was the exhibit of microscopic objects by the members of this Section, and much interest was shown by the numerous visitors in the display. Eight or nine members took part, and the rooms were kept open all day as well as in the evening.

Among the papers read at the meetings of this year were the following: A Study of Lichens, by Prof. John Dearnness; a subsequent evening being devoted to the practical handling, examination, and the mounting of these interesting plants, under the direction of the same gentleman.

The Growth of Ferns, by Wm. Lochhead, M.A., illustrated by blackboard drawings and figures drawn by the speaker from microscopic mounts.

Observations on microscopic and other forms noted during a recent trip across the Continent, by W. E. Saunders; illustrated by specimens of interest in various branches of natural life.

Microscopic Manipulation, by R. W. Rennie, illustrated by beautiful pieces of apparatus made by the speaker. The attendance and interest in the meetings were good, and on the whole, the Section looks back on a fairly satisfactory year.

J. H. BOWMAN, Secretary.

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

Having been chosen as the Delegate to represent the Entomological Society of Ontario on this most interesting occasion, the commemoration of the landing of Cabot, it becomes my privilege to submit a report of its work and proceedings during the past year.

The membership of the Society I am pleased to report has been well maintained and in addition thereto it is very gratifying to be able to say that on or about the opening of the current year a branch of this Society was inaugurated in Toronto by the affiliation of the Local Society formed about a year before, thus starting out with quite a considerable membership and manifesting much enthusiasm under the new regime.

The additions to the library were quite important including, among others, a full set of the annals of the "Entomological Society of France." The additional volumes, numbering nineteen, thus bringing the total library register up to 1,418 volumes.

There was also a limited addition to the collection of insects.

The official organ of the Society, "The Canadian Entomologist," still maintains its high standing among its class of literature. During the year 1896 it completed its twenty-eighth volume of 319 pages. Of the forty eight contributors thirty were from the United States, two from New Mexico, one from New Zealand, two from Europe, the remaining thirteen being Canadian. The contributors aggregated eighty-six articles, in some of which were described one hundred and eleven new species and four new genera.

Among the more important papers published during the year the following deserve particular mention.

The Coleoptera of Canada, by Prof. H. F. Wickham. These are a very useful series of illustrated articles for beginners as well as those more advanced. They were continued through five numbers and are a continuation of similar articles in two previous years.

The North American species of Gnathodus, by Mr. Carl F. Baker.

The American species of Isotoma, by Mr. Alex. D. MacGillivray.

Canadian Hymenoptera No. 7, by Mr. W. Hague Harrington, F.R.S.O.

A Contribution to the knowledge of North American Syrphidae, by Mr. W. D. Hunter.

Lepyrus, by John Hamilton, M.D.

The Cigar case bearer of the Apple (*Coleophora Fletcherella*), by Dr. Jas. Fletcher.

New American parasitic Cynipidae (*Allotriinae*), by Mr. Carl F. Baker.

The larger species of *Argynnis* and the mystery of their life history, by Mr. H. H. Lyman, M.A.

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On two interesting new genera of scale insect parasites, by Mr. L. O. Howard.  
 Index to the Mantidae of North America north of Mexico, by Mr. Samuel H. Scudder.

A summary of the members of the Genus *Chilosia*, Meig, in North America with descriptions of new species, by Mr. W. D. Hunter.

Some notes on Insect enemies of trees, by Mr. A. D. Hopkins.

Some new Nematids, by Mr. C. L. Marlatt.

Notes on the preparatory stages of *Erebia Epipsodea*, Butler, by Mr. H. H. Lyman, M.A.

A number of book notices, current publications of Entomological literature, correspondence, obituary notices, etc., also appear. At this time it will not be inopportune to mention the serious loss to the Society, from death, of two of its very active members, Mr. John M. Denton of London, and Captain J. Gamble Geddes, of Toronto.

The thirty-fourth Annual Meeting of the Society was held in its rooms, in London, on Wednesday and Thursday, the 21st and 22nd of October, 1896. A very full report of these proceedings is given in the Annual Report published by the Society (in addition to the Monthly Magazine) to the Department of Agriculture of the Province of Ontario.

This report consists of 127 pages replete with numerous illustrations. Two plates of these illustrations are worthy of particular mention as illustrating the study of economic entomology in the public schools, a work which should be heartily commended.

In addition to the report of the proceedings of the parent Society in which is embodied an extended and interesting Annual Address from the President, it contains also—

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

The report of the Montreal branch with the annual address of its President.

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

The following papers also appear in this annual report, viz.

Notes on the Season of 1896, by Rev. T. W. Fyles, F.L.S.

Some Insectivorous Mammals, by Mr. Robert Elliott.

Entomology for Rural Schools, by Prof. J. Hoyes Panton. Especially to be commended for the introduction and propagation of knowledge of economic Entomology among the children of both sexes.

The Importance of Entomological Studies to an Agricultural and Fruit-growing Community, by Rev. Thos. W. Fyles, F.L.S.

Two Insect Pests of 1896, by Prof. J. Hoyes Panton.

Notes on Insects of the Year 1896, by Rev. C. J. S. Bethune.

Insect Injuries to Ontario Crops in 1896, by Dr. Jas. Fletcher.

Some Beetles Occurring upon Beech, by Mr. W. Hague Harrington, F.R.S.C.

Notes on the Season of 1896, by Mr. J. Alston Moffat.

Warning Colours, Protective Mimicry, and Protective Coloration, by Prof. F. M. Webster.

The San Jose Scale, by Prof. F. M. Webster. A very exhaustive and valuable treatise on the subject.

Lepidopterous Pests of the Meadow and the Lawn, by Rev. T. W. Fyles, F.L.S.

Rare Captures During the Season of 1896, by Mr. Arthur Gibson.

The Butterflies of the Eastern Provinces of Canada, by Rev. O. J. S. Bethune.

The Geological Section reported that regular meetings were held weekly during the year with a fair attendance. Several places of geological interest had been visited by members and collections made. Valuable papers had been read, also four or five lectures given.

A collection of minerals having been presented by the Dominion Government to the free library, which is accessible to our members, will be an incentive to more active work and increased membership.

The Botanical Section reported that the weekly meetings from the 1st May to the middle of July were well attended, several very pleasant outings had been held, and that the work of the year had been encouraging.

The Microscopical Section reported having had a year of continued success with fortnightly meetings from October 11th to April 17th, when its meetings were discontinued in favor of the Botanical Section. The subjects studied were arranged under ten different classifications, each led by a different member.

Each of the Sections above enumerated, as well as the parent society, look forward with anticipations of much greater usefulness and increase of membership upon occupying the new suite of rooms which have been secured and are now occupied.

The Montreal Branch presented its twenty-third annual report which showed a very marked increase in the membership. Eight meetings had been held during the course of the year at which ten excellent papers had been read, and the financial status was explained to be in a very healthy condition. The President's annual address was a very impressive one, urging upon the members to undertake and work up some special subjects among the very many open and now neglected, and enumerating a long list of such.

JOHN D. EVANS,  
Delegate.

### ANNUAL ADDRESS OF THE PRESIDENT.

BY JOHN DEARNESS, I.P.S., LONDON.

#### *Members of the Entomological Society of Ontario :*

LADIES AND GENTLEMEN,—It is my pleasant duty this evening to welcome you to the thirty-fifth annual meeting of the Society.

Since our last annual gathering our quarters have been removed from a room in the highest flat of the old Victoria Hall to these commodious and well lighted apartments in the beautiful new Y.M.C.A. Building. The removal of the cases, library, instruments, etc., a difficult matter, was well directed by the librarian, assisted by Mr. Balkwill. It was effected without accident or injury to the glazed cases or specimens. The librarian merits our commendation and thanks for the pleasing and convenient arrangement of the library, specimens and furniture of the Society in these rooms.

The year's work of the parent Society will be disclosed as the meeting progresses. Reports of branch societies and of the sections into which the members break up for the practical study of allied sciences will be presented by the respective officers. This year we shall have the pleasure for the first time of having reports from two new branches formed respectively in Quebec City and Toronto.

Last year we mourned the encroachment made by death in the ranks of our membership. At this meeting we are grateful that no name has thus to be taken off our roll, although our sympathies are called forth towards two of our directors who are unable to take part in the proceedings by reason of serious illness, viz., Mr. A. H. Kilman, director for the fourth division, and Professor Panton. We trust that God will bless the means employed to their speedy and complete recovery. Professor Panton's work last year was so helpful and acceptable that we miss him the more at this meeting.



Fig. 1. Army  
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Fig. 2. Eggs, p  
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Fig. 4. Tachina fly  
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THE INSECTS OF THE YEAR.

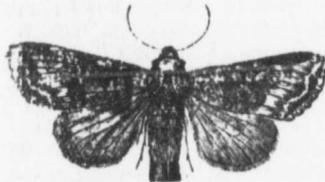


Fig. 1. Amputating brocade moth (*Hadena Arcticica*.)

stocked with the larvæ as those acres of spring grain referred to, many of which had to be re-sown. No parasite was reported on them. What became of them?

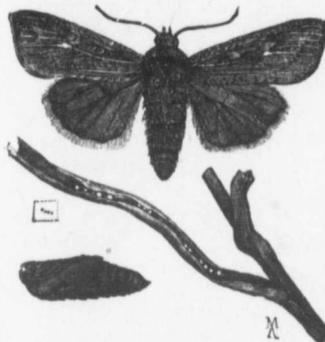


Fig. 2. Eggs, pupa and moth of the Army Worm (*Leucania unipuncta*.)

In 1896 the army-worm (Figs. 2 and 3) devastated grain fields in many townships of Ontario, as witness the dark patches of infested country shown in the map of the Province published on page 45 of our last report. To illustrate how numerous they were in one school section in my own division: a lady told me that coming along at the time when the army was migrating from a grain field on the east side of the road in search of forage farther west they were so thick on the road that the faster travellers were crawling over the others instead of seeking a way round, if, indeed one could be found, and that not knowing but that the procession might be of indefinite duration she was constrained to lift her skirts and pick her steps on tip-toe, even then very unwillingly stopping forever at every step the progress of some of the hungry marchers. The Province throughout its length and breadth was thus patched over with incalculable numbers of the army worm. True their predatory enemies, during the short season their larvæ were fair prey, waxed fat and multiplied on them. The red-tailed Tachina, or possibly the yellow-tailed one, Fig. 4, adorned many a neck with one or two pretty eggs, but notwithstanding the great losses from these and other causes the one-spotted Leucania was the most common moth to be seen in the fall even in townships where not a larva had been reported. Why was not the whole country overrun with this insect this year? The causes and conditions of the appearance and the still more curious disappearance of such insects as the amputating brocade (cut-worm) moth and army worm challenge and invite investigation.



Fig. 4. Tachina fly (*Nemorax leucaniae*.)



Fig. 3. Army Worm.

If the army worm had its "innings" last year, this year the San José Scale has had the lion's share of attention. It is to be earnestly hoped that we are more frightened than hurt, but I am truly thankful we are well frightened. So far as I know, Dr. Fletcher and Prof. Panton, the officers of the Ottawa and Guelph experiment stations, deserve the chief credit for sounding the alarm. One benefit from the scare is that it has led many people to discover what a scale-insect is and to learn that for years their fruit trees have been injured by the native or naturalized species of this class of insect. If the alarm perpetuates, as it appears to have started, a crusade against scale insects of all kinds much good will result. I have been sent or shown several things and asked whether they were the dreaded

scale. They were mostly the Oyster-shell Bark-louse, *Mytilaspis pomorum* (Fig. 5.) One or two I took to be the Scurfy Bark-louse (Fig. 6), others included the woolly aphid, insect eggs, and a species of lichen. Doubtless the experiment station officers could give a long list of similar inquiries. Attention being diverted to those minute insects the presence of the San José one will be the more promptly detected. The destructiveness of this scale and the expense and difficulty of killing it except by methods that endanger its host will, if a few more instances of its introduction from nurseries occur,



Fig. 5.  
Oyster-shell  
Bark-louse.

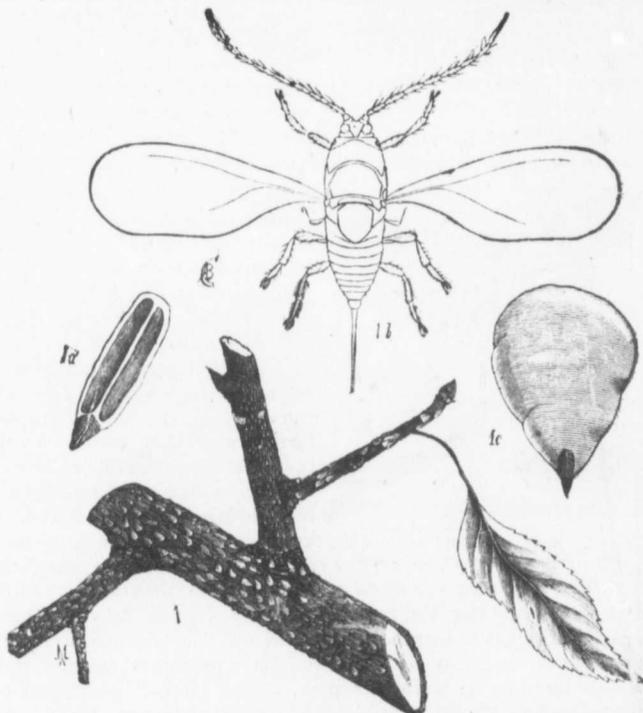


Fig. 6. The Scurfy Bark-louse (*Chionaspis furfurus*).

lead to legislation. I have met some people who had got the idea that there is a quarantine already established against nursery stock imported from abroad. Reports of the efforts to obtain such measures on the other side of the line have probably given rise to the impression. This meeting offers a fitting time and place to give an expression as to whether legislative action should be taken\*

The San José Scale, if it ever becomes established in this country, will not, like the moths above referred to, be marked by sudden disappearance, nor will it, like the codling-moth or pear *Psylla*, confine its ravages to a single species of tree, nor even to trees under cultivation. Prof. Webster, of the Ohio Experiment Station, has published a list of twenty two trees and shrubs upon which this scale has been found in his State. A list that includes plants with such dissimilar saps and cambiums as walnut, willow, elm, gooseberry, peach, grape, sumac and basswood may be extended to include almost every tree and shrub in the country. The State of Massachusetts has, within the past seven years, expended over \$600,000 in its efforts to control and exterminate the gypsy moth, but no amount of money could effect the extermination of this destructive scale insect if it once got a foothold in a widely scattered number of our woodlands and orchards.

\* In a late discussion Dr. Fletcher placed reliance for the suppression of this insect more upon the education and individual efforts of farmers and of fruit-growers than on legislation. Government might assist—as it is doing now through established agencies—but it would be most dangerous for the people to lapse into indifference owing to the belief that they are protected by an Act of Parliament against invasion by this scale insect.

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Fig. 5.) One woolly aphid, officers could minute insects destructive-methods that series occur,



In respect to protection, we have much to hope from the vigilance and energetic action of economic entomologists in the United States. In this connection much credit is due to Prof. Webster, of Wooster, for outspoken and manly denunciation of nursery companies he named who negligently contributed to the spread of this pest and of whose criminal negligence we have had a taste in Ontario. It was doubtless at his prompting that the Ohio Horticultural Society issued the call for the National Convention held in Washington last March to consider the suppression of insect pests and plant diseases by legislation. The proceedings of this convention served to direct attention to the dangers from imported insects that confront our fruit growers and to prepare the way for guaranteeing nursery stock and adopting other legislative preventives of the spread of pernicious insects and fungi.

ENTOMOLOGY IN SCHOOLS.

It must have pleased the friends of scientific education who read the last annual report to observe that the teaching of entomology in the public schools occupied so large a share of attention.

The Western Fair Board this year repeated its offer of prizes for the life histories of injurious insects exhibited by schools. The prizes were won by Mr. J. W. Atkinson's

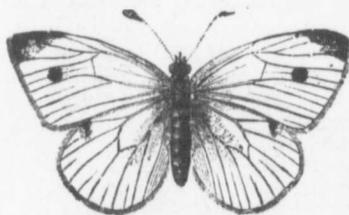


Fig. 7.—*Pieris rapae*, male.

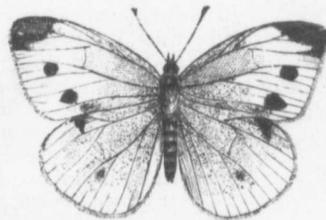


Fig. 8.—*Pieris rapae*, female.



Fig. 9.—*Pieris rapae*; a, caterpillar; b, chrysalis.

school, Avon P.O., and Miss Corsaut's, No. 15, London Township. The former exhibited the cabbage butterfly, *Pieris Rapae*, in egg, larvae (Fig. 9a) blown and in alcohol, pupae (Fig. 9b) and imagines of both sexes (Fig. 7 the male, Fig. 8 the female butterfly), pressed.

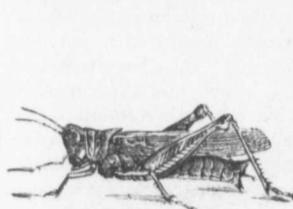


Fig. 10.—Red-legged grasshopper.

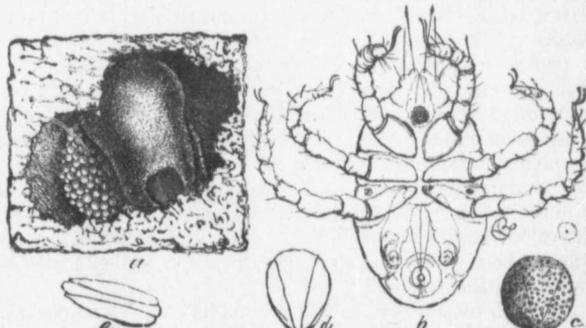


Fig. 11.—*Trombidium Locustarum*.—a, a female with her batch of eggs; b, newly hatched larva—natural size indicated by the dot within the circle on the right; c, egg; d, e, vacated shells (after Riley).

leaves showing the work of the larvae, and a readable description of the insect and account of the observations made upon its life history.

Miss Corsaut's school exhibited a series of specimens of grasshoppers (Fig. 10) one or two with parasites attached, the red mite, *Trombidium locustarum* (Fig. 11), and a dissection of a locust.

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It is to be hoped that an increasing number of county and township fair boards will follow the example of the Western in offering encouragement to the true study of insects in life. Collections of insects as commonly seen at county fairs have little claim to the honor of scientific exhibits. Their proper place is with wax flowers, rosettes of sea-weed, and other such pretty bric-a-brac. There is little scientific value in a collection of insects arranged at hap-hazard without notes and dates, be they ever so nicely spread. Economic interest in nine cases out of ten centres in the larval form of insects. Exhibits to be worthy of the name of science should attempt to show the phases of the life cycle, or at least something more than the mere capturing and preserving of a pretty object. The best prizes in the class ought to be offered for exhibits of complete representations of insects in their various stages. We should add to our extensive collections here such series of the more important economic insects, taking as a pattern this one of the gypsy moth\* which shows so well the egg, larvæ, pupa and imago of that insect.

During the year I received several inquiries from teachers near and remote asking suggestions in the matter of directing children in the practical study of insect life. Anticipating that in the future others may desire the information, I avail myself of the opportunity afforded by the printing and circulation of this report, to gratify the desire more fully and satisfactorily than I could do by letter.

At the outset the purpose of the lessons should be clearly defined in the teacher's mind. The aim should not be to fill the learner's memory with knowledge about insects but to train the young eye to see and the mind to reason about, to connect and relate the phenomena observed and to make these observations and reasonings the occasion for practice in correct expression by voice, pen and pencil.

The study, if natural, will be attractive to children. Flowers and insects are the classes of objects, next to mud pies, that they take most delight in. Now I recall Wordsworth's lines:—

" Oh ! pleasant, pleasant were the days,  
The time, when, in our childish plays,  
My sister Emmeline and I,  
Together chased the butterfly !  
A very hunter did I rush  
Upon the prey :—with leaps and springs  
I followed on from brake to brush  
While she, God love her ! feared to brush  
The dust from off its wings."

In a recent biographical sketch of that eminent training-school principal, Edward Austin Sheldon, of Oswego, by his talented daughter, there occurs this passage:—"This latter book (Harris's 'Insects Injurious to Vegetation,') was quite a classic with my father and me. We would sit in an unfurnished room of our unfinished house with the light burning so as to attract insects in at the open windows. We would soon have a delightful collection of moths, beetles and flies which we caught, killed, and then tried to determine by comparison with his book—an operation in which my father found me an enthusiastic rather than a valuable assistant. This keen and special interest in insects came about from the fact that my father's own work in the young training school was for some time zoology, and he saw that with the masses of children, insects gave one of the easiest and most inviting entrances to the whole domain of organic life. This idea, however, cost him much persecution and ridicule from those who could not understand the connection between grasshoppers and a well-educated child, not knowing grasshoppers very well themselves."

Each teacher will as skilfully as he can, introduce the study. Plans to arouse an easily obtained interest will readily suggest themselves.† The main points may be

\* The speaker here exhibited a case received from the State Entomologist Fernald illustrating all the stages in the development of this destructive insect.

† Since writing the above I have received from Prof. Roberts, director of the College of Agriculture, Cornell University, Ithaca, N. Y., a series of seven "Teacher's Leaflets on Nature Study," entitled respectively: "How a squash plant gets out of the seed," "How a candle burns, Four apple twigs, A children's garden, Some tent-makers, What is nature-study? Hints on making collections of insects. Some of the illustrations used in this paper are borrowed from leaflets Nos. 5 and 7. I can highly commend the series. The printer, W. F. Humphrey, Geneva, N. Y. is permitted to sell them to non-residents of the State at 5c. each or in large quantities at 1c. each. J. D.

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Fig. 12. Apple twig. Eleven moths. (After An

cloth; or, being remove the bottom set over a small the ground but

illustrated by one or two examples and the technique rather than the methods may be described here. Take for example the cabbage butterfly, *Pieris Rapae* (figs. 7, 8 and 9) the study of which won the first prize above referred to. For a class beginning after midsummer holidays this insect is always easily obtained. Construct a cage by covering a box of horizontal cross section of from 40 to 100 square inches with mosquito netting or cheese

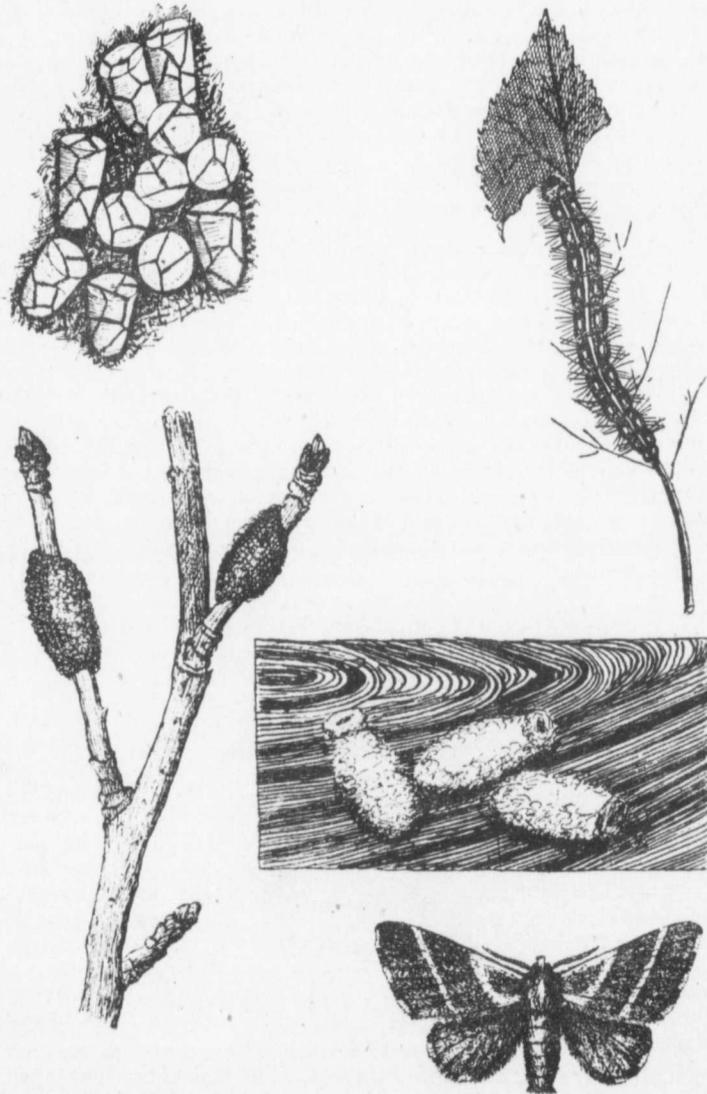


Fig. 12. Apple-tree Tent Caterpillar (*Clisiocampa Americana Harris*). Two bracelets of eggs on apple twig. Eleven eggs enlarged. A full grown caterpillar. Three cocoons under a chip. Imago of moth. (After Anna B. Comstock in Teacher's Leaflet No. 5.)

cloth; or, being more convenient for feeding and studying, take an ordinary band-box, remove the bottom and substitute a netting or cheese-cloth covering. Use the latter to set over a smaller box such as a chalk-box. Many insects pass the pupal stage buried in the ground but chrysalids of butterflies are commonly found suspended in dry situations.

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Earth to the depth of an inch may be put in the box and upon that some brushy twigs upon which to lay the leaves for food and chips to which the chrysalids may be attached. In the case of the cabbage worm, have the children collect the worms of various sizes and with them bring a leaf or parts of leaves to serve as food. If the supply of food is maintained the larvæ will eat voraciously, grow fast, and in a few days prepare to transform into pupæ or chrysalids. When these are formed, in the example under notice the box may be set away in the wood-shed or other secure cool place until the following spring awaiting the final transformation. Will you await the delightful surprise to discover to the children the connection between the beautiful white butterfly and the green cabbage-worm, (figs. 7, 8 and 9) or will you lead them to discover it when they are collecting and observing the larvæ? Circumstances will determine. You can and should stimulate a search for the youngest and smallest specimens. Some pair of sharp eyes may trace one to the egg, attached alone by its end to the under side of a cabbage leaf. Then institute a search for eggs, these will be brought in numbers and the hatching studied. It is needless to say you should have a magnifying lens; every teacher should have one.

In the spring the tent caterpillar is very suitable for study. It is no trouble in the beginning of the season to find a bracelet of varnished eggs encircling a twig of apple tree or wild cherry, (fig. 12) cut off the twig with another attached so as to form a fork that the newly hatched insects may weave a tent upon it. Set two or three of these forks in bottles of water, to stimulate the growth of the buds so that when the eggs are hatched the young tent-makers may have some leaves to feed upon. In time transfer them to the breeding cage with chips resting on the earth, under these chips they will spin their cocoons. These cocoons may be given to the children to watch during the holidays, for before the 1st of September the moths will have emerged. The conditions of growth in the school-room may be so unfavorable that healthy cocoons are not formed; supplement the supply by out-door captures. These two examples are selected out of many that might be taken. Nothing has been said of the important part of the study—observations on the habits, moulting, organs, mouth, antennæ, legs, segmentation, etc. These should all receive due attention.

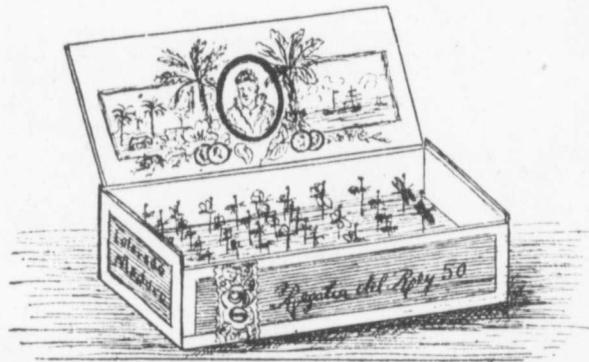


Fig. 13. In Teachers' Leaflet No. 7 (A. B. Comstock.)

When the moths are bred you may, if you wish, release them, but you may wish to preserve what represents a life history of the insect. Obtain a box 6 or 8 by 10 inches, 2 to 4 inches deep with a close wooden or glass cover, a cigar-box does very well for a beginning. (Fig. 13). Tack linoleum or cork in the bottom and then line the inside with white glazed paper. Two boxes similarly lined, hinged together, covered to resemble a large book and shutting very tightly are much used for insect cases.

The eggs are easily preserved. The leaf, twig, etc., may be pinned in the box, the eggs may be touched with coal oil to prevent hatching.

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Fig 14. Cyanide bottle (after P.)

for the insect described in the putting some inserted into t glued to it. with pin holes. ing or taking benzine put a shut in box or with creosote.

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The larvæ are taken at various stages and killed with fumes referred to below or by dropping into hot water or into water and alcohol. They may be 'blown' as follows: snip off the anal end, empty by repeated gentle rollings with a lead-pencil from the head backwards, then blow up through a straw inserted in the opening, tie to keep the air in, and dry. Or they may be preserved in alcohol by putting them first into a 20 per cent. solution in water, the next day in a 40 or 50 per cent. solution, the next day into a 60 or 75 per cent. solution. They will keep indefinitely in a 75 per cent. or stronger solution. The more gradually the strength of the alcohol is raised the better the form and marking will be retained. If put at once into strong alcohol, soft bodied insects are shrivelled out of recognition.



Fig 14. Cyanide bottle (after Riley).

Frequently parasites may be discovered in or upon (living) insects. These should be carefully observed and specimens of them kept.

Butterflies and moths (*Lepidoptera* from *Lepis* a scale and *pteron* a wing, the wings being more or less covered with scales or microscopic feathers which give them their markings) whatever way captured, commonly with a net when in the open field, are transferred to a bottle or tin box and there killed with fumes of chloroform, ether, benzine, creosote, tobacco or cyanide of potassium. A cyanide bottle (Fig. 14) which should have a wide mouth and a tight cork, is prepared by dropping one or a few small lumps of cyanide of potassium, enough altogether to be as large as a marble, varying of course with the size of the bottle, pour over the lumps enough of a mixture of plaster of Paris and water of cream-like consistency to well cover the cyanide, or put in water enough to cover and add dry plaster of Paris enough to make a cement. Allow it to dry before corking. It is well to slip in strips of paper or a thin layer of cotton batting or discs of blotting paper or thin cork

for the insects to rest on. Robertson's cyanide bottle described in the American Naturalist is constructed by putting some pieces of cyanide in a pill-box which can be inserted into the under side of the cork of the bottle or glued to it. The free side of the pill-box is perforated with pin holes. Keep tightly corked except when inserting or taking out an insect. To use chloroform, ether or benzine put a few drops on a bit of cotton batting and shut in box or bottle with the insect, or in like manner use a piece of cork saturated with creosote.

After killing, lepidoptera are spread on a board until dry. The spreading is easily done before the insect becomes rigid. To make a spreading board (Fig. 15) take two pieces of smooth soft board one-third to one-half inch thick and ten to eighteen inches long by two or three inches wide, tack them a half inch apart at one end, a quarter inch at the other to cross cleats; below the opening tack an inch-wide strip of linoleum, corky side upwards, from cleat to cleat.

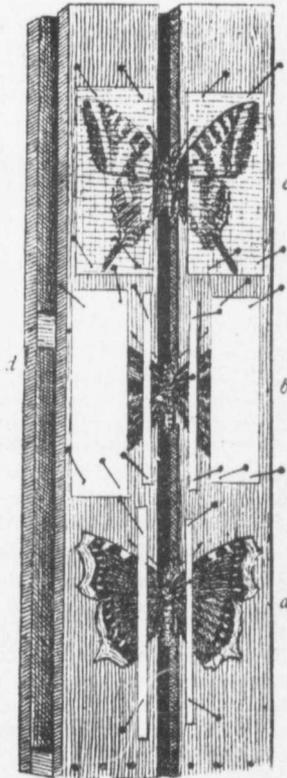


Fig. 15. A spreading board. The cleat *d* is one of two short ones that do not extend in far enough to interfere with the linoleum strip. Another should be shown at the upper end extending all the way across. (After Anna B. Comstock in Teacher's Leaflet No. 7; Coll. of Agric., Cornell Univ.)

Insert a pin through the body of the killed insect just behind the head; stick the pin into the linoleum so that the insect's body will be carried down to the wings through the opening between the boards. Carefully, so as not to brush the "dust" off the wings expand them on the boards and over or across them pin narrow strips of paper (Fig. 16) to keep them in proper position until they dry. Two or three days will suffice for the drying. Beetles should be pinned through the right wing-cover (Fig. 17).

In the box we have spoken of nicely arrange the preserved material—eggs, larvæ

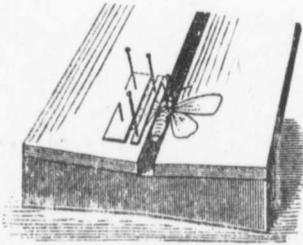


Fig. 16. Spreading board for butterflies and moths (after Riley).

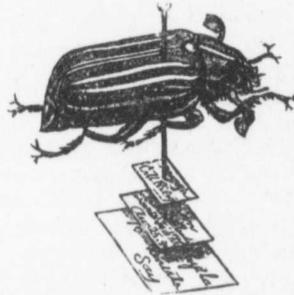


Fig. 17. Method of pinning and labeling beetles (after Riley).

dried or in vials of alcohol, parasites if any, pupæ, moths, or butterflies, etc. Photographic sketches of three such preparations were published in last year's report opposite p. 32. Keep living insects out, first by having boxes which close and stay tight, second by keeping in them a camphor ball or crystals of naphthaline. Above all take good care of your accurately dated notes of observations. One such box as this the results of the teacher's and pupils' own efforts and investigations is likely to prove of greater educational and practical value than memorizing a whole text-book on entomology even though such study were supplemented by catching at random and mounting hundreds of beetles, moths and butterflies.

One of the most serious defects in our public school system of education is the lack of exercises that train children to observe and to reason from their own observations. Such kind of training cannot be obtained from text-books nor tested by examinations, and hence will the more slowly gain its proper place. But I hope that the influential efforts of this society, now that it has taken the subject up, will continue to stimulate and encourage nature study in our schools, at least along that line in which it is particularly interested which the quotation from Mr. Sheldon shows to be so appropriate and which is no less practical than disciplinary.

Mr. Fyles, in moving a vote of thanks to the President, expressed the pleasure experienced by all who were present in listening to the address; he found it most interesting and full of valuable lessons to all.

Dr. Fletcher seconded the motion and said that he thought all had enjoyed very much the presentation of the affairs of the year that Mr. Dearness had given. For himself he considered the remarks in the address singularly pertinent. No branch of science meant more in actual dollars to the people of the country than that of entomology. Of all the crops that we grow, whether in the field, the orchard or the garden, at least one-tenth was lost owing to the depredations of insects, and yet to-day fewer persons applied themselves to this study than to almost any other branch of science. The strange thing is that so little is done to instruct children regarding their insect friends and foes. The plan proposed by the President in his address—the study of practical entomology in the rural schools, is an admirable one, and yet nothing has hitherto been done in Ontario in this respect. In Manitoba the rural schools are much in advance of ours; there the children are taught some practical entomology and botany, and are rapidly coming to know the insects and weeds that are giving trouble, and to recognize common plants and other

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objects. Children on the farm may, by a little instruction of this kind, save many false steps from being taken in the warfare against pernicious weeds and insects. Through his official correspondence he finds a vast amount of ignorance about these things that ought not to exist, and the only way to remedy it was by beginning with the young. He considered that the President's address was eminently practical and useful, because it treated of such common insects as the tent caterpillar and the cabbage butterfly. Knowledge such as this, if spread throughout the country schools, would mean the saving of hundreds of thousands of dollars. Take the San José Scale for instance, the most destructive insect yet known. How few persons could recognize it if they saw it! How few could tell it from the oyster-shell bark-louse! Who can answer the question as to its effect upon Canada? He believed that President Dearness was doing a great deal by this address, in spreading a knowledge of the work of this Society, and in popularizing the study of entomology. Turning to the reports of the Branches, which had been read, he drew attention to the fact that the Montreal Branch had held no less than 207 meetings, and of these probably 200 had been held in Mr. Lyman's own house, where he entertained the members and enabled them to make use of his valuable library and extensive collections. Few men had done such a good work for the science as this.

Dr. Bethune rose to put the vote of thanks to the meeting, and said that all present must highly appreciate the address of the President and heartily subscribe to the favourable comments which Dr. Fletcher had made upon it. He was glad to find that the President again took up the subject of teaching entomology in the rural schools, which he and Prof. Panton had brought before the annual meeting last year. It was satisfactory to learn that the Western Fair Association continued to offer prizes for the exhibition of life-histories of insects by school children, and the good work presented showed that some of the schools at any rate appreciated the opportunity afforded them. With regard to the extraordinary disappearance of insects that were prevalent in immense numbers last year, he thought that there were two causes for their destruction, viz., the work of parasites and the very changeable weather during the winter. Mr. Moffat, last year, when the army worm was swarming all over the Province, predicted that we should not be troubled with it this year, and we all know how true his prophecy proved. We may ascribe its absence this year to the excessive mortality caused by its parasites and other natural enemies. Dr. Bethune then put to the meeting the motion for a hearty vote of thanks to the President for his excellent address, and pronounced it "carried" amid much applause.

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

#### THE LOCUSTS OF THE BIBLE.

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

Solomon, the favoured of God, who lived in the golden age of Israelitish history, was renowned as a wise ruler, an enlightened philosopher, a gifted poet. He was moreover a distinguished naturalist, for it is told in his praise that "he spake of trees, from the cedar that is in Lebanon, even unto the hyssop that springeth out of the wall; he spake also of beasts, and of fowl and of creeping things, and of fishes."\*

We may infer then that a knowledge of Natural history is not unbecoming in the man of position, the man of affairs, the gentleman, the scholar.

Such knowledge was needed in Solomon's days, for amongst the Baalim worshipped by the heathen around, and too often by Israel herself, was *Baalzebub*, the god of the flies, whose name was afterwards given to the Jewish devil. What bugbears have arisen in the minds of men ignorant of natural science!

Before Solomon's time the great Israelitish lawgiver, Moses, had paid much attention to the economic aspects of entomology, and by sacred writers in other periods of the history of God's ancient people thoughtful allusions, inculcating important lessons, were made to insect life and habits.

\* I Kings iv. 33

In studying these references and their teaching, we have to encounter great difficulties arising from the fact that between the science of the ancients and that of our own day there is but little connection. Most of Solomon's wise sayings in natural history have passed into oblivion. The reasons for the discrimination made by Moses in regard to food are unknown. The treasury of Egyptian wisdom that he drew from is gone, and generally, we have to form conclusions from obscure meanings of obsolete terms, and from statements made in highly figurative language.

Moreover, we have to fit the information thus gathered to a fauna with which we are imperfectly acquainted, and which exists under changed circumstances, and may itself have undergone changes both by losses and accretions.

Among the insects most frequently mentioned in the Scriptures, the locusts take a leading place. They are sometimes called grasshoppers, and they are often associated with "the caterpillar and the palmer-worm." It is of this army I purpose now to treat.

And first, for the better understanding of my subject, it may be well for us to take a glance at the modern systematic arrangement in which locusts and grasshoppers appear.

Both are found in that large order of insects named the ORTHOPTERA from two Greek words *orthos*, straight; *ptera*, wings. They are straight-winged insects.

By Westwood the Orthoptera were sub-divided into four groups which he named respectively *Cursoria*, *Graptoria*, *Ambulatoria* and *Saltatoria*; into

*Runners*, like the Cockroach.

*Graspers*, like the Mantis.

*Walkers*, like the Spectre Insect.

*Lepers*, like the Locust and Grasshopper.

The locust and grasshopper then are leaping straight-winged insects.

To set before you the points of distinction between them, that have come to be recognized by Naturalists in our own day, I cannot do better than make two brief quotations from Harris, whose work on "Insects injurious to Vegetation" is one of our Entomological classics. He says:—

"Grasshoppers, properly so called, \* \* are those jumping orthopterous insects, which have four joints to all their feet, long bristle-formed antennæ, and in which the females are provided with a piercer, flattened at the sides, and somewhat resembling

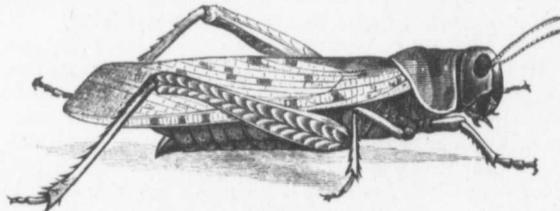


Fig. 18. A Grasshopper or Locust.

a sword or cimeter in shape. The wing-covers slope downwards at the sides of the body and overlap only a little on the top of the back near the thorax. This overlapping portion, which forms a long triangle, is traversed, in the males, by strong projecting veins, between which in many of them, are membranous spaces as transparent as glass. The sounds emitted by the males, and varying according to species, are produced by the friction of these overlapping portions together." *Ins. inj. to Veg.*, p. 155.

Again he says:—

"The various insects included under the name of locusts (Fig. 18) nearly all agree in having their wing covers rather long and narrow, and placed obliquely along the sides of the body, meeting, and even overlapping for a short distance, at their upper edges, which together form a ridge on the back like a sloping roof. Their antennæ are much shorter

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*Ibid*, p. 165.

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than those of most grasshoppers, and do not taper towards the end, but are nearly of equal thickness at both extremities. Their feet have really only three joints; but as the under side of the first joint is marked by one or two cross lines, the feet, when seen only from below, seem to be four or five jointed. The females have not a long projecting piercer, like the " \* \* " grasshoppers, but the extremity of their body is provided with four short, wedge-like pieces placed in pairs above and below." \* \*

"The males, though capable of producing sounds, have not the cymbals and tabors of the crickets and grasshoppers; their instruments may rather be likened to violins, their hind legs being the bows and the projecting veins of their wing-covers the strings. *Ibid.*, p. 165.

Between the grasshopper and the locust then there are well-marked differences in structure, and in their methods of producing musical notes. But these differences have come to be recognized by naturalists in very modern days.

By the English generally both kinds of insects are still called grasshoppers. If I had been asked when a boy to tell the differences between them, I should probably have said, the locusts are creatures that we read of in the Bible and books of travel; the grasshoppers are those long-legged fellows that spring up before you when you walk through the grass.

We learn from Kirby and Spence that it was reported that a cloud of grasshoppers had enveloped a ship when it was distant 200 miles from land. Here locusts were certainly meant, for grasshoppers (as *we* understand them) are incapable of long sustained flight. And Hasselquist quoted by the same authors tells of "locusts or grasshoppers."

I have no doubt that with the translators of our English Bible "grasshoppers" and "locusts" were synonymous terms. The Hebrew word *Arbeh* is translated by them, in some places (as in Exodus X, Proverbs XXX, 27) LOCUST, in others (as in Judges VI, 5 and Jeremiah XLVI, 23) GRASSHOPPERS. And in the Prayer Book version of the Psalms—a version retained from the "Great Bible" of A.D. 1540—the reference in Psalm CV, 34, to the Plague of Locusts in Egypt reads thus,—“He spake the word, and the grasshoppers came, and caterpillars innumerable: and did eat up all the grass in their land, and devoured the fruit of their ground.”

Again, for the better understanding of my subject I will ask you to glance at the life history of the locust as it is known to us. It is very much the same in all lands.

The mother locust when about to deposit her eggs makes an opening in the earth about an inch deep, using her abdomen as a drill. The horny plates at the extremity of her body which she can bring to a point for the penetrating of the soil, and expand for the widening of the orifice made, enable her to work with facility. In the receptacle thus formed she lays a batch of eggs surrounding it with a frothy mucous which hardens into a protection against moisture. She then conceals the hole.

It is calculated that each female will deposit in the course of the season from 10 to 175 eggs.

In due time the young larvæ appear, and comical little fellows they are, largely made up of legs of which they have six. They are gregarious by instinct, and they have healthy appetites. They feed and grow, and cast off their skins when these become too tight for them—having more expansive ones beneath.

They have no wings; and when they march they take a few steps and then a jump,—a few steps and then a jump,—and so onwards. In Eastern lands where they abound, this mode of progression gives to their advancing multitudes a strangely undulatory and wave-like appearance.

With many kinds of insects the pupal state is a quiescent state—not so with the locusts. Their pupæ are both active and voracious. They cannot fly, but they bear the cases in which the wings of the future imagines are forming.

At length the time comes for the perfect insect to appear; the skin of the pupæ splits along the back, and the imago extrudes itself, drawing its wings out of their cases, and

its legs from theirs as if it were drawing off its boots. In a few minutes it is fully developed, and is ready for feeding, for pairing and for flight.

Our largest Quebec locust, *Edipoda Carolina*, Burm., measures about three inches and a quarter in expanse of wings. The *Edipoda migratoria* of Palestine is double that in size. But it must not be forgotten that the locust plague of Egypt was a unique and miraculous visitation. We are expressly told that "Before them there were no such locusts as they, neither after them shall be such." They came on an east wind that had blown for a day and a night. Traditions concerning them must have lingered long, and probably gained in the telling; and so it is not, perhaps, very strange that Pliny the elder should have heard of locusts from India that had a length of three feet and legs so set with spines that the women used them for hand-saws. Men in Pliny's time could doubtless "draw the long bow" and listen, *auribus patentibus*, to travellers' wonders. In our day we tell bear stories, moose stories and fish stories. It seems that in Pliny's day they told locust stories.

I have in my collection a locust from the tropics which has an expansion of wings of nine inches, and its legs are four inches long. This formidable insect is hard, warty, and crested like a lizard, and its wings are of a dark blood-red. Fancy creatures such as this descending in "numbers numberless"—darkening the sky—tumultuous—bewildering—beating in your face—clinging to your hair and clothing—writhing under your feet—whirring, clattering, gnawing all around you—devouring everything eatable, and then in the rage of hunger falling upon one another.

The scene is too horrible. Yet it is one that has been often witnessed. The Tartars tell of men smothered by locusts.\* And but a few months ago it was stated that a French explorer had been overpowered by locusts, and when the swarm lifted and men came they found a skeleton.

The Hebrew word ARBEH which, as we have seen, is translated *locusts* or *grasshoppers*, originally signified *multitudinous*. It is translated in the Septuagint *akris*; in the Vulgate *locusta*, and in Suker's German Bible, *henschrecke*. In Judges, vi. 5, and in Jeremiah, XLVI., our English translators rendered it *grasshoppers*. It is generally believed to have been the *Edipoda migratoria*. The *wandering* locust according to modern term—the *swarming* locust according to the ancient appellation.

It was my good fortune to see and to capture several specimens of this interesting insect when I was a boy. After long-prevailing south-east winds, they had been brought, probably from Spain or Africa, to the east coast of England. Certainly I accounted it a noble creature, with its helmeted front and its wide-spreading, fan-like under-wings, which one might fancy to be formed of delicate green gauze. When it alighted its horny feet came down together with a clatter that was startling.

Another word is in frequent use in the Jewish Scriptures to denote locusts. It is CHAGAB, which is derived from a word that signifies to *veil* or *cover*—The swarms cover the earth and veil the sun. By our English translators Chagab is usually rendered *grasshoppers*; and in the connection in which it is employed it suggests the idea of *smallness*, as in Numbers XIII. 33: "And there we saw the giants, the sons of Anak, which came of the giants; and we were in our own sight as grasshoppers, and so we were in their sight." It became in the late Hebrew a collective name for the locust tribe (see Speaker's Commentary). It is thought to have been especially applied to the species *Acridium peregrinum*.

There is a third kind of locust quite common in the East, the *Acridium lineolum*.

One of the insects that the Israelites were allowed to take for food was the "Bald Locust" of our English Bible—the SALAM of the Hebrew. The latter term means a *consumer*. This insect is believed by Wood to have been a *Truxalis*, a kind of locusts with elongated heads suggestive of baldness.

\* Kirby and Spence's Entomology, Letter VII.

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Besides those words translated *locust*, *bald locust* and *grasshopper*, in our versions, there are others variously rendered which are yet believed to have signified locusts, either of different kinds or in different stages of growth

CHARGOL, the "beetle" of Lev. xi. 21, 22, is believed to have been some kind of locust for it is numbered among the insects that "have legs above their feet to leap withal." In connection with this, Wood, in his Natural History of the Bible, expressed a belief that there are no people that eat beetles; but in this he was mistaken. Dr. Hartwig says:—

"The Goliath beetles of the coast of Guinea are roasted and eaten by the natives who, doubtless like many other savages, not knowing the value of that which they are eating, often make a *bonne bouche* of what an entomologist would most eagerly desire to preserve."—*Polar and Tropical Worlds*, p. 592.

Of words that are supposed to denote the locust in an immature state, we have:—

CHASTIL, *the devourer*, translated "caterpillar" in 1 Kings, viii. 37, 2 Chron. vi. 28; Psalm lxxviii. 46; Isaiah xxxiii. 4; Joel i. 4, and ii. 25.

YELEK, *the feeder*, translated "caterpillar" in Ps. cv. 34, and Jer. iv. 14 and 27; and *cankerworm* in Joel i. 4 and ii. 25, and in Nahum iii. 15, 16.

Dr. Thompson gives a graphic description of a procession of these "caterpillar, locusts." He says:—

"Their number was astounding, the whole face of the mountain was black with them. On they came like a living deluge. We dug trenches and kindled fires, and beat and burned to death 'heaps upon heaps,' but the effort was utterly useless. Wave after wave *rolled up* the mountain side, and poured over rocks, walls, ditches and hedges—those behind covering up and bridging over the masses already killed. . . . It was perfectly appalling to watch the animated river as it flowed up the road and ascended the hill behind my house. . . . For four days they continued to pass on towards the east, and finally only a few stragglers were left."—*The Land and the Book*, p. 417.

This account will perhaps help us better to understand what is meant by "palmer-worm." In considering this a double difficulty faces us—the meaning of the original word GAZAM: the meaning of the English word *palmer-worm*. The latter certainly does not mean the *Ypsolophus pomatellus*, Harris, of our Canadian lists.

GAZAM or GEZEM, the "gnawer," is rendered in the Septuagint *kampe* from *kampto*, to bend (as a caterpillar in motion). In the Vulgate it is translated *eruca*, and in the German *reupe*.

In Joel, i. : 4, we read "That which the palmer-worm (*gazam*) hath left the locust (*arbeh*) hath eaten" "Literally," says Pocock, "That which the *licking* (locust) hath left the devouring (locust) hath eaten."

The Seventy understood by GAZAM *something that progressed with undulations*.

The knowledge of the Eastern locusts and their ravages was no doubt spread amongst the English people by returned Crusaders and other pilgrims from the Holy Land. How would such men tell of a scene such as Dr. Thompson witnessed? They would probably speak of the immature locusts as caterpillars and describe their progressive movements as undulations. And the common people associating things described with things that were familiar to them would probably think of the devouring "processionary caterpillars"\* of Europe which, like the "army-worm" of this continent, do incalculable injury.

At the close of the Crusades hordes of masterless, dissolute men, in passing through Europe on their return, must have devoured and wasted all they came upon, and yet were they proud of the cross and palm-branch, the tokens of their service. In irony, it may be—remembering the ravages of these men—the common people came to speak of

\* *Cnethocampa processionea* and *Chsiocampa neustria*.

gregarious, wandering caterpillars as *palmer-worms*; and so the English translators found a word ready coined and well fitted to represent *gazam*, the "waster," in *kampe*, the "scuffler."

It is surprising what unsatisfactory definitions of such words as *palmer-worm* are given even in dictionaries of some note. In the "Dictionarium Britannicum of N. Baily ('Philologus')," printed by J. Cox in MDCCXXX, we find "*Palmer-worm, a caterpillar with many feet.*" How many feet? Philologus seems to have thought that caterpillars had an indefinite number of such appendages. He evidently was not an entomologist. In "Reid's Etymological Dictionary" the explanation of *palmer-worm* is *a worm covered with hair*. What a wide field does this present for the student of languages to speculate in! He might say, Does the explanation denote a lizard, like the "slow-worm (*Anguis fragilis*)," but having a hirsute covering, or a serpent, like the "pretty worm of Nilus" that "kills and pains not,"\* or a true worm belonging to the Entozoa or the Lumbrici?

Perhaps the simplest accurate definition that can be given to "*palmer-worm*" is *a wandering and destructive larva*. This would tally both with the English word and the original.

That locusts should abound in Palestine was natural. The inhabitants were a pastoral people. Around the cities were small tracts of cultivated land, but the country at large was wilderness. In the undisturbed soil the locusts would deposit their eggs in safety, and their progeny would grow and increase. The Francolin or Red Partridge might devour some of them; and dwellers in the wilderness like St. John the Baptist might make of them their bread, sweetening it with "honey out of the stony rock"; some of the insects might even be taken as delicacies for the feasts of kings, for in the British Museum is a sculptured scene of feasting brought from Nineveh, in which attendants are bearing locusts strung upon sticks in the manner that small birds were served in later times at the banquets of the Norman nobles. But such inroads would make but little impression upon their hosts, and at length they would arise in their strength—God's great army—directed by Him "who maketh the clouds His chariot and walketh upon the wings of the wind."†

Many stories are told of calamities brought by locusts. These are specimens, and they have a bearing upon what has already been said:

"From 1778 to 1780 the whole empire of Morocco was so laid waste by swarms of these insects that a dreadful famine ensued. Mr. Barrow, in his travels, states that in the southern parts of Africa the whole surface of the ground might literally be said to be covered with them for an area of nearly 2,000 square miles. When driven into the sea by a north-west wind, they formed upon the shore, for fifty miles, a bank three or four feet high; and when the wind was south-east the stench was such as to be smelt at the distance of 150 miles. Major Moore observed at Poonah an army of locusts which devastated the whole country of the Mahrattas, and most likely came from Arabia. Their columns extended in a width of five hundred miles and were so dense as to darken the light of the sun. It was a red species (not the common *Gryllus migratorius*), whose bloody color added to the terror of their appearance."—*The Polar and Tropical Worlds*, p. 589.

But no merely human account can approach the sublimity of the inspired description of a flight of locusts given by the prophet Joel—a description marvellous for the richness of its sustained metaphor and the splendor of its hyperbole.

The prophet sounds the alarm:

JOEL II. : 1. Blow ye the trumpet in Sion, and sound an alarm in my holy mountain: Let all the inhabitants of the land tremble: for the day of the Lord cometh: for it is nigh at hand.

2. A day of darkness and of gloominess, a day of clouds and of thick darkness, as the morning spread upon the mountains: a great people and a strong: there hath not been ever the like, neither shall be any more after it, even to the years of many generations.

\* *Antony and Cleopatra*, Act V., Scene II.

† Psalm CIV., 3.

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Then he tells of the damage :

3. A fire devoureth before them : and behind them a flame burneth : the land is as the Garden of Eden before them, and behind them a desolate wilderness, yea, and nothing shall escape them.

He portrays the foe :

4. The appearance of them is as the appearance of horses : and as horsemen, so shall they run.

5. Like the noise of chariots on the tops of the mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, a strong people set in battle array.

He speaks of the terror they excite :

6. Before their face the people shall be much pained : all faces shall gather blackness.

He describes the assault :

7. They shall run like mighty men : they shall climb the wall like men of war : and they shall march every one on his ways, and they shall not break their ranks :

8. Neither shall one thrust another : and they shall walk every one in his path : and when they fall upon the sword, they shall not be wounded.

9. They shall run to and fro in the city : they shall run upon the wall, they shall climb up upon the houses : they shall enter in at the window like a thief.

Then he recapitulates :

10. The earth shall quake before them : the heavens shall tremble : the sun and the moon shall be dark, and the stars shall withdraw their shining :

11. And the Lord shall utter His voice before His army : for His camp is very great : for he is strong that executeth His word : for the day of the Lord is great and terrible : and who can abide it ?

And then he gives the lesson :

12. Therefore also now, saith the Lord, turn ye even to Me with all your heart, and with fasting, and with weeping, and with mourning :

13. And rend your heart and not your garments, and turn unto the Lord your God : for He is gracious and merciful, slow to anger, and of great kindness, and repenteth Him of the evil.

Irresistible indeed is He who holdeth all things in His keeping, who can marshal the base things of the earth to confound the mighty, and things that are despised to bring to naught things that are. The nations well may tremble when He gathereth His great army, the locust, the caterpillar and the palmer-worm, to make the fruitful lands barren for the wickedness of them that dwell therein.

Mr. Harrington said that he was much interested in the paper which had just been read. Residents of northern temperate regions like Ontario could form little idea of the vast numbers of locusts which visited south-eastern Europe, and parts of Asia and Africa. Dr. Sharp, in a volume of the Cambridge Natural History, stated that in bulk the insects in existence in the world exceeded all other forms of animal life put together, and mentioned in illustration a swarm of locusts that was seen passing over the Red Sea in November, 1889. It was estimated to extend over two thousand square miles, and taking the weight of each individual locust at one-sixteenth of an ounce, the whole swarm was calculated to weigh the enormous amount of 42,850 millions of tons! The steamship from which it was observed, was sailing beneath the swarm at the rate of twelve miles an hour in the opposite direction and took between seven and eight hours to pass from under it.

Mr. Law spoke of the light thrown upon God's dealings with man by Mr. Fyles's paper and expressed the pleasure with which he had listened to it.

The President next called upon the Directors to report upon the insects of the year that had been worthy of note in their respective localities.

Mr. Harrington, the Director of Division No. 1, gave the following account of the season at Ottawa :

#### NOTES ON THE INSECTS OF THE YEAR 1897.

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

The climatic conditions obtaining during the past winter were evidently unfavorable to many insects. Intense cold during periods when there was but a scanty snow-fall, alternating with decided thaws, caused extensive injury to many species of plants, and must have, in some degree, similarly affected insect life. The unfavorable winter was followed by an unusually wet spring, with frequent and violent rain storms, which undoubtedly destroyed myriads of our winged foes and friends, whose brief lives are frequently prematurely ended by heavy showers and storms. As a result, apparently, of this inclement weather there was, in the vicinity of Ottawa, a marked scarcity of the larger hymenoptera, especially of bees and wasps, the number and strength of whose colonies are dependent upon the survival of the fertilized females, and their ability to provide food for the first brood. This scarcity of macro-hymenoptera was clearly noticeable all summer; very few of the larger ichneumonidæ, etc., being observed, except species which, like *Thalessa*, are parasitic upon wood-eating larvæ, and are thus not affected materially by unfavorable weather. Even in autumn, when the *Spiræas* and Goldenrods generally swarm with *Crabro*, *Andrena*, *Halictus* and many allied genera, comparatively few species and individuals were observed. The minute parasitic forms were obtainable in moderate numbers, but many species usually abundant were not met with, especially such as appear in the early summer.

As regards the occurrence of injurious insects there is but little of importance to mention. The copious rains, while destroying many insects, produced such a vigorous plant growth, that the foliage became too luxuriant to be much injured by any ordinary manifestation of insect life. The ravages of leaf feeding insects were therefore but seldom noticeable, and the foliage during the summer maintained an unusual freshness and plentitude. The only noticeable exception to the general scarcity of phytophagous insects was the appearance of great numbers of the tent caterpillars (*Clisiocampa*) Fig 19, which were more abundant and destructive than for many years. Early in spring their webs were seen disfiguring the neighboring woods, and occasionally the city shade trees, and as the larvæ increased in size, the unsightly webs became still more conspicuous among the defoliated branches. Many kinds of trees suffered from this infestation, but the most extensive operations were upon poplars, of which large areas were in some districts so defoliated as to have the appearance of having been scorched by fire passing rapidly over them. During July the newly emerged moths (Figs. 20 and 21) appeared in countless thousands, and in the city were a source of much annoyance, and some little personal discomfort. They swarmed so at night around the electric arc lights,

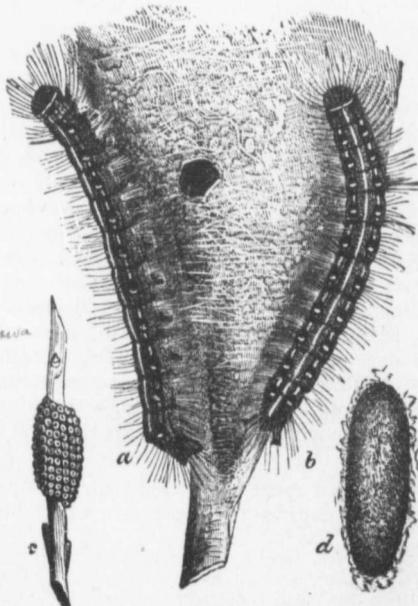


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that the air seemed literary filled with them, and in their flight they dashed against pedestrians most unpleasantly. The pavements were almost covered by those which kept falling to the ground, and at every footstep a most unpleasant crunching of moths was



Fig. 20, Male Moth.

(Clisiocampa Americana.)



Fig. 21, Female Moth.

(Clisiocampa Americana.)

experienced. Upon illuminated buildings, especially upon shop windows, they fluttered and crawled in myriads, and they dashed into every open window or doorway. The plague lasted for some days, during which an immense number perished in the arc-lamps and in other ways. The tent caterpillars are among those insects but little affected by climatic changes. The clusters of eggs (Fig. 19, c.) encircling the twigs are protected by a waterproof varnish-like secretion, and the caterpillars as soon as hatched proceed to spin the web which serves to protect the colony against the weather's vicissitudes, and to some extent from various enemies. Their parasitic enemies, however, are numerous and watchful and find opportunities to infest many of the caterpillars, so that the increase of the species is checked and eventually stopped, and an unusual abundance one year may be followed the next season by a comparative scarcity.

Dr. Bethune, the Director for Division No. 2, was next called upon to report :

## NOTES ON THE SEASON OF 1897.

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

Collectors of insects throughout the Provinces of Ontario and Quebec have, with few exceptions, pronounced the season of 1897 an "off year" as far as the capture of specimens was concerned. The scarcity of many common species may no doubt be largely attributed to the character of the preceding winter, which was remarkable for its sudden changes from mild weather to extreme cold and the frequent thaws which occurred. These great and rapid alternations of temperature are usually very fatal to any insects whose winter quarters are exposed or near the surface of the ground. But not only was the winter a trying one for insect life, the spring was for the most part cold and wet, and summer, coming very late, brought little fine or hot weather; with the exception of some ten days of intense heat during the early part of July, the season was characterized by a series of heavy rains and frequent storms. Seldom, therefore, has there been a season when the climatic conditions were so unfavorable for the healthy development of most kinds of insects, and seldom a season when the entomologist has had so little to record.

The most serious outbreak of the year was that of various species of Aphides (Fig. 22), which appeared in countless numbers on all kinds of trees and plants, and in many cases wrought serious damage. Currant bushes seemed to suffer the most, and before the summer was over had lost all their leaves. Cherry, plum, apple and other fruit trees were injuriously affected, and in the flower garden roses, herbaceous plants and annuals were severely attacked. The cool, damp weather that prevailed during the summer was especially favorable to the multiplication of these tiny creatures, and so numerous did they become that in the month of October and on sunny days in November the air was filled with winged specimens to the great discomfort of everyone out of doors and to the especial annoyance of bicyclists, whose eyes

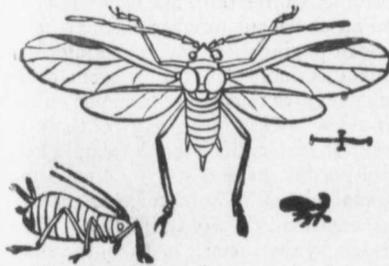


Fig. 22. Winged and wingless forms of Aphides—much magnified.

became filled with them. This superabundance of aphides was widespread over large areas in Ontario, and extended to several of the neighboring States, much damage being done by them in New York, Ohio and Michigan.

In the month of May the larvæ of the Eye-spotted Bud-moth (*Tmetocera ocellana*) Fig. 23, were very abundant on plum trees in this neighborhood, and did a considerable



Fig. 23. Eye-spotted Bud-moth and larva.

amount of damage. This tiny insect has often been noticed in our annual reports and is no doubt familiar to most fruit growers in this Province and Quebec. It attacks the opening buds of apple, pear and cherry as well as plum trees, by eating through the leaves and forming a habitation for itself in the tender foliage, which it draws together and lines with silk. In this protecting case it continues to grow and consume the surrounding leaves, and often destroys in this way a whole cluster of blossoms or young fruit. When abundant, as it was this year, it does a very considerable amount of damage. The caterpillar is of a dull greenish-brown color, with a few short hairs on its body, proceeding from minute warts; the moth (Fig. 23) is a pretty little creature, ashen-gray in color, with a broad white band of irregular outline across the fore wings, and a black eye-like spot formed, when the wings are closed, at the outer margin of the band. From this it evidently derives its specific name. The insect can, no doubt, be kept under control by an early spraying of the trees with Paris green in the usual manner, and by plucking off and crushing the clusters of leaves containing the caterpillars.

Last year I mentioned the reappearance of the Apple-tree tent-caterpillar (*Clisiocampa Americana*, Harris). In the latter part of May this year, I found several of the tents, or webs, on apple trees and promptly destroyed their inmates. During the month of June the moths were somewhat numerous, coming into the house at night and bouncing about the lights in their usual blundering manner. We may expect that this troublesome insect will again become abundant and cause great damage to fruit trees unless their owners are on the alert in the spring and at once destroy all egg-bracelets (Fig. 19, c) that they can find, and the nests of caterpillars in their early stages before they scatter over the trees. Wild cherry and plum trees should especially be watched, as they form a favorite breeding ground for the insect.

While the web-forming caterpillars of the spring are thus on the increase, it is very remarkable that the Fall web worm (*Hyphantria textor*) should have been scarce last year and entirely absent this year about Port Hope. Though no observations have been made, it seems evident that the destruction of this insect is due to the work of parasites, as it has been a gradual process, extending over more than one year. If the extermination had been caused by climatic influences—by the alternate freezing and thawing during the winter—it would have been a sudden destruction, the work of a single season. A similar disappearance of a common species has taken place in the case of the Tussock moth (*Orgyia leucostigma*). I did not see a single caterpillar of this species in my garden last year and observed only one moth. In Toronto, where it was so very destructive last year, it was noticeable here and there throughout the city and some trees were partially defoliated by it, but there was no widespread injury and consequently no public alarm occasioned by it. During the preceding winter the Park Commissioner, under instructions from the City Council, destroyed an enormous number of the cocoons of this insect, the sum of \$1,000 having been spent in paying boys for collecting them. As all the cocoons collected were destroyed without discrimination, the wisdom of the proceeding is somewhat doubtful; myriads of useful parasites must have been put an end to as well as the pupæ of the noxious moth. It would be well in future cases of the kind to entrust the collected material to an entomologist with instructions that he should keep all parasitized cocoons till the summer following and permit the inmates to escape, and burn all the rest. Dr. Howard, United States Entomologist at Washington, has recently published a most valuable and interesting pamphlet entitled, "A Study in Insect Parasitism," in which he gives an account of a severe attack by the tussock moth on the shade-trees of Washington in 1895. Very large numbers of the cocoons were collected and it was found that over ninety-eight per cent. of them were parasitized, only two per cent.

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being free from the attacks of these destroyers. In 1896 the tussock worms were few in numbers, as might have been expected from such wholesale destruction, and did little injury to the trees, but this year they have increased in numbers again owing to the destruction of the parasites themselves by others which prey upon them—secondary parasites, as they are termed. Thus was verified the old rhyme:

“Big fleas have little fleas to bite 'em.  
And so on ad infinitum.”

The “Army worm” (*Leucania unipunctata*) which was so abundant and did so much damage throughout this Province and the neighboring States last year, was, as Mr. Moffat predicted, conspicuous by its absence this year. As far as my own observations are concerned, I did not see a single caterpillar and not more than half a dozen of the moths, nor have I heard of any injury being done by the insect in any part of the country. This immunity is undoubtedly owing to the friendly work of parasites, especially the *Tachina* flies mentioned in the Report for last year.

The Grape-vine Flea-beetle (*Graptodora chalybea*) [Fig. 24], has been very destructive of late years to the foliage of the Virginia Creeper (*Ampelopsis quinquefolia*). Where spraying with Paris green was not resorted to several times during the season, the vines

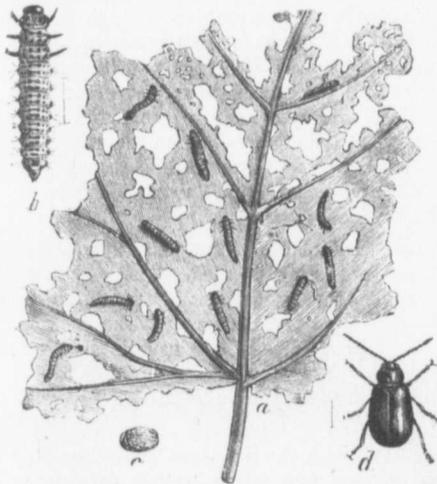


Fig. 24.

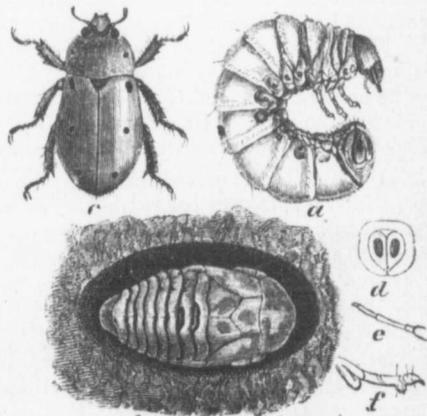


Fig. 25.

were completely stripped of their leaves before the end of August. Strange to say, a grape-vine against a fence only a few yards from some badly affected creepers was not attacked at all.

Among the interesting records of the year may be mentioned the capture of a specimen, for the first time at Port Hope, of the Spotted Pelidnota (*P. punctata*, Linn.) [Fig. 25], which feeds upon the grape-vine. I have never before met with this insect east of Toronto, but Mr. Evans tells me that he has taken it at Trenton. A specimen of *Papilio Marcellus* was again seen in the town park on the 24th of July—the same locality where it had been observed last year. Several species of *Plusia* have been common throughout the summer, visiting flowers in the day-time and attracted indoors by light at night, and have continued until late in the autumn; *P. precatationis* and *simplex* [Fig. 26], were the most abundant, and several of the rare *P. biloba* were captured, one as late as November 5th, when it was found sipping nectar from the few hardy flowers left in the garden.



Fig. 26.

Dr. Fletcher upon being called upon by the Chairman, gave a full and interesting account of the appearance of the

San Jose Scale in Ontario, and the measures that had been taken to counteract it (See his paper on this subject, page 78). He stated that the tent caterpillars were so abundant at Ottawa, as mentioned by Mr. Harrington, that they actually starved themselves out by stripping the foliage of the trees that they infested. He did not think that they would be as numerous next year in consequence of the destruction of large numbers by parasites and the fact that many of the females were infertile and laid no eggs. The larch saw-fly had re-appeared in Eastern Ontario, but the currant saw-fly had been quite infrequent. Out worms also were not so abundant as usual; for them the best remedy is a mixture of bran, sugar and arsenic, which should be placed, a teaspoonful in amount, at the base of the corn-hills, or at intervals between the rows where seeds have been sown in the spring. He found that the cut-worms would eat this mixture just as readily when dry, as when moistened with water, and with equally effective results. The fall web-worm was not nearly so numerous as usual at Ottawa, but the aphides, as mentioned by Dr. Bethune, was excessively abundant and injurious. The leaf-hopper of the grape had been abundant in the east; it could be controlled most readily with kerosene emulsion. The horn-fly, which of late years had been such a plague to cattle, had now almost disappeared as an injurious insect, and was not so numerous as the *Stomoxys*, the common biting stable-fly.

The invasion of Ontario by the San Jose Scale was the next subject brought up for discussion. Dr. Fletcher spoke on the subject and read extracts from a letter he had received from Mr. Martin Burrell, of St. Catharines, and exhibited a copy of the poster which had been issued from the Central Experimental Farm at Ottawa, by direction of the Minister of Agriculture. The poster had been widely distributed to post offices, agricultural societies, etc., throughout the country and had attracted much attention. Both the Dominion and Ontario Governments were doing all they could to prevent the spread of the insect. He strongly advised that all purchases of fruit trees should be made from Canadian nurseries where the Scale had not made its appearance.

Dr. Fletcher then continued his remarks upon the insects of the year, upon which he had been speaking before the adjournment the preceding evening. The pea moth, which had been very injurious throughout the country during the last few years, he had at length succeeded in breeding, and had brought specimens for exhibition at the meeting. He had also bred the apple fruit-miner, which bores in all directions through the fruit; specimens of this fruit were exhibited. *Selandria media*, which bores into the top of rosebuds, had been successfully reared and its life history worked out. He then gave an account of the rearing of *Erebia discoidalis* and *Brefos infans*.

Mr. Harrington asked whether all trees infested with the San Jose Scale should be destroyed. Dr. Fletcher replied that a badly infested tree is not worth preserving. Experiments have been made of spraying with pure kerosene instead of the kerosene emulsion, but there was very great danger of killing the trees as well as the insects upon them.

#### THE WORK AGAINST THE GYPSY MOTH, 1897.

BY A. H. KIRKLAND, MALDEN, MASS.

The committee having in charge the work of exterminating the Gypsy moth, in its annual report for 1896, recommended that the legislature appropriate the sum of \$200,000 for the work of 1897. After several hearings before the legislative committees, in February the sum of \$150,000 was appropriated. This sum being available comparatively early in the season a large force of men were set at work destroying the egg-clusters and preparing the worst infested woodlands for the summer operations. Over 1,000,000 egg-clusters, each probably containing from 300 to 500 eggs, were destroyed, 300 acres of infested forest land were cut over or thinned of trees, the ground

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cleared and rubbish burned. By the time the eggs hatched the greater part of the burlaps had been placed on the trees. Spraying with arsenate of lead was commenced as soon as the leaves developed and was continued until about the middle of June. The poison mixture was applied at the rate of 20-150 gal. water, and about three tons of ingredients for making arsenate of lead were used in this work. The season proved a very unfortunate one for spraying operations. In May there were, I think, twenty days on which rain fell, and in June sixteen. In many cases this nullified the effect of the poison to a great extent and necessitated respraying. But even under these conditions from 60 per cent. to 80 per cent. of the larvæ in infested sprayed woodlands were destroyed.

Spraying with the arsenate of lead has this year shown itself as one of the best and cheapest methods for controlling the increase of the Gypsy moth. The extremely wet season favored a rank growth of foliage; this gave the insects abundance of shade, and later a great part of the large caterpillars refused to come to the burlaps, but remained clustered in tree tops. This necessitated the expensive operation of climbing a large number of trees. The season seemed also very favorable to the growth of caterpillars aside from food considerations. The abundance of tent caterpillars and canker worms, as well as the Gypsy moth, during the past summer confirmed this view. Thorough attention to the burlaps, however, as the caterpillars matured, together with the climbing of trees and destruction of large numbers by hand, made a great inroad into the ranks of the insect. Active operations were not relaxed until all the nests had been laid, and large numbers of pupæ and few moths were destroyed by hand, thus preventing the deposition of a great many egg-clusters. In the summer work from 200 to 366 men were employed. By the time the moth ceased laying our funds ran short, 125 men were discharged and the wages of others reduced. Later, to diminish expenses still further, the entire force was laid off for two weeks. At present writing, a careful search is being made of some outlying districts, while in the inner towns a force of men is at work treating nests. As soon as the leaves have fallen the work in the outlying towns will be prosecuted, so far as means permit.

#### *Results of the Year's Work.*

The results of the year's work may be summarized briefly as follows: The increase and spread of the Gypsy moth has been well controlled, and there has been less stripping of trees throughout the whole infested region than ever before. In the outer towns marked progress has been made towards extermination. The number of outlying colonies has never been so small as at present, and the infestations of the territory included within the border of the infested region were never so well known. The number of insects taken this year in the existing outlying colonies is much smaller than that of 1896. For example, in one of the Brookline colonies about 15,000 larvæ were destroyed in 1896, where but 191 were found in the same place the past summer. While much good work has been accomplished in the outer towns, it is apparent that the moth has increased near the centre of the infested district. The results of a hasty inspection indicate that the numbers of the moth have increased in Malden and vicinity.

Considerable areas of woodland in the large Metropolitan Park system are known to be infested, but their condition, on the whole, is better than that of last year. The destruction of the eggs previously mentioned prevented the increase of the insect in the woodlands. Owing to the amount of travel through the parks this infestation will menace the surrounding region, until funds permit the prosecution of exterminative work in the parks.

#### *What is Needed.*

So far we have been unable to burn the candle at both ends. With insufficient means we cannot carry on exterminative work over the whole region. Either the outside or inside territory must be neglected to a certain extent. To restrict the border line of infestation has seemed to be a matter of vital importance to the success of the

work, and we believe that the chief efforts must be devoted to the outer towns, and in the present state of finances, controlling measures are all that can be used in the inner towns. What is needed is a good financial backing for a few years, then we shall be able to reduce the size of our request for funds as the work ceases to be one of insect destruction and becomes more and more one of inspection.

That never since 1892 have we been able to carry out our complete plans is a continual source of discouragement. Mr. Forbush and Prof. Fernald have expended their best energies in this work. The non-salaried committee conducting the work have given freely of their time and attention. Conditions have been carefully studied and plans made, only to be hampered by lack of funds. We believe that the best possible use has been made of resources which have been placed at our disposal. If any of our friends or critics will show us how to do two dollars' worth of work for one dollar, we will then show them how to exterminate the Gypsy moth with appropriations of the size made in the past. There seems to be a growing feeling throughout the state, on the part of tax payers, that the people of this Commonwealth in protecting themselves from this insect are protecting as well the adjoining states, and, in fact the whole country. That this argument is a just one there can be no doubt, and should the insect be allowed to multiply in this region, the through traffic in freight and passengers, in a short time would probably distribute the Gypsy moth over the greater part of the country. Whether this consideration of the matter from the tax payers' standpoint will tend to reduce the size of the appropriations for our work this year is problematical. Two things are certain, we need more funds than we have yet had, and we need to just as great an extent the moral support of all who are interested in the eradication of one of the worst foes to agriculture and horticulture that has ever reached our shores from a foreign country.

#### ELECTION OF OFFICERS.

The meeting then proceeded to the election of officers for the ensuing year, with the following result (see page 2.)

It was moved by Dr. Fletcher and seconded by Mr. Evans, and resolved, that the library and rooms committee be instructed and empowered to deal with matters pertaining to the library and collections, such as adding books and specimens, providing cases, &c., and to secure the proper heating, lighting and cleaning of the rooms.

The treasurer, Mr. J. A. Balkwill, read the following report of the receipts and expenditure for the year ending August 31, 1897:

#### REPORT OF THE TREASURER.

RECEIPTS.		EXPENDITURE.	
Balance on hand, September 1st, 1896..\$	530 93	Annual meeting and report.....\$	219 08
Members' fees .....	389 85	Salaries .....	350 00
Pins, cork, etc .....	60 32	Insurance .....	28 08
Government grant .....	1,000 00	Pins, cork, etc .....	47 00
Sales of "Entomologist," etc.....	133 37	Library .....	59 60
Advertising .....	17 50	Rent .....	117 77
Interest .....	20 80	Printing .....	587 42
		Expense acct. postage, etc .....	168 30
		Balance on hand.....	575 52
	\$2,152 77		\$2,152 77

We, the auditors of the Entomological Society of Ontario hereby certify that we have examined the accounts of the treasurer and find them correct, and that the above statement is in accordance therewith.

LONDON, October 8th, 1897.

R. W. RENNIE, }  
JAS. H. BOWMAN, } Auditors.

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The librarian and curator, Mr. J. Alston Moffat, read his annual report as follows :

### REPORT OF THE LIBRARIAN AND CURATOR.

At the last annual meeting of the Society, negotiations were in progress with the directors of the Y.M.C.A. for a room in their new building ; these having been successfully completed, the property and business of the Society were moved thereto.

At a meeting of the local board it was authorized to engage assistance and have the removal accomplished with the least delay possible, as soon as the room was ready for occupation. Preparations were commenced, and with the assistance of Mr. Balkwill all the books and papers were packed into boxes of a convenient size for lifting, loaned by Secretary Saunders for the purpose, in sufficient numbers that all emptying and refilling during the transfer was avoided, proving a great convenience and saving of time. After considerable delay, final decision was arrived at to begin moving on Monday, the 16th November, and by the evening of the 19th everything was in the new room, but in terrific confusion. The transfer was made without loss or injury of any account and during most favorable weather.

The cabinets and book cases have been—according to my judgment—placed to the best advantage possible, consistent with the form and dimensions of the room, and to the procuring of the most accommodation for the work of the Society and its material on hand.

With the more conveniently situated location has come a large increase in the number of visitors, whilst much surprise and admiration has been expressed at the extent and beauty of the collections.

According to a resolution passed at the last annual meeting, the 27 volumes of the *Annals of the Entomological Society of France* have been bound and placed in position.

Besides those that are bound annually, a number of valuable publications that have been accumulating for the past three years were approved of by the President and bound, and thus made available to the members ; also a third series of the *Butterflies of America*, by W. H. Edwards.

The bound volumes received from governments and public institutions during the year were the following:

The annual report of the Geological Survey of Canada for 1894.

“ “ “ “ “ 1895.

“ “ Department of Agriculture, Ontario, for 1895.

“ “ Bureau of Industries, Ontario, for 1895.

The report of the N. Y. State Entomologist for 1896.

The Smithsonian report for 1894.

“ “ 1895.

The 48th annual report of the Regents of the New York State Museum in 3 volumes, containing amongst other important matter, a description of the edible and poisonous fungi of N. Y., illustrated by 43 colored plates.

The proceedings and transactions of the Royal Society of Canada, for 1896.

The report of the California State Board of Horticulture for 1896.

The report of the Fruit Growers' Association of Ontario for 1896.

The eighth annual report of the Missouri Botanical Garden for 1897.

The United States National Museum report for 1893.

“ “ “ “ 1894.

The seventeenth annual report of the U. S. Geological Survey, in three parts, 1895-6.

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Auditors.

The total number of volumes added to the library during the year was 88.

The full number now on the register is 1,506.

The number of volumes issued to local members was 33.

The large number of 29 species, new to the native collection of lepidoptera added thereto by the generosity of Mr. Bice, from his captures at electric lights during the season of 1896, and those he has contributed in the season of 1897, that are already identified, with a few northwest micros received from Mr. Hanham and Dr. Fletcher, and determined by Prof. Fernald, have by that much increased the power of the Society to deal with material sent to it for identification; but much more requires to be done in the same direction, before it is in a position to meet the demands made upon its assistance from distant provinces, with credit to itself and satisfaction to those concerned.

A fine specimen of the "Tarantula," *Mygale Hentzii*, was received from Mr. B. E. Couldery, of Belleville, Ont., through the good offices of his nephew, Mr. A. C. Couldery, one of our members. A very opportune addition to the collection, when so much curiosity is excited in the community by newspaper reports of its being brought to this latitude in consignments of tropical fruits.

A further gift of Santo Domingo insects has been received from Miss Davida Ronquie, in which are some particularly interesting and attractive specimens, from that but little investigated locality.

On motion it was ordered that the thanks of the Society should be given to Mr. Bice, Mr. Hanham, Dr. Fletcher, Mr. Couldery and Miss Ronquie for their kind contributions to the Society's cabinet.

Mr. Dearness read the following report of the delegates who were appointed to attend the meeting of the British Association at Toronto:

#### REPORT OF THE DELEGATES TO THE TORONTO MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Your delegates to the meeting of the British Association, held in Toronto, from the 18th to the 25th of August, have the honor to report that they duly discharged their commission.

The Association, besides its interesting public lectures and meetings in the evenings and its numerous brilliant social functions mostly held between 4 and 6 p.m., transacted its more serious work in ten different sections, working in sessions, usually from 10:30 a.m. to 3:30 or 4 p.m. These sections were respectively:

A.—Mathematical and Physical Science, which for much of its work subdivided into the departments of Mathematics, Physics and Meteorology.

B.—Chemistry.

C.—Geology.

D.—Zoology.

E.—Geography.

F.—Economic Science and Statistics.

G.—Mechanical Science.

H.—Anthropology.

I.—Physiology.

K.—Botany.

The daily number of addresses in each of these sections varied from five to fifteen, so that every day there were from sixty to a hundred addresses delivered or papers read. These were for the most part highly technical and approached the line of further advancement in the several subjects. The sections of Anthropology and Geography had by far the largest general attendance.

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Subjects of a strictly Entomological character were placed on the programme of section D (Zoology) of which Professor Miall, F.R.S., was President. One of your delegates, Rev. Dr. Bethune, had the honor of being elected on its Executive Committee, where his name appears in such distinguished company as that of Dr. Anton Dorhn, Prof. C. S. Minot, Dr. L. O. Howard, Prof. C. Lloyd Morgan and Dr. Theodore Gill.

The Entomological papers read were :

- 1.—Mimicry as evidence of the truth of Natural Selection, (with lantern illustrations), Prof. E. B. Poulton.
- 2.—Economic Entomology in America, Dr. L. O. Howard.
- 3.—The Statistics of Bees, (an inquiry into the time occupied by the successive journeys of workers), Prof. F. G. Edgeworth.
- 4.—Theories of Mimicry as illustrated by African Butterflies, (with lantern illustrations), Prof. E. B. Poulton.
- 5.—The Army-Worm in Ontario in 1896, Prof. J. Hoyes Panton.
- 6.—A supposed new Insect structure, (with lantern illustrations), Prof. L. O. Miall.

Seven Canadian Committees were formed to investigate or prosecute scientific problems of special application to the northern part of this Continent. One of these was to investigate the organic life of the Pleistocene Beds of Canada ; another to secure the establishment of a Biological Station in the Gulf of St. Lawrence ; a third to study the Biology of the Great Lakes.

The Treasurer's Report showed a membership of 1,362 persons, and grants for the purposes of scientific study and research of \$6,500.00. One of these is a grant of one hundred pounds sterling for an "Index generum et specierum Animalium,"

Canadian subjects naturally received much attention, but it was a pleasant surprise to hear that in the estimates of the General Committee a much larger sum of money had been voted than usual, in order to further the pursuit of investigations in Canada and to assist the above-mentioned Canadian Committees.

Respectfully submitted.

J. DEARNESS } Delegates  
C. J. S. BETHUNE }

#### A STUDY OF THE GRYLLIDÆ (CRICKETS).

BY WILLIAM LOCHHEAD, LONDON.

The crickets are easily distinguished from the other families of the Orthoptera by their long hind legs fitted for jumping, their long antennæ, and their wing covers which are flat above and bent abruptly down at the sides. The wing covers of the males are modified for the production of musical sounds, and the females in most genera are provided with long, stout ovipositors.

Although possessing these characters in common, yet as a whole, the crickets are a heterogeneous group. For example, the mole-cricket (*Gryllotalpa*) is large, often one and a quarter inches long, and provided with powerful fore tibiæ fitted for digging ; while *Nemobius* and *Anaxiphus* are quite small, often less than one-quarter inch long ; the tree-cricket (*Oecanthus*) is delicate in structure compared with the common black crickets.

From an economic standpoint the Crickets are not nearly so injurious to vegetables as the grasshoppers and locusts, and for this very reason have not been studied as carefully as they might be. The snowy tree-cricket appears to be the only member of the family which has taken to evil habits. The eggs are deposited in the branches of certain plants such as the raspberry, blackberry, plum and peach, which are often destroyed in consequence of the boring and weakening of the fragile stem. These beautiful crickets have also been known to feed on ripe fruits.

It is possible to separate the genera of the family by the following method :

A.—Crickets with broad fore tibiae.

B.—Antennæ long and setaceous.

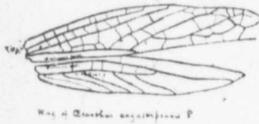


Fig. 27. Wing of *Ecanthus angustipennis*, female.

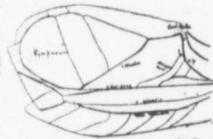


Fig. 28. Wing of *Ecanthus angustipennis*, male.

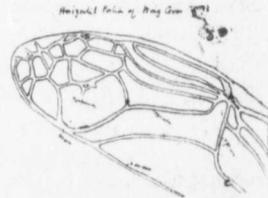


Fig. 29. Horizontal portion of wing-cover of *Nemobius fasciatus*, male.

C.—Fore tibiae with four spurs, *Gryllotalpa*.

CC.—Fore tibiae with two spurs, *Scapteriscus*.

BB.—Antennæ rather short and filiform.

C.—Body smooth ; head horizontal, *Tridactylus*.

CC.—Body velvety ; head vertical, *Rhipiptoryx*.

AA.—Crickets with slender fore tibiae.

B.—Hind femora stout.

C.—Apical spurs on hind tibiae five and equal, *Anaxiphus*.

CC.—Apical spurs six and unequal.

D.—Last segment of maxillary palpi nearly same length as penultimate, *Gryllus*.

DD.—Last segment of maxillary palpi twice as long as penultimate, *Nemobius*.

BB.—Hind femora rather slender, *Oecanthus*.

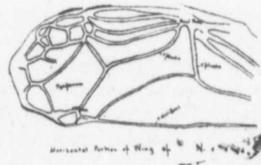


Fig. 30. Horizontal portion of wing cover of *Nemobius vittatus*, male.

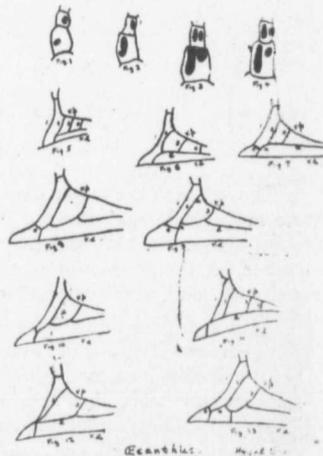


Fig. 31. Antennal marks and Harpa areas of *Ecanthus*.

VENATION OF THE WINGS.

H. de Saussure and J. Pungur have worked out a nomenclature of the veins in this family. That portion of the wing cover which assumes a vertical position on the side of

the body is This vein se but none to much stunt vertical and Anterior ; th female is h along the ou the branche

The Ve branches wh the Vena Pl angle toward from the ber tinues in ar Dividens to harp-shaped On the outsi partly come of the wing t or two cross

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Species

1. Luctuosus .
2. Abbreviatus
3. Angustus . . .
4. Neglectus . . .
5. Niger . . . . .
6. Pennsylvanic

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the body is traversed by one large vein with its branches, the *Vena Radialis*, (Figs. 27-28). This vein sends out a large number of branches towards the outer border of the wing but none towards the inner. In the case of much shortened wing covers this vein is very much stunted and often only the branches are visible. The edge formed between the vertical and horizontal portions of the wing cover is composed mainly of the *Vena Ulnaris Anterior*; the other branch *V. Ulnaris Posterior* (Fig. 27), which is easily seen in the female is hard to detect in the male. The *Vena Dividens* is a well defined vein running along the outer border of the horizontal portion of the wing cover and anastomosing with the branches of the *Vena Plicata* which traverses the horizontal field (figs. 27-30).

The *Vena Plicata* in the female runs directly backwards giving out four to six branches which anastomose with one another forming a net work (Fig. 27). In the male the *Vena Plicata* runs directly, then bends at the first quarter of its length at a right angle toward the inner border where it forms the *Anal Node*, (Figs. 28-30). The part from the bend to the Node is the stridulating instrument. From the Node the vein continues in an oblique direction again to the outer border where it unites with the *V. Dividens* to form a knot—the *stigma*. In this way the *V. Plicata* bounds a triangular harp-shaped area in which several (0 to 5) undulating cross veins run—*oblique veins*. On the outside of the oblique part of the *V. Plicata* there is a confusion of veins which partly come from the *Anal Node* and partly from the *V. Plicata* so that in the last third of the wing there is a roundish area, the *Tympanum* or *Mirror* sometimes crossed by one or two cross veins. Behind the mirror lies a network of veins.

GRYLLUS.

Scudder in his materials for a Monograph of the N. A. Orthoptera enumerates six species, namely: *luctuosus*, *abbreviatus*, *angustus*, *neglectus*, *niger* and *Pennsylvanicus*. Following Scudder's descriptive remarks I have compiled the following synoptic table:

Species.	Color of Elytra.	Length of Elytra.	Length of Ovipositor.	Hind Femora.
1. <i>Luctuosus</i> . . . . .	black or brownish . . . . .	.....	in. .70	in. .45
2. <i>Abbreviatus</i> . . . . .	dark, bordered with light brown.	covering abdomen . . . . .	.74	.44
3. <i>Angustus</i> . . . . .	like No. 2 but more slender . . . . .	.....	.64	.38
4. <i>Neglectus</i> . . . . .	black or jet black . . . . .	as long as abdomen . . . . .	.56	.40
5. <i>Niger</i> . . . . .	.....	longer than neglectus . . . . .	.45	.44
6. <i>Pennsylvanicus</i> . . . . .	like neglectus . . . . .	.....	.45	.....

It will be apparent that the distinctions are based chiefly on the length of the ovipositor of the female which I found to be extremely variable. Moreover no method of identifying the males has been given. As far as the color is concerned it is of no value as a guide to species since it, too, is very variable. Sausure admits (*Melange Orthop.* p. 317) that the species seem to grade into each other, and "it is impossible to define the limits of each. The accidental shortening of the wings already sufficiently embarrassing in itself seems often to become complicated with a shortening of the ovipositor. The color is very variable and it is impossible to settle on any character with certainty which can separate the species." The length of the ovipositor is made the chief character in distinguishing the two species of Sausure and Beutenmüller. I find in my collection all lengths from 10 to 21 mm., so here it is impossible to draw a limit.

Sausure gives the names *abbreviatus* and *luctuosus*. Under the former he places the varieties *neglectus* and *Scudderianus*, and under the latter he places the variety *Pennsylv-*

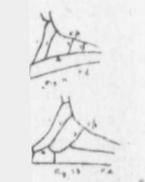
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*vanicus*. Beutenmüller gives the names *abbreviatus* and *Pennsylvanicus*. Under the former he places the variety *angustus* and under the latter he places the varieties *luctuosus*, *niger* and *neglectus*.

An effort was made to separate the species of *Gryllus* by the aid of the wing venation but it was impossible to find variations which were constant. The number of oblique veins varies from three to five. The diagonal vein or vena plicata bifurcates to form the mirror which is more or less rounded. A transverse vein crosses the mirror. In all specimens examined the structure of the mirror remains practically the same; the transverse vein in some cases is rather faint. Beutenmüller states that *abbreviatus* has a much larger head and is more clumsy than *Pennsylvanicus*, but I fail to see any differences. One form *luctuosus* has long hind wings which project like tails behind the wing covers. This character is peculiar to both sexes. I see no reason why this character is not sufficient to delimit this form as a distinct species. We may then refer all the other varieties of the region to one species *abbreviatus*.

Fernald describes *abbreviatus* as follows: Black, elytra fusco-testaceous; veins testaceous; wings wanting; ovipositor as long as body.

The same author describes *luctuosus*: Black or brownish; elytra fusco-testaceous or black; wings extending to the end of the abdomen; ovipositor as long as the femur and half the tibia.

#### NEMOBIUS.

From the study of the tympanal areas of wing covers of the males of *Nemobius* I am unable to find any constant variation in the venation, so I am obliged to place all the members under one or two species by reference to plates. It will be seen that the harp area is traversed by only one oblique vein, that the tympanum is sometimes quadrate, sometimes more irregular, often with veins penetrating it and ending blindly. The degree of development of the apical part of the wing cover varies even in the same variety. The extremity of the wing cover is not prolonged but widely rounded, and the tympanum is thrown far back so that the apical area is very short and is composed usually of but one row of cells. The vena plicata bifurcates to enclose the tympanal area which moreover encloses two, sometimes three cells. (Figs. 29-30.) Saussure is unable to separate our forms by any constant variation in the tympanum and my studies confirm his conclusion.

As in *Gryllus* there is a form with long caudate wings. I would be in favor of limiting the species *fasciatus* to this form. The remaining forms would then fall into the species *vittatus*—the smaller forms making the variety *exiguus*.

#### ECANTHUS.

The specimens of *Ecantus* collected about Ithaca, N.Y. and Windsor, Ontario, present many variations in venation, color, shape of wing and surface markings. They were collected during August, September and October, and the great majority of them were caught on *Ambrosia artemisiifolia* (ragweed) and *Euphorbia corollata* (white spurge). A few were taken on grape vines, orchard trees and sumach. In color the specimens ranged from snowy white to almost black.

I have made an attempt to classify the species of *Ecantus* according to the venation of a portion of the wing cover of the male. This is the portion called the *harpa* by Brunner. As will be seen by reference to a drawing of the wing cover of a male the vena plicata during the first quarter of its course forms the file or rasp. Extending in an oblique direction from the file are two or more veins more or less undulating which connect with the vena dividens. The file and oblique veins constitute the harp. Evidently the function of the oblique veins is to make tense the large vein to which they are attached.

The chirp of *Ecantus* is a sexual call of the male to the female. It is natural to suppose that the females recognize the peculiar call of the males of the same species and

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Figure 31 oblique veins These undulate three, four and

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The venat tions as in figu number have th seen that an ad two, and whic remarkable; in two as in figure united into one as in figure 31, united with the (e) and (x) hav itself. Usually in figure 31, 5,

KEY

A. Wing c  
—*nigricornis*.

AA. Wing

B. Sec

BB. Se

an

cannot be lured by the calls of a different species. If such be the case then the peculiar sounds and calls must be produced by harps differing a little in structure, perhaps in the number of oblique veins or in the tenseness of these veins, that is whether undulating or straight.

The classification of the species is somewhat difficult. Several entomologists prefer to place all our native members in one species while some would make three or four. This question will remain in dispute till the life history of the genus has been thoroughly worked out and experiments have been made upon interbreeding.

Charles A. Hart of Champaign, Illinois, in an article in the Entomological News Vol. 3, 1892, page 33 divides the *Cecanthi* by means of black markings on the first two segments of the antennæ. These markings are very distinct and appear to be quite constant, and should they be discovered to be of functional importance are of great value as they are discernible by the naked eye, and easily outlined with the aid of an ordinary lens. In *Niveus* (Fig. 31, 1,) the markings are two black circular spots, one on underside of first and second segments.

In *Angustipennis*, (Fig. 31, 2,) the markings are a curved black line on first segment and a black oval spot on second.

In *Nigricornis*, (Fig. 31, 3 and 4) on the first segment there are a black longitudinal line, and a black spot exterior to it with similar markings on second segment. In some cases the markings are confluent at the upper part of the first segment.

Figure 31, 5 shows the venation peculiar to the harp of *Niveus*. The number of oblique veins varies from three to five, only the first two meeting the vena dividens. These undulate considerably and meet vena dividens at an acute angle. Oblique veins three, four and five extend parallel to one and two, but end in a second longitudinal vein (*d*.)

The venation of *Angustipennis*, (Fig. 31, 6) is remarkably like that of *Niveus* but there is a difference in oblique vein two. In *Niveus* it seems to extend from the vena plicata to vena dividens, but in *Angustipennis* it ends at the longitudinal vein (*d*) which is continued down to vena dividens.

The venation of *Nigricornis* (Walker) is decidedly variable, yet a study of the variations as in figure 31, 7-13 reveals a type which embraces all the forms. By far the largest number have the venation as shown in figure. By a reference to figure 31, 7-13 it will be seen that an additional cross vein has been developed between the oblique veins one and two, and which is marked (*e*) on figures. The migration of veins has been somewhat remarkable; in some cases a straightening has taken place so as to make one vein out of two as in figure 31, 11, where cross vein (*e*) and (*x*) portion of oblique vein two have been united into one line. In some cases (*e*) and (*x*) have become more inclined to each other as in figure 31, 10, while in other cases the oblique veins (1) and (2) have converged and united with the disappearance of veins (*e*) and (*x*) as in figure 31, 12. In figure 31, 8, (*e*) and (*x*) have begun to straighten; in figure 31, 9 oblique vein two has straightened itself. Usually there are only three oblique veins but occasionally a fourth is found as in figure 31, 5, 6 and 11.

#### KEYS FOR THE DETERMINATION OF THE SPECIES OF *CECANTHUS*.

##### I. Males.

A. Wing covers with a cross vein between the oblique veins 1 and 2 of harpa.—*nigricornis*.

AA. Wing covers without a cross vein between the oblique veins 1 and 2 of harpa.

B. Second oblique vein extending to vena dividens—*niveus*.

BB. Second oblique vein terminating at longitudinal vein between VV. plicata and dividens—*angustipennis*.

## II. Females.

- A. Wings extending beyond the tip of ovipositor.  
 B. Pronotum with a single mesal brown band—*angustipennis*.  
 BB. Pronotum without a mesal brown band—*niveus*.  
 BBB. Pronotum dark or with three bands—*nigricornis*.  
 AA. Wings not extending beyond the tip of ovipositor—*nigricornis*.

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A paper on *Drasteria erectea* by Prof. F. M. Webster, illustrated with some very beautiful drawings, was read by Dr. Bethune.

A vote of thanks to the Treasurer and Secretary for their labours in the interests of the Society, was moved by Dr. Fletcher, seconded by Mr. Fyles, and carried unanimously.

Mr. Harrington, seconded by Mr. W. E. Saunders, moved a vote of thanks to Mr. Dearness the retiring President, for the interest he had taken in the affairs of the Society and his labour on its behalf. Carried unanimously.

During the meetings many rare and interesting specimens were exhibited by those present, among which may be mentioned a large number of moths obtained at electric lights by Mr. Bice of London, and the following, collected in the neighborhood of Quebec

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by Mr. Fyles and other members of the Quebec branch: *Phyciodes nycteis*, *Terias lisa*, *Sannina exitiosa*, *Spilosoma congrua* and *cunea*, *Rheumaptera basiliata*, *Tetrachora testata*, and *Conops sagittarius*. Mr. Fyles also reported the capture of *Anarta melaleuca* and *Melipotis limbolaris*.

The meeting then adjourned, after a very profitable two day's session, during which much enjoyable time was spent in the comparison of specimens, and in examining the many interesting books and cabinets belonging to the Society. All who were present expressed their pleasure at the new quarters of the Society, which are so much more convenient, as well as brighter and more comfortable than the former rooms.

### THE VALUE OF SYSTEMATIC ENTOMOLOGICAL OBSERVATIONS.

By J. ALSTON MOFFAT, LONDON, ONT.

Francis Albert Rollo Russell, Esq., Vice-President of the Royal Meteorological Society, &c., &c., has this to say upon the influence of weather on insect pests:

"The effect of a particular kind of season on insect pests is worthy of more attention than it has hitherto received. The importance of attacking in time and as far as possible destroying the insect life which, if neglected, inflicts incalculable damage on crops and gardens, has scarcely been realized, owing to the blight being generally regarded as a necessary evil, not to be foreseen or prevented. The development of insect pests is generally favored by dry weather. Stunting of the growth, and over maturation of the sap of plants induce early changes in the maturing and structure of aphides; the insects multiply without the interference of the ordinary destructive influences of bad weather, and delicate maggots, etc., which are generally drowned in very large numbers by storms of rain, emerge unharmed. At the same time it may happen that corn and other crops may be enabled by earlier hardening of the case, stalks, etc., to protect themselves against attacks which in wet years would bring serious damage. In some countries, and in respect to some crops, it is customary to arrange the date of maturity with special regard to the protective power of the plant and the period of expected attacks from insects. The whole subject is at present too little under scientific observation, and great benefit might result if the following branches of inquiry were systematically investigated: (1) The influence of different kinds of weather in developing insect pests; (2) the time of appearance of crop insects in different seasons in relation to the weather, and the time at which crops are most open to attack in different seasons, according to the weather; (3) the treatment of the ground in drought with a view to destroy threatening pests in their early stages, and, in general, the conduct of agricultural operations with regard to the probable development of particular pests resulting from particular kinds of weather; (4) the issue of forecasts of insect prevalence, derived from a careful study of the habits of various species of insect pests, and of the weather of present and previous seasons."

Everyone knows and admits the powerful and direct connection that exists between the weather and the crops.

That the weather has a powerful influence on the propagation, maturation, multiplication, migration and consequent spread of insect pests, is known only to those who have given the matter some consideration. That some insects are in the habit of appearing periodically is a truth well established by observation, and that the weather must affect these appearances can readily be inferred.

The weather of an extensive territory is often quite diverse in the different portions of that territory, and we can form but very little idea of the influences that are at work, or where they may be at work, in producing the particular kind of weather existing at any given time, in any given locality.

Lieut. Maury, U.S.N., in his magnificent work "The Physical Geography of the Sea," gives his reasons for believing that the great bulk of the precipitation on this continent is evaporated from the sea of the southern hemisphere. The meteorological

observations inform us at times that a violent storm in the Gulf of Mexico is making itself felt in the Gulf of St. Lawrence. Such statements as these assist us in forming some estimate of the far reaching influences that may be affecting the weather of our particular locality.

The forecasts of the weather for the succeeding twenty-four hours, which we have become accustomed to regularly consult, and in good measure to rely upon, and which have proved to be of such immense value to multitudes in their everyday movements upon land or water, are not a matter of guesswork as some seem to suppose, but the condensed result of a vast amount of information gathered together into one central office from numerous distant stations, where it is examined and systematically arranged on purely scientific principles, before the probabilities are issued for the benefit of those living in the different regions into which the country has been divided.

The governments of various countries, realizing the advantage that would accrue to their people from a foreknowledge of what the weather would be for even one day, have established, at very considerable expense, stations all over their countries with suitable instruments for registering the atmospheric conditions and changes, with a competent person in charge to note these and transmit them by telegraph to the central office at stated times. The qualified meteorologist in charge of the central office or weather bureau receives these dispatches from all the separate stations far and near, and has to arrange, compare and condense the information thus obtained. Having been thus placed as it were upon an elevation from which he can survey the whole atmospheric movements that are going on all over the country at one glance, and being familiar with the laws that govern these movements, he has to make his observations from what they are at the present, as to what they are likely to be during the next twenty-four hours in the different regions into which the country has been divided.

For instance, he receives from a station hundreds of miles away information that a storm of a particular kind is raging there, the wind blowing in a particular direction, at the rate of so many miles an hour, he has to calculate by the rate it is travelling and its direction, at what particular time it will be likely to reach particular points along its course. But he may get at the same time information that hundreds of miles away in the opposite direction another storm is prevailing, which may throw the previous calculations completely out as he has now to take into consideration what influence the one will have upon the other, and if they unite what is the direction it will pursue, and whether with increased or diminished force. And so it is through the whole range of every condition and commotion of the atmosphere that exists at any particular place all over the country. Such a brief statement may help to show how thoroughly the weather bureau is under intelligent and scientific control, and that we may confidently rely upon its forecasts as proximately correct. And if the informing stations were increased in numbers, and the regions for which the probabilities are issued were reduced in dimensions they would be yet more reliable.

Now North America is getting to be pretty well dotted over with agricultural experiment stations, supported by government aid, for the benefit of the agriculturist and the general good of the country, and every well appointed agricultural station has an entomologist attached, whose duty is to report upon the depredations done by insects in his particular district, and the means taken to prevent or lessen the same, and bulletins are issued with more or less frequency giving the results of the work done by each, and the success obtained, partial or complete, or none as the case may be, and the probable reason for the same indicated.

Everyone who has the opportunity of seeing the quantity of literature of this description that is being issued from the various stations must be impressed with the industry exhibited in the investigations that are being made into the life and habits of insect pests, and the best means to be used in preventing their ravages. Now as each of these entomologists is in great measure working independently of all the others, and may not be informed as to the department that others are engaged in investigating until it appears in the bulletins of their respective stations, there cannot help but be a good deal of

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duplicating of each other's work going on, and as the seasons are short for some departments of this kind of work, and as attention must be given to it while the opportunity lasts, if the work is to be accomplished at all, many of them may not find the time for reading all that is necessary to keep them informed of what others are doing in a similar line. This fact has recently been fully stated by one who is himself well to the front in this kind of work, when he remarked that with the regular daily work of his position to attend to, it was utterly impossible for him to read all the bulletins that came to his office, and he requested as a favor, that any having matters of special importance that they wished him to see, should mark their papers so that he might not run the risk of losing the benefit of it. This statement discloses both the weakness and the needs of the entomological work that is being done in connection with the agricultural experiment stations.

The highest results in any work can only be reached by united effort under the supervision of one directing head.

With the apparatus and methods of the weather bureau before us, it seems easy to indicate a remedy for the present waste of time and energy that results from each individual entomologist pursuing his vocation with reference almost exclusively to his own locality, and with little information as to what others may be doing at the same time.

It would appear then as if the pressing need of the present system to complete its efficiency is a central bureau of entomological intelligence, with a person in charge appointed solely for his suitability for the position, and whose whole time could be given to the work of supervision. With such a permanent, central office established for giving and receiving information upon all manner of entomological subjects, we can easily understand how it would tend to unite the widely separated entomologists on the staff of the different agricultural stations, making them realize that they were not working alone though separate, and that each being kept informed of what the others were doing would in a measure reap advantages from the other's labors. And when one considers how much has already been done, largely by individual labors, we can form some estimate of how much more might be accomplished by well directed united effort under intelligent guidance. And as the regularly appointed entomologists increase in numbers, the greater will become the need for such a central systematizing bureau to prevent a waste of energy in duplicating each other's work, and that these will increase rather than diminish is certain, as the value of their labors is only now beginning to be realized, and the expense of their maintenance is being returned to the community a hundred fold.

It would be an easy matter to indicate how such a bureau should be conducted, but its ordinary work would be largely controlled by circumstances and necessities, as the course of events required. But it would be known to exist for the express purpose of receiving and disseminating all sorts of information about the doings of insects all over the country, and the best means of combating or preventing their depredations. Thus, the person in charge being kept fully informed of what was going on in the insect world, far and near, might be able to give warning of danger to one locality from what he had been informed was going on in another; and in the case of migratory insects, only such a fully informed person could indicate effective means of dealing with them, and in such a case, the meteorological and climatic conditions are of the first importance. He might even be able to issue forecasts of the probabilities for the coming season. We know what correct guesses Mr. Scudder made about the spread of the imported cabbage butterfly, from scant information gathered with great labor. I took my first Colorado potato beetle at Hamilton, about three years in advance of the time calculated for its appearance in that locality, indicating that the calculations had been made upon insufficient data.

Then there would be bulletins issued from this central bureau, with more or less frequency, as the circumstances required, which every entomologist would be sure to read, as they would be expected to contain a summary of the latest intelligence of what was being transacted by, for or against the insect community all over the continent, or the world for that matter, which could not fail to prove of the utmost interest and advantage to every student in that line, whether he is economic, scientific, or recreative, and would

keep each informed of what others were doing, and save in many instances an unnecessary expenditure of time and labor.

The information received at such a bureau need not be confined to that coming from the regularly appointed entomologists at the agricultural stations, but from every person who took an interest in the subject, and who had made an observation which he thought was worthy of reporting. Thus the sources of information would be increased, which are at present quite too few and widely separated. But we hope for a time when every town and district will have at least one intelligent observer to report for that locality. Then, how many curious, interesting and important questions of insect economy that long have, and still remain involved in mystery, will find a solution through the united systematic work of numerous observers? Thus, with those interested in the doings of insects at shorter distances apart, the east would be united to the far distant west, and the north with the south by means of this central bureau, and instead of our having bits of information about widely separated spots, as if they stood apart and alone, we would get an intelligent connected view of the various steps in the progress which unite the two extremes into one harmonious whole.

#### ON BUTTERFLY BOOKS.\*

BY HENRY H. LYMAN.

Having been asked by one of the members of our branch for advice on the books most necessary for one engaged in the study of the North American Lepidoptera, I have thought that this subject might be of sufficient interest to some of our other members as to render it not unsuitable for a short paper.

Hitherto I have always recommended anyone entering upon the study of North American insects to purchase Harris's *Insects Injurious to Vegetation* as the first and most necessary work upon the subject, and I recently noticed in a paper by Dr. S. H. Scudder, on "The Young Entomologist and what he wants," reproduced by the Montreal Witness, from the "Independent," that the writer gives the same advice saying, "the best single book is Harris's *Insects Injurious to Vegetation*."

If Harris's classic work no longer enjoys that unquestioned supremacy which it has held for so many years, the only work which may claim to rival it is Prof. Comstock's "Manual for the Study of Insects," which has certainly some very valuable features, and is of course more modern and "up to date," though one may not agree with all the views set forth. I should certainly recommend both these works to everyone entering upon the study of entomology.

A smaller and much cheaper, but very useful work is Dr. Packard's "Entomology for Beginners." It serves as a general introduction to the science, treating of the "Structure of Insects," "Growth and Metamorphosis of Insects," "Classification," "Insect Architecture," "Injurious and Beneficial Insects," "Directions for Collecting, Preserving and Rearing Insects," with directions for dissecting insects, cutting and mounting microscopic sections of insects, and a list of the most important works on general entomology and the biology of insects, together with a glossary and index. Naturally with so much ground to be covered but little space could be given to the consideration of the different orders, thus only 24 pages are given to a review of the coleoptera, 20 to the diptera, 24 to the lepidoptera, 16 to the hymenoptera and 36 to the other orders.

To any one wanting a more extended guide for the collecting, rearing and preservation of insects, no better work can be recommended than Dr. Knagg's "Lepidopterist's Guide," which is issued at the moderate price of one shilling, and which though, of course, written for English collectors, will be found very useful by all, as its general directions and suggestions as to treatment are very generally applicable.

\* Read before the Montreal Branch of the Entomological Society of Ontario, 8th December, 1896.

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When we turn from general works to those dealing with a single order, either in whole or part, the choice is more difficult and no one book is sufficient.

To any one who has the money to spend and who is interested in the butterflies of the whole continent north of Mexico, no finer work can be recommended than the magnificent volumes of Mr. Wm. H. Edwards on the butterflies of North America with their 152 exquisite coloured plates, but unfortunately the price, aggregating \$135 for the three volumes, places the work beyond the reach of the great majority of lepidopterists.

For the butterflies of the Eastern United States and the contiguous parts of Canada, Scudder's splendid work leaves nothing to be desired, as it is a complete manual on the most elaborate scale of the butterflies to be found in the region, with a great wealth of illustration, but unfortunately its price, \$75, puts it also out of the reach of very many.

An excellent work, dealing with almost the same territory but comprising about one-fourth more species and published in 1886, at a moderate price, is French's "Butterflies of the Eastern United States." This is a very useful work of 402 pages and gives descriptions of 201 species. The nomenclature and classification follow those of Mr. W. H. Edwards. Short directions are given for collecting, setting, preserving and rearing specimens, and there is an accentuated list and an analytical key. The preparatory stages where known are described with considerable detail, and the distribution is given in a general way. There is, however, a dearth of illustrations, especially in the *Lycænidæ* and *Hesperidæ*.

A less pretentious but extremely useful work is Scudder's "Brief Guide to the Commoner Butterflies of the Northern United States and Canada," published in 1893, by Henry Holt & Co, at the very moderate price of \$1.25. The author has selected for treatment 84 species which he judges would be almost surely met with by an industrious collector in the course of a year or two years' work in the Northern States east of the great plains and in Canada, but such as he classes as "rare" or occurring only in restricted localities are omitted. This, I think, is a pity, as no one starts out to collect merely common things however beautiful, and we all long for the rare and valuable. Besides, several are omitted which occur over wide areas, such as *Grapta Gracilis*, which is found in the Adirondacks, the White Mountains, in the Muskoka region, on the Lower St. Lawrence and even to the extreme end of the Gaspé Peninsula, and also *Colias Interior*, embracing a similar but apparently still wider distribution.

One great charm that I found in the acquisition of my first entomological work, viz, Coleman's *British Butterflies*, was that it treated of *all* the species found in Great Britain, and so I felt confident that whatever I caught I would find treated of there and it certainly seems to me that the few extra pages that would have been required for these species, even if their addition had slightly enhanced the cost of the book, would have been well worth the cost.

This book has no illustrations of any of the species, but though this is doubtless disappointing to the beginner, it has this advantage that when he has worked out the determination of any butterfly by the analytical key and the description he has a much more scientific knowledge of the species than if he merely named it by a superficial comparison with a good figure. The nomenclature, of course, is Mr. Scudder's own, the general adoption of which most of us, I think, would regard with disfavour. Otherwise the book has much to recommend it to the beginner.

Another work, of very limited scope but very beautifully illustrated, is Beutenmüller's "Descriptive Catalogue of the Butterflies found within fifty miles of New York City," published in the "Bulletin of the American Museum of Natural History," separate copies of which may still be obtained from the author at \$1 each.

This work consists of sixty-eight pages and five plates, two by the Lithotype Printing Co. being especially fine. Ninety-three species are treated of and of these sixty-two are figured. Descriptions of the caterpillar and chrysalis are given where known, and the food plants and short notes on the life history. It is certainly to be regretted that this pamphlet is not more generally accessible.

"The Butterflies of Maine," published by Prof. C. H. Fernald in 1884, is an excellent pamphlet of 104 pages, describing the sixty-nine butterflies known to have been taken in Maine. It contains an accentuated list of the scientific names and the principal "common" names which have been given, and there is also an artificial key for the determination of the butterflies. There are no plates but there are thirty-five woodcuts illustrating a number of the species in one or more stages.

For the Sphingidæ, the most important work is Prof. J. B. Smith's Monograph, published in Trans. Amer. Ent. Soc. XV., 1888, and obtainable separately at \$2. This work extends to nearly 200 pages and is very exhaustive in its treatment. There are ten plates, eight devoted chiefly to the genital armature and two chiefly to venation, but there are no figures of species. About 30 pages are devoted to tracing the classification of the group from the time of Linnæus in 1758 down to the publication of this monograph in 1888. The preparatory stages are not described, but where known may be found from the references, which are very complete. This, however, has the disadvantage of compelling the hunting up of these descriptions in other works, which one may be unable to do if a complete entomological library is not within reach.

"The Sphingidæ of New England," published in 1886 by Prof. Fernald, is an excellent pamphlet of eighty-five pages and six plates, illustrating ten species, with the larva or larva and pupa of most of them. Forty-two species are described, and there is an analytical key and the scientific names are all accentuated and the work is on similar lines to the same author's "Butterflies of Maine."

"Descriptive Catalogue of the Sphingidæ found within fifty miles of New York," by Wm. Beutenmüller, is another excellent work on the same plan as his work on the butterflies. It consists of forty-six pages and six plates, which figure forty-two species, while forty-six altogether are described in the text. With such a work no one should have any difficulty in determining his specimens. This work was published in the Bulletin of the American Museum of Natural History, and except for the few author's separates is unfortunately only accessible to those able to consult this work.

For the groups intervening between the Sphingidæ and the Geometridæ there is as yet unfortunately no approximately complete work, nor indeed any work other than check list or catalogue at a moderate price.

In July, 1872, Mr. R. H. Stretch undertook the publication of a work entitled "Illustrations of the Zygenidæ and Bombycidæ of North America." It was to be issued in parts, each of which was to contain a coloured plate. The work was intended to extend to thirty parts at \$1 each, or with plain plates 75c. each. The genera and species were not taken up in consecutive order but irregularly as specimens could be obtained, and as the work was discontinued after the issue of the ninth part, with which the author closed his first volume, it is very incomplete, and while rather costly in the first instance has become more so from its comparative rarity.

Dr. Packard has begun the publication of a sumptuous work, "A Monograph of the Bombycine Moths of America, north of Mexico." The first volume, which is all which has so far appeared, treats of the Notodontidæ, and costs \$15 in paper covers, or \$16 bound in cloth, and is, therefore, a costly work. The part already issued is a quarto volume of 291 pages with forty-nine plates, ten maps and eighty-five cuts. Of the plates seven are of the moths, one being coloured and the others done by the heliotype process, thirty which are coloured illustrate the larvæ with great fulness of detail, ten are devoted to venation, one to other structural details, and one to three moths with the larvæ of two of them.

The eggs and cocoons or pupæ are not illustrated on the plates, but a number of pupæ are illustrated in the introductory part of the work.

For the Geometridæ the monumental "Monograph" of Dr. Packard, published by the United States Government as one of the volumes of its geological survey of the territories, should be in the hands of every lepidopterist who can afford the very moderate price, \$4 I believe, at which it is, I suppose, still obtainable.

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This magnificent work is in quarto form, consists of 607 pages and 13 beautifully engraved plates, six being devoted to venation, one to anatomical details, and the remaining six to the perfect insects and a few larvæ and pupæ. These six plates contain no less than 389 figures of moths, and thirty-six figures of larvæ and pupæ. The work embraced all species of this group known to Dr. Packard up to the date of its publication, and is indeed wonderfully complete.

For the Pyralidæ I know of no exhaustive work, but for the Phycitidæ the paper by the Rev. Geo. D. Hulst in the Trans. Am. Ent. Soc. XVII., 1890, and obtainable separately, I believe, for about one dollar, should be studied. This paper consists of 136 pages and three plates illustrative of structure and venation.

For the Crambidæ, Prof. Fernald's recent monograph of eighty pages, with its three plates of venation and structural details, and its six exquisite colored plates of the species is all that could be desired, but for the Tortricidæ there is no reasonably complete work at a moderate price. One of the earliest illustrated papers was that by the late Coleman T. Robinson, published in Trans. Am. Ent. Soc. II., 1869, which was intended to be the first of a series to include the whole of the species found in the U. S. This first paper illustrated with six beautifully colored plates, embraced descriptions of no less than seventy species, but the project was cut short by the untimely death of Mr. Robinson. Since that event the chief work issued on that group is that of Lord Walsingham, eighty-four pages, quarto, with seventeen colored plates, published by the trustees of the British Museum, but this is a somewhat expensive work, costing £2.

I do not know of any general work on the Tineina.

In regard to catalogues and check lists, there is no general catalogue of North American Lepidoptera. For a mere check list I would recommend that issued by Prof. J. B. Smith, with the assistance of Drs. Skinner, Hulst, Fernald and Riley, which is sold at \$1.00.

For the butterflies Edwards's "Revised Catalogue of Diurnal Lepidoptera," issued in 1884 is to be recommended, though Dr. Strecker's catalogue, issued in 1878 at the cost of \$2.00, though having certain defects, contains much useful information and more complete references.

For the Sphingidæ, Zygæidæ and Bombycidæ, using the latter term in its older sense, there is no American catalogue, but they are, of course, embraced in Kirby's world-wide catalogue of Sphingines and Bombyces, with the exception of some of the groups, such as the *Ægeriadæ*, which he excludes, but this is an expensive work costing £2 4s

For the Noctuidæ we are indebted to Prof. J. B. Smith for a comprehensive catalogue of 424 pages, which is obtainable for \$2.50.

Other works might be mentioned with commendation but the selection has been purposely restricted to those which are most indispensable.

Of books on the other orders of insects I am not competent to speak, but for anyone who is primarily interested in the economic relations of butterflies or other insects no works can be more highly recommended than "Insects Injurious to Fruits," by Dr. Wm. Saunders, and Prof. J. B. Smith's "Economic Entomology."

It is, doubtless, impossible to do much in the entomological line without some books, but by a judicious selection ten or twenty dollars may be laid out to purchase a very fair selection of the most useful works for a beginner, and then other works could be added as one's interest in the subject developed and one's means would admit.

#### SOME HOUSEHOLD INSECTS.

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

So many enquiries are repeatedly made respecting common insects that frequent houses and cause annoyance to the inmates, or damage to household goods and provisions,

pp 51-61

that it has seemed desirable to give some account of those most frequently complained of, and suggest some methods of dealing with them. Hitherto very little has been published upon this class of troublesome insects, and not much has been known about their life histories; but last year the deficiency was satisfactorily removed by the publication at Washington of a bulletin on "The Principal Household Insects of the United States," by Dr. Howard, Entomologist in Chief of the Department of Agriculture, and his assistants, Messrs. Marlatt and Chittenden. In the following pages we shall freely draw upon this work, as nowhere else can the same accurate information be obtained, and by no other writers have the life histories of these insects been so carefully studied and the details so clearly and admirably set forth.

#### COCKROACHES.

Most houses in towns and cities are infested with cockroaches to a greater or less extent, and even isolated dwellings in the country are sometimes inhabited by an unwelcome colony of these creatures. I have known them to be introduced into remote places by means of the trunks of visitors, or packages of groceries received from some distant city. Mr. Fyles (15th Annual Report, 1884, p. 43) relates the occurrence of large numbers at Ohaudiere Curve, a wayside station, nine miles from Point Levi, P. Q., where luggage is transferred from the Grand Trunk to the Intercolonial Railway, and *vice versa*, and where the insects were evidently brought by immigrants from Europe. They usually frequent kitchens and pantries and are especially abundant about the stove or fireplace on account of their fondness for heat. For this reason, as well as for the sake of the abundant food supply, they are often present in great numbers and become a perfect nuisance in bakeries. They are also excessively numerous and troublesome on board ship, the moisture and heat of the vessels being particularly favorable to them. In the daytime they are rarely seen, as they always avoid the light, and conceal themselves in crevices, behind baseboards, under boxes or barrels, etc., wherever in fact they can squeeze their flat, thin bodies, and escape observation. If disturbed they scuttle off with great rapidity to the nearest hiding-place and can rarely be captured or destroyed. It

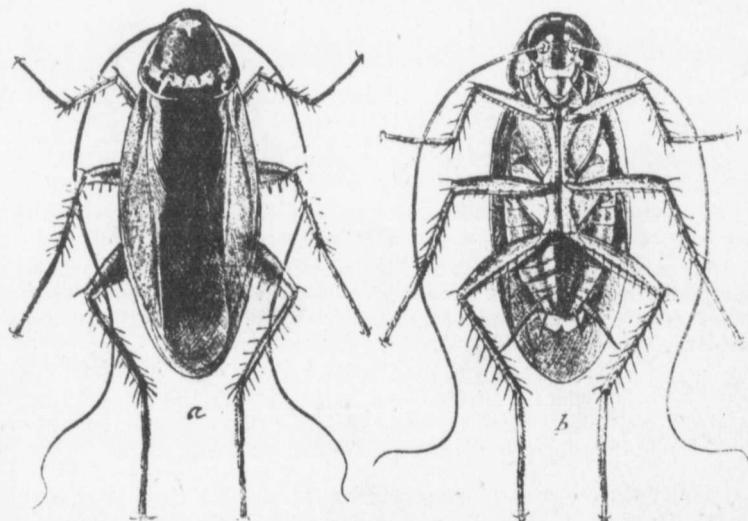


Fig. 32. The American Cockroach; a view from above; b from beneath; both enlarged one-third (after Marlatt).

sometimes happens that a large colony has established itself in a kitchen for months without being discovered, till a sudden entry with a light after the usual hours has revealed their presence.

Cockroaches, crickets, grasshoppers, and other species, near the estimated the tropical cou feeders, and wings expan species have regarded as the German *Australasia*) roach (Fig. : inch in lengt is a native ( gradually sp its place bei

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Cockroaches belong to the family Blattidæ, of the order Orthoptera, which includes crickets, grasshoppers, locusts, etc. This family consists of a very large number of species, nearly a thousand having been named and preserved in collections, and it is estimated that about four times as many more are in existence in the world, chiefly in tropical countries. The great majority of them live out of doors and are vegetable feeders, and some attain to large dimensions. I have a specimen from Mexico, whose wings expand five inches, and larger species than this are known. Happily, but few species have become domesticated, and in North America there are only four that can be regarded as household pests. These are the American Cockroach (*Periplaneta Americana*), the German (*Ectobia Germanica*), the Oriental (*P. orientalis*), and the Australian (*P. Australasia*). As far as my limited experience goes, the first named, the American Cockroach (Fig. 32) is the common species in Ontario. Full grown specimens are about an inch in length, of a light brown color, and furnished with ample wings in both sexes. It is a native of this continent, having originated in the warm regions of the south and gradually spread northward; it is especially abundant in the Middle and Western States, its place being taken in the Atlantic States by one or other of the imported species.

The German Cockroach (Fig. 33) is more familiarly known under the name of the "Croton Bug," from its association with the Croton waterworks system in the city of New York. It had, no doubt, been introduced into the city long before, but had not attracted general attention till the extension of the waterworks and the immense

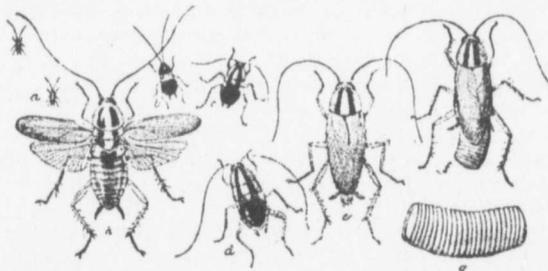


Fig. 33. The German Cockroach; *a* first stage; *b*, *c*, *d*, second, third and fourth stages; *e* adult; *f* female with egg-case; *g* egg-case enlarged; *h* adult with wings spread. All natural size, except *g*.  
(After Riley).

multiplication of piping in houses enabled it to make its way from one building to another without difficulty, and the dampness and heat of hot water pipes afforded it the most favorable conditions for living and increasing. As its name indicates, it is a European species, being particularly abundant in Germany and the adjacent countries. It has, however, been carried by commerce and emigrants to all parts of the world, and is now spreading so rapidly in England, owing probably to the immense importation of goods "made in Germany," that Miss Ormerod tells us it is supplanting the familiar English species, known as "the black beetle." It is much smaller than the other domestic species, rarely exceeding five-eighths of an inch in length, very light brown in color and distinctively marked on the thorax with two dark brown stripes. It is more active and wary than the larger species and much more difficult to get rid of; it also multiplies much more rapidly, the breeding period being shorter and a greater number of eggs being produced at a time.

The Oriental cockroach is the common species in England, where it is known in the household by the name of "the black beetle." It is supposed to be of Asiatic origin, and to have spread through Europe several centuries ago. It is very dark brown, almost black, in colour, shining, and much stouter than the other species. The wings of the male are shorter than the body and in the female are so abbreviated as to render her practically wingless. It is notably gregarious in habit, the individuals living together in colonies in the most friendly manner. This species was brought in early days to the British settlements in North America and is very common now in the Eastern States; it has also spread far inland, and has been found even in New Mexico

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The fourth species, the Australian, resembles very closely the American cockroach, but may readily be distinguished from it by the bright yellow band surrounding the prothorax and the yellow dash from the shoulder on the sides of the upper wings. It is very abundant in Florida and some of the southern states, but is not likely to become acclimatized in Canada. *P. australis*  
A specimen was sent to me last summer by a lady in Toronto who had found it among some bananas. It is the only living specimen that I have seen in this country, and evidently came with the fruit from the tropics.

The structure and life history of the domestic cockroaches are thus described by Mr. Marlatt: "They are uniformly dark brown or dark coloured, a coloration which corresponds with their habit of concealment during daylight. They are smooth and slippery insects, and in shape broad and flattened. The head is inflexed under the body, so that the mouth parts are directed backwards and the eyes directed downward, conforming with their grovelling habits. The antennæ are very long and slender, often having upwards of 100 joints. The males usually have two pairs of wings, the outer somewhat coriaceous and the inner ones more membranaceous, and once folded longitudinally. In some species the females are nearly wingless. The legs are long and powerful, and armed with numerous small bristles or spines. The mouth parts are well developed, and with strong biting jaws, enabling them to eat all sorts of substances.

"The cockroach in its different stages from egg to adult shows comparatively little variation in appearance or habits. The young are very much like the adult, except in point of size and in lacking wings. In their mode of oviposition they present a very anomalous and peculiar habit. The eggs, instead of being deposited separately as with most other insects, are brought together within the abdomen of the mother into a hard, horny pod or capsule which often nearly fills the body of the parent. This capsule contains a considerable number of eggs, the number varying in the different species, arranged in two rows. When fully formed and charged with eggs the capsule is often partly extruded from the female abdomen and retained in this position sometimes for weeks or until the young larvæ are ready to emerge. The capsule is oval, elongate, or somewhat bean shaped, and one of its edges is usually serrate. The young are in some instances assisted to escape by the parent, who with her feet aids in splitting the capsule on the serrate side to facilitate their exit. On hatching, it is said, the young are often kept together by the parent and brooded over and cared for, and at least a colony of young will usually be found associated with one or two other individuals.

"They pass through a variable number of moults, sometimes as many as seven, the skin splitting along the back and the insects coming out white, soft, but rapidly hardening and assuming the normal colour. Their development is slow, and probably under the most favourable conditions rarely is more than one generation per year produced. The rate of growth depends largely upon food and temperature, and under unfavorable conditions the time required for development may undoubtedly be vastly lengthened. The abundance of cockroaches is, therefore, apparently not accounted for so much by their rapidity of multiplication as by their unusual ability to preserve themselves from ordinary means of destruction and by the scarcity of natural enemies."

They will eat almost anything, animal or vegetable, and especially the food materials found in store rooms and kitchens. They will also gnaw boots and shoes, the cloth and leather binding of books, which they sometimes damage very seriously, the paste or sizing used being apparently the chief attraction. In a house that I occupied a few years ago they were very numerous in the kitchen and scullery, and often made their way up to my study on the floor above. One night when I was writing, a specimen climbed up on my inkstand and began to drink the ink. After watching it for some time I killed it, and found the body was completely filled with ink! Evidently nothing comes amiss to them in the way of food.

But besides the loss they occasion by their consumption of supplies, they are almost a greater nuisance from the disgusting odour they leave on everything that they touch, and which cannot be got rid of without vigorous washing with soap and hot water.

Dishes of food, and their

Remedies  
 dark corners, conditions are not it is necessary thorough "holes" under which they are found; then wash with disinfectants or wainscots or wall paper; but if not after a short time unpleasantness.

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species about in my own house. Blattella germanica morium pharao the little black as a rule, find it sometimes seen

Dishes of food left uncovered at night are often utterly ruined in this way by the morning, and their contents have simply to be thrown away.

**Remedies.**—A clean kitchen, with well-scoured sink and no damp places or neglected dark corners, will usually be fairly, if not entirely, free from these creatures, as the conditions are not favorable to their multiplication. But if they should become established, it is necessary to wage an active warfare against them. First we should recommend a thorough "house cleaning" of the kitchen, pantries and parts adjacent, moving everything under which they could possibly squeeze their flat bodies, and killing all that can be found; then apply powdered borax to all cracks and crevices in the floors, skirting boards, wainscots or walls. This will usually be found effective, and the cockroaches will disappear; but if not fully exterminated at once the powdered borax should be applied again after a short interval. It is, happily, a clean substance, and its use is attended with no unpleasantness.

Another remedy that is highly recommended is the use of Pyrethrum insect powder. This must be fresh and applied liberally to all places frequented by the insects. It is, however, much more expensive than borax, and involves more trouble, as the cockroaches are usually only partially paralyzed by it, and require to be searched for in the morning and destroyed in the fire. If the infested portion of a building can be made air-tight, the insect powder may be burnt and the fumes will penetrate into every crevice and destroy the creatures in their hiding-places; but this plan can rarely be carried out effectively. Instead of burning insect powder, bisulphide of carbon might be evaporated with still more deadly effect; but this is too dangerous a remedy to be employed in a dwelling house.

A simple mode of trapping them has been found very useful. Any deep vessel or jar may be used. Place against it a number of sticks bent over so as to project a very little way into the interior; half fill the vessel with stale beer, for which the insects have a special fondness. In the morning great quantities of dead and dying specimens will be found, which have climbed up the sticks and dropped into the liquid within. By frequent use of a trap of this kind the number of cockroaches on the premises may be very satisfactorily reduced.

#### HOUSE ANTS.

Next to the cockroaches, the insects mostly complained of by housekeepers for their depredations upon the domestic stores are what may be called the "House Ants," as distinguished from those that live out of doors and rarely come into dwellings. The

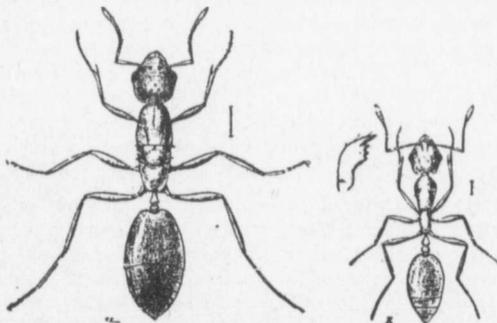


Fig. 34.—The red ant (*Monomorium pharaonis*):  
a, female; b, worker—much enlarged. (After Riley.)

species about which I receive the most enquiries, and which has been very troublesome in my own house in the summer time, is the little reddish-yellow ant (Fig. 34) (*Monomorium pharaonis*, Linn). Another species, about equally common and troublesome is the little black ant (*M. minimum*, Mayr.). The former makes its nest in the house itself as a rule, finding a suitable place under the flooring or in the wall behind the plaster; it sometimes selects for its abode a place near a hot water pipe and in such cases con-

tinues its activity throughout the winter. The black species has its nest out of doors and finds its way in through the crevices of a window frame or some other tiny opening. Both species are annoying, not so much from the amount that they make away with, as from their habit of getting into articles of food, especially sweets of any kind. Frequently the sugar bowl, when brought to table, is found to be swarming with them, or the pot of jam or marmalade that was opened for one meal is full of smothered specimens as well as lively ones when brought out of the cupboard for the next.

It is unnecessary here to enter into any description of the marvellous life-history and habits of ants. Many most interesting books have been written upon their highly organized societies and their remarkable intelligence, among these may be mentioned the works of Dr. McCook and Sir John Lubbock. We are only concerned now to know enough about these tiny species to enable us to deal with them effectively. The individuals that cause the annoyance are all neuters, or workers; the males and females do not appear upon the scene. Should the nest be discovered, there will be found within it one or more females, and a quantity of larvæ and pupæ, which from their white colour and shape are popularly supposed to be eggs. At a certain season of the year, which varies with different species, there may be seen issuing from the nest, apparently in a tremendous state of excitement, a swarm of winged ants, which speedily take flight and from their numbers in the air frequently prove a great nuisance to those whose persons may be covered with them. These winged individuals are males and females, whose marriage takes place in the air. The males soon perish and the females which escape their natural enemies, birds, toads, etc., remove their wings and begin the work of forming new colonies, producing an immense quantity of eggs.

It is evident that the destruction of the workers that come into the house will not exterminate the colony to which they belong. It is therefore all important, if possible, to discover the nest. This may often be done by following the line of advancing and retiring workers till they are traced back to their abode. If at all practicable, without injury to the house, the nest should be destroyed by pouring into it some coal oil or boiling water; where this cannot be done, it may be possible to inject a small quantity of bi-sulphide of carbon, but care must be taken not to have any light near for fear of an explosion, and to air the apartment thoroughly afterwards. In the case of the little black ant, it is often much more difficult to find the nest in consequence of its being out of doors, but when found its destruction is usually an easy matter as it may simply be drenched with coal oil. Failing the discovery of the nest, the only effective mode of getting rid of the nuisance is to entrap and destroy the ants as fast as they appear. This can readily be done by taking a wet sponge from which the water has been squeezed and sifting fine sugar into it; lay it on a plate or saucer where the ants are in the habit of congregating, and in half an hour or so it will be found full of ants; drop it with its living contents into boiling water and get rid of one host of invaders; repeat the operation from time to time and in a few days the ants will cease to be troublesome. They will, however, appear upon the scene again after some time, when the same process will have to be repeated; but it requires but little time and the expenditure of no large amount of patience.

While housekeepers complain of these tiny ants, gardeners often make enquiries regarding the destruction of the much larger species which disfigure lawns by the great mounds they construct over their nests. A very easy and expeditious method is to be found in the use of bi-sulphide of carbon. Last summer I completely exterminated three colonies on my lawn in the following manner: I purchased a two ounce vial of the bi-sulphide, and at dusk in the evening, when the ants had returned home from their foraging expeditions, I poured about a third of it down the principal openings into the nest and at once covered the whole with a sheet of brown paper. After about ten minutes I set fire to the paper, which caused a series of explosions to take place within the nest. The next morning not a single ant was to be seen, and the mound was easily flattened down. The scorched grass soon recovered, and in a week or two not a trace of the unsightly nest remained. The other two nests were destroyed during the same evening and in a similar manner.

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## MOSQUITOES.

No insect causes so much annoyance and actual suffering to the human race as the Mosquito. It is everywhere prevalent in the summer time and in many localities is so excessively abundant as to be an intolerable pest. Though only active in warm weather it seems that no amount of cold will destroy it. It occurs in prodigious numbers in our Northwest Territories, and, if the travellers' tales from the Yukon and Klondike may be credited, it swarms within the Arctic Circle in such myriads that human beings can hardly live under its overwhelming and incessant attacks.

Though so common an insect and so obtrusive in its onslaughts upon entomologists as well as upon ordinary mortals, it is a remarkable fact that almost nothing was known about the American species till they were recently studied by Dr. L. O. Howard, of Washington, and the results of his observations were published in the volume mentioned at the beginning of this paper. Writers have been content to quote the descriptions given by Réaumur of a European species, which he studied at Paris one hundred and fifty years ago, and have taken for granted that his careful and accurate records made in France are applicable, without verification, to the numerous species that inhabit North America. That the species are numerous, notwithstanding the general practice of speaking of "the Mosquito" as if there were but one kind from the Atlantic to the Pacific, is shown by the fact that Mr. Coquillett has determined twenty distinct species in the collection of the National Museum at Washington, and there is good reason to believe that not half the existing species are represented there.



Fig. 35.—Female mosquito (*Culex pungens*), side view—much enlarged. (After Howard.)

Dr. Howard has made *Culex pungens* (Fig. 35) a species common at Washington, the subject of his special studies, and we may present here a condensed account of his history of its life as being typical of any species with which we may be troubled. The eggs are laid on the surface of water in masses containing from 200 to 400. As seen from above, the egg-mass is gray brown; from below silvery white, the latter appearance being due to the air film. The eggs laid during the night began to hatch at two o'clock in the afternoon of the same day during warm weather towards the end of May, but in cooler weather they sometimes remained unhatched until the second day.

The larvæ (Fig. 36) issue from the under side of the egg masses and are extremely active at birth. In general they pass through apparently three different stages, reach maturity and transform to pupæ in a minimum of seven days. When nearly full-grown their movements were more carefully studied as they were more easily observed than when newly hatched. At this time the larva remains near the surface of the water, head downwards, with its respiratory siphon, which takes its origin from the eighth abdominal segment at the exact surface and its mouth filaments in constant vibration, directing food into the mouth cavity. Occasionally the larva descends to the bottom but never remains below the surface for more than a minute at a time. In ascending it comes up with an effort, with a series of jerks and wriggings with its tail, but descends without difficulty, its specific gravity seeming to be greater than that of water.

The pupa (Fig. 36) differs from the larva in the great swelling of the thoracic segments, and in this stage the insect is lighter than water. It remains motionless at the surface and when disturbed does not sink without effort, as does the larva, but is only able to descend by a violent muscular action. It wriggles and swims as actively as the larva, and soon reaches the bottom of the vessel or breeding-place. As soon as it ceases to exert itself, it floats gradually up to the surface of the water again. The air tubes no longer open at the anal end of the body, but through two trumpet-shaped appendages on the thorax, from which it results that the pupa remains upright at the surface, instead of with the head downward. This reversal of position enables the adult insect, which issues from the thorax, to support itself on the floating skin while the wings are expanding.

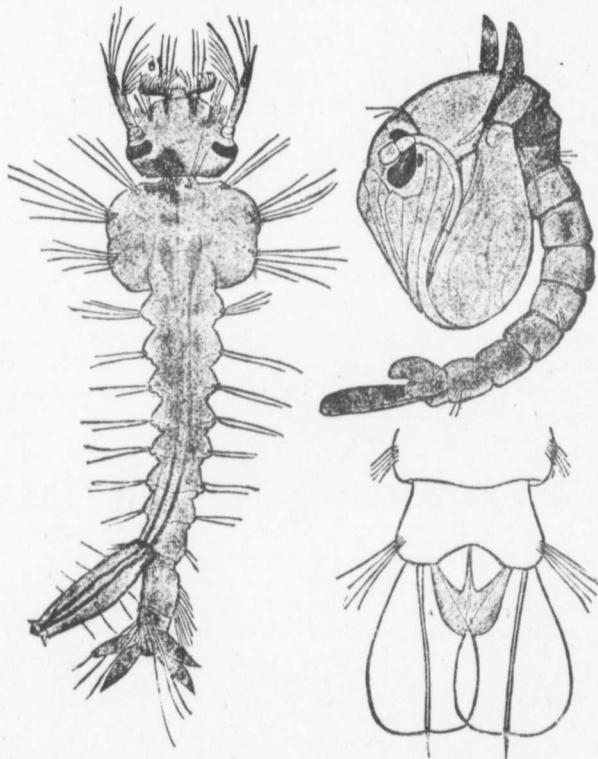


Fig. 36.—Full grown mosquito larva (*Culex pungens*) at left; pupa at right above, its anal segment below—all greatly enlarged. (After Howard).

The shortest time observed for the life of the insect from the laying of the egg to the emergence of the winged mosquito was ten days, during hot weather at the end of June; but the length of time which is required for a generation may be indefinitely prolonged if the weather should be cool. The extreme shortness of this June generation is significant, as it accounts for the fact that swarms of mosquitoes may develop upon occasion in surface pools of rain water, which may dry up entirely in the course of two weeks, or in a chance bucket of water left undisturbed for that length of time.

The insect passes the winter in the adult winged state and frequently resorts to cellars and out-houses for the purpose. The degree of cold seems to make no difference to their successful hibernation, as may be understood from their abundance in the extreme north.

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It is a well known fact that the adult male mosquito does not necessarily take any nourishment, and that the female cannot depend upon the blood of warm-blooded animals for its food. Mosquitoes undoubtedly feed normally on the juices of plants, and not one in a million ever gets an opportunity to taste blood. When we think of the enormous tracts of marsh land into which warm-blooded animals never penetrate, and in which mosquitoes breed in countless numbers, the truth of this statement becomes apparent.\*

*Remedies.*—To prevent the annoyance of mosquitoes in houses, particularly in bedrooms, it is a good plan to burn a small quantity of pyrethrum powder, about enough to cover a fifty cent piece, heaped up in the shape of a cone and lighted at the top; this will suffice for an ordinary sized bed-room. The fumes penetrate to all parts of the room and stupify the insects for some time. Should they revive, the operation may be repeated. Of course the door and windows should be closed for the time being in order to prevent the escape of the smoke from the burning powder. A quiet night may also be secured by killing all the mosquitoes that are to be found resting on the walls and ceiling of the room. The latter may be reached by tacking the lid of a small tin box to the top of a sufficiently long stick and putting into it a spoonful of coal oil. If this cup is shoved under a mosquito on the ceiling it will at once try to escape, and in its efforts fall into the coal oil and end its existence.

A far more important matter, however, is the destruction of the larvæ, or the abolition of their breeding-places. In our Annual Reports for 1892 and 1893, papers by Dr. Howard were published in which he gave most interesting details of his experiments with coal oil for the destruction of mosquito larvæ. It need, therefore, only be mentioned here that the method consists in pouring a thin layer of coal oil over the surface of the water in which the insects are breeding. The larvæ and pupæ, we have seen, live almost entirely at the surface of water and cannot remain beneath for more than a minute at a time. The coal oil will at once fill up their breathing tubes and cause immediate death. Large numbers also of the female mosquito will be destroyed before their eggs are laid, as it has been found that the coal oil does not deter them from trying to deposit their eggs on the surface of the water. This method, of course, can only be employed in the case of pools of stagnant water of no very large dimensions. When the breeding-place of the mosquitoes is too extensive to admit of this treatment, their numbers can be kept in check by the introduction of small fish into the waters. But the most fruitful places for the production of these pests on a large scale are swamps and marshes. Nothing but their drainage, which may prove a profitable undertaking for other purposes, will suffice for a cure. Rain water barrels and similar receptacles, which are common about houses in the country, produce swarms of mosquitoes during the summer and these readily find their way into the rooms so close at hand. All such vessels for holding water should be kept closely covered, especially at night, when the female mosquitoes resort to them for the purpose of laying their eggs.

#### FLEAS AND BUGS.

The consideration of the blood-thirsty mosquito leads one on to think of other insects that have similar evil propensities and that sometimes become a torment to suffering humanity. Fleas are now rarely met with in the older settled parts of Canada, though they were common enough thirty years ago; occasionally, however, a house may be found to be infested with them. Dr. Howard states that the species most frequently sent to the Department at Washington from cities in the Eastern States proved to be the cosmopolitan flea of the dog and cat (*Pulex serraticeps*), and not, as was supposed, the human species (*P. irritans*). This accounts for the rarity of these pests in well-ordered houses where the dogs and cats are kept clean.

\*For many interesting particulars regarding mosquitoes, see a paper by Mr. J. A. Moffat in the 24th Annual Report, 1893, page 43.

Fleas (Fig. 37) belong to the order Siphonaptera, a name derived from the sucking apparatus of the mouth and the absence of wings in the adult insect. The body is oval



Fig. 37.—Adult flea (*Pulex serraticeeps*): a, egg, both much enlarged. (After Howard).

and greatly compressed, allowing the insect to move freely between the hairs of the animal upon which it lives; it is also very hard and smooth, enabling the creature to slip away from between the fingers of its captor or the teeth of a dog. Its escape is also facilitated by its long and powerful legs, which enable it to leap an immense distance when compared with the size of its small body. Its eggs are laid between the hairs of the infested animal, but are not fastened to them, so that when the animal moves about or lies down they are shaken off to the floor or ground. The larva, which is very minute and rarely seen, except by those who search for it for purposes of study, lives upon the animal and vegetable matter contained in the dust to be found in the cracks of

floors or the sleeping-places of animals. The frequent sweeping and scrubbing of the rooms in well-ordered households is, no doubt, an effectual preventive of their development.

**Remedies.**—Should a dog or cat be found to be infested with fleas it should be thoroughly dusted with insect powder, and its sleeping place turned out and cleaned. Any bedding it has lain upon should be burnt and fresh material such as straw or shavings, be supplied and frequently renewed. The kennel should also be washed inside with some coal oil or benzine. If any rooms in a house are infested, the carpets or rugs should be taken up and thoroughly beaten and shaken out of doors and the floors scrubbed with hot soap and water. An ingenious plan for exterminating the lively adults was adopted by a Professor in one of the buildings of Cornell University. He tied sheets of

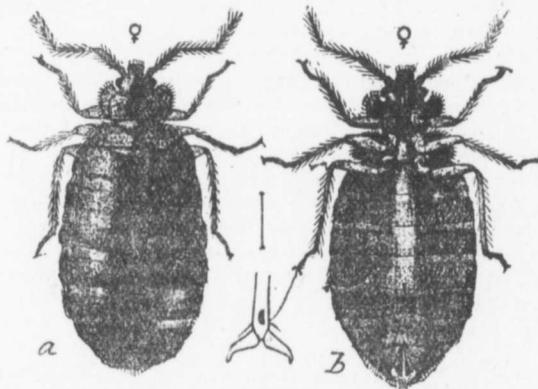


Fig. 38.—a Female bed-bug (*Cimex lectularius*) gorged with blood; b same, from below—much enlarged (after Marlatt).

sticky fly-paper, with the sticky side out, around the legs of the janitor of the building and kept him walking for some hours up and down the floor of the infested room. Nearly, if not all, the fleas jumped on his ankles, as their invariable habit is, and were caught by the fly paper!

The Bed-bug (Fig. 38) is, unhappily, a well-known pest all the world over, and though usually confined to houses of the meaner sort where cleanliness is not regarded as a virtue, it frequently finds its way into well-ordered households, to the great dismay and horror of the inmates. It belongs to the order Hemiptera, which includes the true bugs, a race of insects provided with a piercing and sucking beak, and usually furnished when fully grown with two pairs of wings, the first pair of which are thickened at the base like

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the wing-covers of beetles, but only covering about half the back, the remainder being thin and membranous. The bed-bug, however, is destitute of wings, otherwise it would probably be a far more common pest than it is; in colour it is reddish brown; the body is round or oval in shape and very flat, so that it can easily crawl into cracks or crevices in furniture, walls or floors. The writer has on several occasions been compelled to deal with these disgusting creatures, when occupying for the first time some premises that had been previously inhabited by dirty, careless people. Once it was a cottage containing four or five rooms that was intended as a dwelling for a laundress and her family. It was found to be swarming with bugs. The windows, doors, etc., were stopped up and made as airtight as possible, and then powdered sulphur was set on fire in an iron vessel in each room and left till the following day. This was repeated two or three times; the house was then thoroughly scrubbed and the walls freshly papered. It was a great satisfaction to find that the method adopted was perfectly successful and not a single bug was afterwards seen. In the case of furniture, especially wooden bedsteads, the best plan is to apply benzine or coal oil to all joints and crevices which may harbour the insect, and repeat the operation till there is no doubt of its extermination. The benzine may be forced into the crevices by means of a fine syringe, or with a small paint brush. The liberal use of hot soapsuds to all woodwork is also of very great value.

Among other household insects one of the worst pests is the Clothes Moth, a full account of which was given by Dr. Fletcher in our Twenty-third Annual Report, 1892, page 53; it is unnecessary therefore to deal with it here. The Cheese or Meat Skipper, a serious trouble at times in the larder, has also been recently discussed by Miss Mary E. Murtfeldt in the Twenty-fourth Annual Report, 1893, page 98.

Library pests are not a serious trouble in Canada so far as I am aware, but in more southern and damper climates they are often very destructive. It was highly gratifying to learn a few months ago that the annual reports of the Entomological Society of Ontario had been the means of saving the public library at Hamilton, Bermuda, from a threatened destruction. During the winters of 1892 and 1893 I had the pleasure of spending a few weeks in those delightful isles, and on each occasion was kindly welcomed by Mr. F. T. Frith, the librarian. He was much distressed by the abundance of a "book worm" which was doing much damage to the bindings and the inside of the backs of many of the volumes in his charge. The insect was evidently a species of *Lepisma*, commonly called "the silver fish," from its peculiar form and scaly body. At the time I recommended the use of insect powder as a possible preventive, though it could not be very conveniently used without the risk of soiling the books to some extent. As a result of my visits our annual reports have been regularly sent to the Bermuda library, and Mr. Frith now tells me that he has carried out with complete success a method of destroying the insect that he learnt from these pages. In the Twenty-fourth Report, 1893, page 94, there is an article on "Fumigation with bisulphide of carbon for the complete and rapid destruction of the insects which attack herbarium specimens, furs, woollens, etc." and a description is given of a fumigating chest for the purpose. Mr. Frith adopted the plan and had several wooden chests made, lined with zinc, carefully soldered at all joints. Around the upper edge of the box a gutter of zinc was made and filled with water, into this falls a flange of metal from the lid and thus the box is perfectly sealed and no air or vapour can pass through. In these boxes he placed as many books as they would hold and on the top of them an open vessel of bisulphide of carbon. The liquid soon evaporates and the vapour, being heavier than atmospheric air, gradually penetrates to the bottom. The books were left in the chests for a day or two, and then they were replaced by others, until the whole of the library was gone over. The operation has proved thoroughly successful and now no obnoxious "book-worms" are to be seen, whereas formerly scarcely a volume could be opened without finding one of these creatures. Thus has the Entomological Society of Ontario saved from destruction the public library of Bermuda!

ON THE ENTOMOLOGICAL RESULTS OF THE EXPLORATION OF THE  
BRITISH WEST INDIA ISLANDS BY THE BRITISH ASSOCIATION FOR  
THE ADVANCEMENT OF SCIENCE.

BY L. O. HOWARD, PH. D.

The extremely interesting and important work which is being done under the auspices of the British Association for the Advancement of Science, in the way of an exploration of the fauna and flora of certain of the West India Islands, has attracted a great deal of attention in this country. The comparatively large sums of money at the disposal of the British Association enable it to carry on many lines of investigation of greater or less importance. To working zoologists, however, the Association has never done anything of greater importance than the present investigation.

In 1887 the first appropriation of £100 was made by the Association. In 1888 the committee in charge of the work co-operated with the sub-committee of the Government grant committee of the Royal Society, and an additional appropriation of £250 was made. That year, as a preliminary step, a bibliography of the published writings on the fauna and flora of these islands was published in the Report of the British Association. In 1889 Mr. F. du Cane Godman, who has done so much good by his survey of the fauna and flora of Central America, co-operated with these committees by sending Mr. Herbert H. Smith, the well known American collector, at his own expense, to St. Vincent. The Association this year made a further grant of £180. In 1890 Mr. Smith had already collected and sent in 3,000 insects from St. Vincent, and the announcement was made that Mr. Godman had continued his employment and sent him to Grenada. At the close of the year 1891 investigations had been made in Dominica, St. Lucia, Barbadoes, St. Vincent, the Granadines, and Grenada. In 1892 the reports upon the insect material began to be published. Practically the material in hand in entomology consists of Mr. Smith's collections, covering a period of two years or more in the islands of St. Vincent and Grenada. These islands are respectively the next to the northern-most and the southern-most of the group known as the Windward Islands—St. Vincent lying directly south of St. Lucia, and Grenada forming the bottom of the chain of the lesser Antilles, bounding the Caribbean sea. Grenada lies only about seventy-five miles from Trinidad, and Trinidad, as is well known, possesses practically a South America peninsula fauna. The careful survey of the results of the collections upon these islands, therefore, should reveal many interesting facts regarding the distribution of species, the most important of which will be the determination of the continuation of the Central American fauna, which holds, as we know, in the main, for the larger West India Islands, running from Yucatan and Honduras through Cuba, Jamaica and San Domingo. Does this fauna persist down through the lesser Antilles, or do we have in these extreme islands a fauna more similar to that of the closely adjacent coast of South America, or is there a coast fauna common to these islands and the entire coast line of South and Central America?

In these investigations the British committee has shown an energy and catholicity of spirit very much to be admired, and which is quite in common, it seems to me, with the general trend of British scientific work. The smallness of their own home island and the thoroughness with which the insects are known has driven British entomologists to all quarters of the globe in search of new material. The British systematists in entomology to-day are concerning themselves with collections from all sorts of out-of-the-way places. Wherever the British traveler goes (and the British are famous travelers), a collection of insects is apt to result, and there is usually in England some worker who is ready to undertake the description of the new forms. This is particularly the case with the larger and better known orders, Lepidoptera and Coleoptera. Outside of these groups the committee has found it desirable to ask the assistance of foreigners, both on the continent of Europe and in America. The material has been thus distributed in the hands of many entomologists and the work of describing and classifying goes merrily on. Already, although as previously stated, it was only in 1887 that the investigation was first begun, papers have been published by Lord Walsingham on the Microlepidoptera ;

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by Simon on the spiders; by Bruner von Wattenwayl on the Orthoptera; by Uhler on the Hemiptera; by Forel on the ants; by Matthews on the Trichopterygidae and Corylophidae; by Peckham on the Attid spiders; by Kirby on the dragon-flies; by Gahan on the Longicorns; by Champion on the heteromorous Coleoptera; by Williston on the Diptera; by Waterhouse on the Buprestidae, and by Ashmead and Howard on the parasitic Hymenoptera. There are papers in preparation by Blandford on the Scolytidae; by Butler and Hampson on the Heterocera; by Champion on the Elateridae; by Gahan on the Phytophaga and Lamellicornia; by Kerremans on the Buprestidae.

I have been much interested in examining all of the papers which have been so far published on the insect collections. I have seen them all, except Dr. Williston's "Dipter of St. Vincent," which, although just published, has not yet reached me, and a paper by Warren, on "New Genera and Species of Geometridae," in which, I learn from the Zoological Record of 1894, no less than 170 new genera have been proposed. The remaining papers cover a rather large field, including groups of Coleoptera, Lepidoptera, Hymenoptera, Heteroptera, Hemiptera, and Arachnida, although in no one group have the entire results appeared.

A brief summary shows that exclusive of the two papers just mentioned, 1472 species have received consideration up to the present time. Of these 789 are new to science while 683 have previously been described. These 1472 species are distributed in 836 genera, of which 75 are new. What a notable contribution to science we have, even at the present time!

In attempting to summarize the conclusions of the different authors in regard to the character of the fauna considerable difficulty is experienced. In many of the groups descriptive work is not enough advanced to allow accurate generalizations and in others certain of the workers have seemed indifferent to the broad interest attaching to this side of the investigation. In Mr. Champion's work upon the Heteromera it is stated that all of the genera except four are common to Central America, and all except eight have been found in South America. Ten are common to Central America, but he states, in general, that taken as a whole, the material studied by him shows a considerable affinity with the fauna of the northeastern parts of South America. The number of endemic genera are very few and the endemic species closely allied to the South America forms. As a result of Uhler's studies of the St. Vincent species he shows that the collection of Homoptera "is an assemblage of forms, mostly small and neat, which offer a striking contrast to the large and showy insects that inhabit the regions of the South American continent, a few hundreds of miles away. It is not, however, to this nearest part of the continent that we must look for the source of distribution from which this assemblage was derived. The Mexican character of the fauna seems unquestionable." In his consideration of the Heteroptera of Grenada he says that "the hemipterous fauna is Central American. It is largely composed of forms which belong to the borders of the tropics, rather than of such distinct tropical ones as inhabit the South American continent." Lord Walsingham, in his consideration of the micro-Lepidoptera, says that the forms are decidedly American, ranging northward to the southern and western portions of the United States and southward as far at least as Brazil; "the majority, however, certainly belong to the truly Central American fauna." In this sentence however, Lord Walsingham speaks of the West Indies as a whole, when, as a matter of fact, of the forty-six species which he describes from St. Vincent, thirty-eight were new while two had previously been found in Brazil, four in the United States, one in Venezuela and two were cosmopolitan. Of the species studied by Mr. Simon from St. Vincent, about eighty per cent. are new, although a considerable number of the novelties were known by him from his own collecting to occur in Venezuela. Of the old species all had previously been found in northern South America, Central America, or southern United States. Only two, in fact, range into the United States. Mr. Gahan simply indicates "a pretty close relation between the West Indian fauna and that of tropical America." Dr. Williston writes concerning the Diptera that most of the forms were minute and consequently belong to groups that have been but little studied from South to Central America. The relationships he considers to be decidedly South American.

Of the parasitic Hymenoptera described by Mr. Ashmead and myself the condition is much like that mentioned by Dr. Williston. The study of the South and Central American forms is not sufficiently advanced to enable any definite conclusions. Mr. Ashmead is of the opinion that the general character of the collections in the families which he has worked up is Central American, but it is only fair to say that the only South American collections which can be compared are those made in the interior of Brazil by Mr. H. H. Smith.

And this introduces what is probably the pith of the whole question of distribution. We must have full collections from the coast of North and South America, as well as full collections from the interior, with elevations carefully noted, before we can speak authoritatively. It has been suggested that the coast fauna of the entire Caribbean Sea is practically the same and that the tableland further to the interior is also practically the same. That many Central American forms extend through the chain of West India islands is undoubted, but whether the entire character of the fauna from one end of these islands to the other is Central American, yet remains to be proved. The opinions which I have quoted show the uncertainty which yet exists, but it is to be hoped that with the publication of the other papers, and the consideration of the entire results, there may be some satisfactory outcome.

It is gratifying to observe that American systematists are receiving deserved recognition at the hands of the British Committee. No less than eight American entomologists have been or are engaged upon the collections. It is a pity, however, that investigations of this character, so pregnant in possibility of valuable results, cannot be undertaken under American auspices. Our lack of thorough knowledge of the faunas and floras of the many interesting regions within our own domain is apparent to all workers. Our own Association is too poor to make successive grants of the magnitude of those made by the British Association, but the subject is one which should be agitated by all of us. Explorations are being made by the general government and by educational institutions, but in general, although the plants and the larger animals receive a fair degree of attention, the minute creatures, and particularly the insects, are, in the main, neglected.

#### PROTECTIVE RESEMBLANCES.

By J. ALSTON MOFFAT, LONDON, ONTARIO.

That the harmonizing of living beings to their surroundings in nature is protective in its influence, does not admit of a doubt, and those who have had the greatest opportunity for observing life in its native conditions are those who are most impressed with the fact. Tropical countries are those where examples of it are most numerous, and probably more striking than in temperate and more northerly regions, for one good reason at least, that life there is more abundant and diversified; and in insect life especially is this the case. Writers upon the subject draw their most surprising examples of it as a rule from southern sources, yet many instructive illustrations of the same principle can be found in our own country. Everyone that has engaged in the health producing and delightful recreation of collecting and observing the habits of insects during a ramble over mountain and meadow, through wood and marshes, or along a lake shore, can give of his own experience instances of how completely his senses were imposed upon by appearances. A familiar example is the Geometrid larvæ that resemble closely the branch of the tree on which they rest, some of them standing out at an angle from the branch like a bit of broken twig, that requires close observation to make sure that it is not what it appears to be. Or Catocala moths, that are so much like the bark of the tree upon which they are at rest that even a trained eye does not always detect them. When collecting them in the day time I have switched a tree, started one and watched it alight upon another, then got within four feet of it and many a time failed to discover it, although I knew it must be right before my eyes, and had to start it again before I could get another sight of it. So closely at times does the animate resemble the inanimate.

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Loitering in a bit of open wood on a hot day, with the mind more active than the body, my eye was arrested by the unusual appearance of a particular spot upon a moss-covered tree. My mental reflection was: How much that bit of moss has assumed the appearance of a moth. I looked closely. It seemed to be a bit of moss only; I gave it a punch with the end of my cane when a desirable specimen of *Agrotis prasina* fell to the ground, ruined.

Having made the discovery that many of the fall moths rested during the day in the shrivelled leaves remaining attached to the trees and bushes, and that a sharp stroke with a stick would bring them to the ground as if dead, I struck an oak branch, something dropped. I recognized nothing but bits of tinted leaves on the ground, and was on the point of moving on when it occurred to me that it fell too heavily for a bit of leaf, then I looked intently, stooped down and examined closely, when I detected the form of a moth, and such a beauty as I thought I had never seen before; my first specimen of *Xanthia togata*, arrayed in golden yellow and purplish brown, blending into and harmonizing perfectly with the tints of the decaying vegetation around it.

The first *Cryptolechia Schlägeri* that I came upon, with its pure white patches and dark and light gray mottling, resting conspicuously on the upper surface of a dark green leaf, and its wings so tightly rolled around its abdomen that the thorax and head formed a lump at the one end, whilst it tapered off to a sharp point slightly turned up at the other, I found it utterly impossible in the "dim religious light" prevailing under the leafy dome of a virgin forest, to decide whether it was the dropping of a small bird or an insect. So to settle the question I jarred it into my open umbrella when it rolled down the side without showing the slightest signs of life and I had concluded to dump it on the ground, but when it reached the level it gave a hitch to regain its feet, and it was dumped into my collecting bottle. *C. Schlägeri* was always a rather scarce moth with me; one and two in a season was usually the limit of my captures, and sometimes a season would pass without my seeing one. Upon one occasion I thought myself in great luck; I had not been long at one of my hunting grounds when I espied the now well known object in its usual attitude on the surface of a leaf. I secured it and very soon I got another; whilst looking around I detected at a little distance the indication of a third. I thought to myself, they are plentiful to-day, so moving towards it I was in the act of enclosing it, when my opinion changed. Oh! That's it, is it? Ah, well, it can stay there; it was the reality this time, not the resemblance.

Strolling in a beech wood one sultry day, and feeling oppressed with excessive heat and want of success I sat down upon a fallen tree. Whilst contemplating the surroundings my attention was arrested by what appeared to be some dried beech leaves attached to a fallen branch that was lying about four feet in front of me and about eight inches from the ground. They were of the same bleached-brown color as the leaves that covered the ground everywhere around. They were partially erect, and seemed to be but loosely attached to the dead branch, as they trembled with every passing zephyr, and they had a decidedly ragged appearance. I could not see anything that held them to the branch, there was no spider web visible, yet they remained suspended. I looked and I wondered, and the more I looked the more I wondered, until at last curiosity overcame my disinclination to exertion, I rose and examined, when I found that I had got a perfect specimen of *Cressonia juglandis*. The deceptive appearance was so complete that it had never entered my mind to suspect it to be a living creature of any kind.

These are a few examples illustrative of how resemblance can be protective to the lives of insects against the raids of collectors, but there is a condition that has to be associated with it to render it perfectly effective, and that is complete motionlessness. Let any insect resemble the substance upon which it is resting ever so closely but move, it has exposed its individuality and its doom is sealed. Life is associated in the human mind with motion. In this case the parallel between man and the lower animals is exact. A large proportion of the carnivora prefer to secure their food in a living state, and for that purpose wait to see it move before seizing it. Travellers inform us that lions and tigers of the jungle will not spring upon a motionless object, and that safety

in an emergency may be secured by feigning death. There are families of birds that take their food only on the wing. A fly is perfectly safe within three inches of a toad's nose if it remains still, but let it attempt to secure safety by flight and it instantly ceases to be an independent portion of animate nature. This gives some indication of how important a matter it is for the safety of insect life that they should remain perfectly still.

But there is another important question that has to be taken into consideration in this connection, and that is the condition of the eyesight, and there is a wide diversity in the zoological world in this matter, from that of the most perfectly developed, to where it is a point in dispute if they have any at all. Yet the ordinary vision of every portion of it is nicely adjusted to its needs. That man's eyesight is not all that he would like is made abundantly plain by his invention of the telescope and microscope, and his constant effort to improve and extend their powers, and that the vision of many of the lower animals does not even reach his is undoubted. The question has often been discussed whether insects have any consciousness of form and color. I am quite certain that a humming bird does not know a man from a post if he remains perfectly still. I have had a Pewee come in contact with the hand that was holding a bottle against a tree in its eagerness to secure a *Catocala* fluttering within, seemingly wholly unconscious of my presence. Many a time when resting in the woods has a ground squirrel come out of its hole close by me. It seemed to realize at the first glance that there was something unusual there, but whether there was danger in it or not it could only discover by investigation, so with that object in view it would come cautiously toward me and would approach so close that I have thought it would climb upon me if I could have kept perfectly still, but my breathing would excite its suspicion. We have the testimony of sportsmen that it is movement that excites alarm in game and makes it seek safety in flight, not the form of the hunter. Hence the utter worthlessness for the purpose intended of those hideous objects we see erected in fresh sown grain fields, and called "scarecrows." They lack motion, or it is of a rhythmical order, and observation soon leads to the conviction that there is no danger in their presence, then familiarity breeds contempt. So then motion is regarded as a sign of life throughout the whole animal world, whether it be in the securing of proper food on the one hand, or as a warning to escape from the feeders on the other, and motionlessness is one of the best means of defence against those that are seeking life to take it, and in the insect world it plays a most important part.

But if insects have very defective eyesight as judged by our standard, they have a complete advantage over us in the faculty of scent. Their power of locating their mates is well known and phenomenal. One example more. Being in an open wood on an early November morning with a light fall of snow on the ground, I saw two moths about forty feet in front of me and about thirty feet apart flying towards each other. I hastened forward to see what they were. They passed out of sight behind a tree about four feet from me; I stepped round it, one of them flew away, the other was secured by the wingless female of an *Anisopteryx*. And it is quite reasonable to suppose that this faculty is of advantage to them in other respects, such as in securing their food and in deciding upon the correct location for ovipositing. There are certain ichneumons that confine their attention exclusively to some particular kind of larvæ. If they have no power to distinguish between the form and color of the various kinds of caterpillars, then it must be by scent that they are guided in their choice, whilst movement on the part of the larvæ would enable them more readily to locate the object of their search.

There is now the question of how much can be learned from observation and experience. We know how much man is indebted to it for his knowledge and wisdom. Practice will enable one person to detect an object where one without it would see nothing; it also sharpens the faculties to distinguish between things that differ, and to the very last he is gaining knowledge by means of it. Many of the lower animals can be educated to some extent in a similar manner, and many of them have been brought to exhibit a wonderful degree of intelligence in that particular direction to which they are naturally inclined, and there can be little doubt but many of them in a state of nature acquire considerable knowledge in their life time, how best to conduct their

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affairs in the condition in which they find themselves placed. The ground squirrel gave unmistakable evidence of being possessed of memory, which is the foundation on which education is built, hence it is capable of being instructed up to the limits of its faculties. How far short-lived insects that come into the world thoroughly under the control of a few desires which they devote their whole time and energies to the gratification of, and whose faculties at the moment of their birth are complete for all the requirements of their existence, do, or can acquire further knowledge by experience for the better ordering of their lives, is a good deal of a problem yet to be solved. I am aware that there is a doctrine of "cumulative mental inheritance," but into that I do not enter. A peripatetic professor gave a lecture upon the "occult sciences." At least, said a reporter, that is what he was advertised to lecture upon, but it is doubtful if there was one in the audience that knew what he was talking about. But then, added the reporter, it is doubtful if the lecturer had the slightest advantage over the audience in that respect.

## NOTES ON THE SEASON OF 1897.

BY J. ALSTON MOFFAT, LONDON, ONT.

The weather here during the past summer was of a decidedly unusual character. The spring opened finely, but May and June were uniformly cool with frequent rains, vegetation progressed steadily but very slowly. July maintained its character for heat, a succession of excessively hot days in it, with heavy showers throughout the month. August was uniformly cool with less rain, and some light frosts at its close; whilst the first part of September was warm, it closed with killing frosts, and the month was excessively dry throughout. Such conditions had a marked effect on insect life, retarding and confusing the appearance of many species, whilst it would no doubt be the means of destroying numbers of them. The ordinary cut-worm moths were present to some extent, but none of them were reported here as being noticeably destructive. The army-worm seems to have retired again to its usual obscurity; but there were plenty of the moths about the lights late in the season, to keep the breed alive, and be ready to produce a future outbreak when the conditions are specially favorable. The frequent rains seemed to have a disastrous effect upon the web-worms, as at no time during the season were their offensive-looking tents at all conspicuous. During the early part of September I noticed the clover-leaf weevil, *Phytodinus punctata*, (Fab) in considerable numbers on the streets of London, indicating that someone's clover had been suffering in this neighborhood. Whilst on a visit to Essex, I saw in the collection of Mr. E. N. Laing a Tobacco sphinx, *Protoparce carolina*, Linn, which he had reared from the caterpillar, and

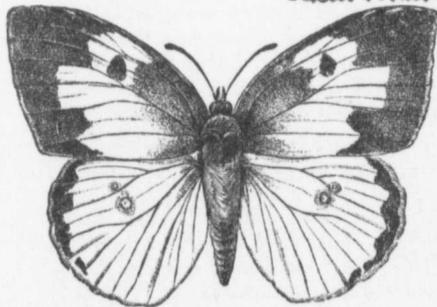


FIG. 39.

as tobacco is now being grown quite commonly in that region as a regular commercial crop, this species may yet become abundant. In a school collection made not far from London, under the superintendance of the teacher, Mr. J. W. Atkinson, and exhibited at the Western Fair, I saw a specimen each of *Megalostoma (Colias) casonia*, Stall (Fig. 39), and *Terias lisa*, B.L. What a splendid thing it would be for our country if every school teacher was an interested collector in some department of natural history, as his example would give a respectable standing to the habit of observing and taking an interest in those simple objects of nature that are strewn so profusely around us, with all the educational, elevating and refining influences associated with it, and which is such an inexpensive means of securing untold enjoyment to those who engage in it. Natural history is now being taught in our schools; to what profit is not apparent. It is set as a task which

has to be learned to pass an examination, and when this is accomplished it is thrown aside as having served its purpose. It may be true, and very likely is, that "Naturalists" like "Poets" are born, not-made; yet I have known parents to prohibit their children indulging a strong inclination to collect natural history specimens, which they greatly admired and in which they took much pleasure, for fear that it might interfere with their school lessons. And by the time they had left school they had lost all taste for natural history. A young lady whose father is known in his locality as an artist and a geologist, and whose brother stands very high in financial circles, but has also gained for himself a name in geology, told me that she was once at a bazaar when her uncle, her mother's brother, said he would pay for anything she liked to take from a particular table. She chose an odd-looking shell in the rough. He scouted the idea, and wanted her to decide upon something that he thought was of some value. But no; she wanted nothing but that shell; and she wanted it very badly. Then handling and looking admiringly upon her treasure she thoughtfully remarked: "We inherited that propensity." From your father's side, I remarked. Oh! she exclaimed, laughingly, there is nothing of that sort whatever on our mother's side. I knew a woman whose boy was given to collecting natural history specimens, and would take them to his mother and would speak of their beauties or peculiarities, and she would look and listen with apparent interest, but she confessed to me that she could see nothing of what he was talking about in them. She did not let him know. She knew they were to him a great source of innocent enjoyment, the treasures which his heart instinctively turned to, and which drew him to his home, and made it exceedingly pleasant for him to stay there; and she was pleased. Wise woman, if unfortunately defective in her perceptive faculties. A personal collection is what is wanted to give interest and permanence to the study of natural history. Whilst others derive benefit from looking at it, it may help to induce them to begin one also.

Elaborate discourses have been given upon "How to study Natural History." Some of them well calculated to crush out all aspirations in that direction, as they land you at once in a tangle of unintelligible phraseology. We have, I dare say, all heard the directions for, how to cook a hare: "First, catch the hare." To any one who has a desire to obtain some knowledge of the natural sciences in any of its numerous branches I would say, first collect your specimens. That is, such as are conveniently obtainable, which excludes astronomy and seismology. Then examine your specimens, when you will probably learn something about them that you did not know before. This may induce you to look at them again, to discover yet something more. Taste can be cultivated, and the faculty of observation is sharpened by exercise. Then you will likely want to collect more, as your curiosity may have become excited; curiosity leads to inquiry. Enquiry when judiciously exercised leads to knowledge. Knowledge when obtained is gratifying, and in time the pursuit of it becomes a perfect pleasure. And the more you know the easier and pleasanter it becomes to acquire more. Then keep that up, a little now and a little again, and very soon you will find it such a delight that, no matter what your condition or occupation may be, you will find some time and opportunity to indulge in it. And if you are endowed with capacity, endurance and perseverance you may attain to the very highest position in your department; but do not expect to begin there; it is not the rule at school to begin with mathematics and work down to the alphabet.

A professor of natural history in a prominent educational institution wished to obtain transparent wings of insects, such as the Neuroptera or gauze-wings, to make lantern-slides of to throw enlarged upon a screen. These I was much pleased to provide him with, and interesting and beautiful objects some of them made. He also wanted the sting of a bee. It was winter. I said I could give him dried specimens, but he might find it difficult to secure a perfect one from such; but from a fresh specimen it could be easily obtained. How? he inquired. Just squeeze the abdomen and it could be cut off perfect, root and all. And where is it situated, in the mouth? Oh, no, I replied, at the other end. But a mosquito's is, is it not? That man knew a good deal about many things, but he must have commenced to learn about where the people usually leave off. We find many men who seem to have forgotten that they ever were boys; but one would be almost ready to believe that the professor had never been a boy.

My own results of Mr method of do single or do in the spring too fresh, an have often w worn and di grass during to the end of be three bro never wholly variety of ori to a yellowish front wings.

In the I Attractiveness after relating enquires "W idea new to n out suspecting (Fig. 40) we goodly number year's take, l that the fema and he wante of female *lar* male *velleda* other. This separate them men, but to g did not at the what I could spreading and under their *velleda*, I beg all the rest, w surface and d found they ha ations that the appear later, I female *laricis* me a lot of fer get me no mo not absolute, l and it is well remains, why males; and in dame, to refus of them did, b of their kind.

Mr. Bice collection. Th *Thyatira pudes* spots on the Guenee's color that large and

My own work during the season has principally been, delightedly observing the results of Mr. Bice's collecting at electric light. I have thought it would be an excellent method of determining the time of appearance of different species; and if they were single or double brooded. I was somewhat surprised to see *Scoliopteryx libatrix* appear in the spring, as I had always regarded it as a strictly fall moth. The specimens were too fresh, and rather late in the season to have hibernated. *Nomophila noctuella* I have often wondered about. It appeared about the first thing in spring, in a sadly worn and dilapidated condition; clearly indicating that it had been sporting in the grass during the warm days of the previous autumn, and continued without intermission to the end of the season. Mr. Felt, *Can. Ent.*, vol. 25, p. 131, says: "There seem to be three broods a year." But I suspect that the broods must overlap, as they were never wholly absent. In mid-summer they were unusually plentiful, with an endless variety of ornamentation; from a uniform light-brown with numerous dark brown dots, to a yellowish-brown with three heavy dark brown transverse bands on their long narrow front wings.

In the September number of the "Entomologists' Record" is a note on "The Attractiveness of Light," signed W. Grover, Guildford, dated July 9th, 1897, in which, after relating that he had found some colored lights more attractive than ordinary light, enquires "Why is light attractive to the males only of so many species?" This was an idea new to me, although we had been having some experience on that very line without suspecting the cause. In the early part of September, the males of *Tolype velleda* (Fig. 40) were in great abundance, and those of *laricis* in goodly numbers. Mr. Bice had a pair of *velleda* of last year's take, but he wanted females of *laricis*. He knew that the female *laricis* was light like *velleda*, but smaller, and he wanted me to give him the distinguishing marks of female *laricis* when at rest, as he was tired taking male *velledas* in a futile attempt to get the female of the other. This I found it very difficult to do; I could separate them by the antennae and the form of the abdomen, but to give a recognizable description of the front wings to separate the two, I did not at the time seem capable of doing. So I requested him to get me a lot to see what I could make out of them. He then brought me a bottle full, so I began pinning, spreading and drawing out their antennae, which they keep completely out of sight under their shoulder pads. After filling two setting boards and finding only male *velleda*, I began to get tired. So I pinned the male *laricis*, then turned up to view all the rest, when I noticed two differing from the others in the whiteness of the upper surface and deeper scollops in the dark outer band, so I pinned and spread them and found they had bristled antennae and rounded abdomens, which confirmed my expectations that they were female *laricis*. Being under the impression that the females would appear later, I took Mr. Bice a specimen and pointed out to him how he might recognize female *laricis* when at rest, but he saw no more of them. I also requested him to get me a lot of female *velleda* to go with the males I had spread; he secured one, and could get me no more, when they totally disappeared shortly after. The rule in this case was not absolute, but it seems to point in the same direction as Mr. Grover's experience; and it is well to be warned in such matters what one has to expect, but the query remains, why is it so? It is known that female insects as a rule are less active than males; and in this case it would be quite excusable for such a portly, richly-robed dame, to refuse to join the revelers by night and dance around a light-pole; yet some of them did, but it may be placed to the credit of the sex that they were not the noblest of their kind.



Fig. 40.

Mr. Bice has again secured quite a number of fine moths new to the Society's collection. Those that I have thus far been able to identify are a single specimen of *Thyatira pudens*, Guen. This seems to be a very rare insect in this country. The large spots on the front wings are a silvery white with the faintest tinge of pink. In Guenee's colored figure, plate 3, fig. 1, they are altogether pink. A single specimen of that large and handsome geometer *Selenia kentaria*, G. & R., and perhaps the first

reported from Canada. It is much deeper in the reddish-brown of the underside than is represented in Mr. Grote's colored illustration, fig 5, plate 1, vol. 1, Trans. Amer. Ent. Soc. Phila. A single specimen of *Aplodes rubromarginaria*, Pack. Also one of *Plagodes Kentzingaria*, Pack. One of *Gortyna speciosissima*, G. & R., a particularly attractive species, illustrated on plate 7, fig. 52, vol. 1 Trans. Am. Ent. Soc., Phila. Also a sphinx new to Canada, *Dilophonota obscura*, Fab. Dr. J. B. Smith directed me to his description in the "Transactions of the American Entomological Society, vol. 15, page 157, where it is clearly defined. He gives the habitat as, "Pa.(?) Texas, Mexico, West Indies, South America." Then adds, "Easily recognized by the small size, gray primaries and unbanded abdomen. Specimens of this very rarely range northward, and a specimen in my possession was said to have been taken in Pennsylvania. I do not know the source whence I obtained it and I cannot vouch for the locality. It is a southern form." All these were most generously surrendered by Mr. Bice to the Society, and form a valuable addition to its collection. He also took several specimens of that curious little snout moth, *Gaberasa ambigualis* of Walker, the *Tortricodes bifidalis* of Grote. It has a split in the front wings of the males, fringed like an incipient feather wing. The first one I saw puzzled me greatly, not knowing but it might be only a freak of nature, instead of a characteristic of the species. An appeal to Dr. Smith put me straight, when he also informed me that the wings of the female were entire. Both sexes were taken by Mr. Bice. Mr. Grote at first described the females as a separate species, whilst at the same time strongly suspecting that they were but the different sexes of one species. There are a number of Mr. Bice's captures yet to be determined.

#### NOTES ON THE SEASON OF 1897.

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

The "Notes on the Seasons," published in the Annual Reports of the Entomological Society, of Ontario, will, I think, be found useful to the rising entomologists of our own day, and, in the future will afford material that may be worked into a complete history of the insects of Canada. In this belief I contribute to the store my memoranda on things that have come under my observation during the past summer.

The season was a remarkable one; the early summer was cold and wet, then came a period of intense heat, which was succeeded by a bright, mild autumn prolonged into November.

#### BREPHOS INFANS, MOESCHLER.

On the 24th of April members of the Montreal Branch invited me to join them for an excursion in search of *Brephos infans*, Moesch. We went to a birch wood some distance from Montreal, and soon had the pleasure of seeing *infans* on the wing. It flies amid the tops of the birches, making an occasional descent to lower foliage. These descents are the entomologist's opportunities; but, as the insect has a rapid and uncertain flight, they can be captured only by a lucky stroke, or a well sustained effort.

I left the business of catching to my companions, for, as we advance in years, we lose—to use the words of Alexander Smith—

"—the wild-deer from the blood,  
The falcon from the eye."

I sat on a stone and watched my friends dash through puddles formed by melting snow and amidst the scrub on the outskirts of the wood, admiring their zeal.

The expedition was a successful one, and, from a female captured on the occasion, Mr. Dwight Brainerd obtained eggs, from which both he and I succeeded in bringing larvæ to the pupal stage. His notes regarding them will be found in the November number of the *Canadian Entomologist*.

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The larvæ I reared were about a week later in their changes than those raised by Mr. Brainerd. This was owing, no doubt, to the difference of climate between Quebec and Montreal. At Quebec the eggs hatched on May the 8th. The larvæ moulted on May the 13th, May the 21st, and June the 2nd, and pupated June the 20th. This species spends probably eight months in the pupa.

CTENUCHA VIRGINICA, CHARP.

On the expedition above referred to I obtained larvæ of *Ctenucha Virginica*, Charp. which had just aroused themselves from their winter's sleep, and were feeding on the wild grasses in the wood. This is a description of them at the time:

Head reddish brown, sides and back set with pencils of black hairs, a sub-dorsal row of tufts of whitish hairs springing from a white line, spiracular line white; moulted April the 26th.

After Moulting, head chestnut red with black face. A fringe of white hairs round the head. Distinct black tufts along the back, sub-dorsal lines pale yellow with yellowish tufts, white spiracular line with tufts of whitish hairs, legs red; moulted May the 21st.

Full Grown Larva, one inch in length, head chestnut-red with black face, mouth organs white, a dorsal line of black tufts bordered on either side with a line of yellow tufts, sub-dorsal line yellow, spiracular line white, between them a line of black tufts, under parts black, legs red.

One larva was almost white—the tufts on its back were yellowish.

Of three that I took particular notice of:—

The 1st spun up May the 28th, and the moth appeared June 25th.

The 2nd " June 9th " " July 7th.

The 3rd (the pale one) spun up June 30th, and moth appeared July 18th.

Newly caught females of *C. Virginica* laid eggs which hatched on July 25th. The larval stage of this species therefore extends over a period of ten months or more.

THE CASE-BEARER OF THE BIRCH.

In the beginning of May, as soon as the leaves of the birch were fairly opened there appeared upon them the curious habitations of a species of *Coleophora*. The following is a description of the larvæ producing them:—

Head brown with a pale V-like mark—opening towards the front—and a few white bristles, shield on second segment brown divided by a pale line, small shield on third segment and anal plate brown, claspers brown, general body color brownish-salmon, darker on the back; length on the 24th of May, two-tenths of an inch.

The larval case at first appears as a closely-woven, elongated capsule with little brown tufts in it. The occupant, when it finds this habitation too narrow, selects at the edge of a leaf a portion bordered with two or three serrations. This it hollows out by eating away the parenchyma. Then it works its way in, cuts off the selected portion, and proceeds to unite the free edges, thus making a new tent. It fills up all awkward interstices with a fine web. Under the microscope the veins and stomata of the skeletonized section of leaf thus appropriated present a beautiful sight.

In feeding the larva bites a round hole in the cuticle of the leaf on one side, and then eats away the parenchyma as far as it can reach on every side without leaving its case entirely.

The larvæ ceased feeding in June, and the moth appeared on July 9th. This is a description of it:—

Colour, pale silvery ash, a tinge of reddish-brown on the after part of the primaries, secondaries narrow, ciliate on both sides, eyes black, antennæ beautifully ringed—brown and white, fringes slightly tawny, tibiæ of hindmost pair of legs clothed with long hairs, expanse of wings half an inch, length of antennæ three-twentieths of an inch. Length of body, one-fifth of an inch.

## SPILOSOMA CONGRUA, WALKER.

I took a female of this species at the Gomin on the 29th of June. It laid eggs on the 10th of July, and these hatched six days afterwards. The larvæ fed on pig-weed, dandelion and plantain. I succeeded in bringing the whole batch to the pupal stage, and took full notes of all their changes. As soon as the appearance of the moths enables me to complete the life history of the species I will send the particulars to the *Canadian Entomologist* for publication. I may say that the larvæ are very different in all their stages from those of *H. textor*, and seem to indicate that *Congrua* should come in the genus *Arctia*.

## UNFORTUNATE SELANDRIA LARVÆ.

On the 7th of July I found on a young ash at St. David's a number of milk-white larvæ with black, shining heads, and black feet (*S. varda*, Say?) They were about three-fourths of an inch long. Next day they moulted, and, after the moult, seemed smaller than before. Their colour was changed to pale lead-colour above and a pale yellow beneath. The head was dark brown above, the face yellow. The legs also were yellow. They fed no more, but became inert and dropped to the ground. The cause of all this became apparent when, on the 23rd of the month, there came from them a number of *Tachina* flies.

## CAPTURES IN AUGUST.

On the 6th of August, passing through the <sup>*Synanthedon*</sup> Fort Woods at Levis, I found a bush of *Spiræa salicifolia* Linn. in full bloom. It was thronged with insects. Without moving from my position I captured *Saurina exilis*, Say (Fig. 41), *Conops sagittaria*, Say, *Anthrax fulviana*, Say, *Perilampus ceruleus*, Say, *Philanthus bilunatus*, Cress, *Eumenes*

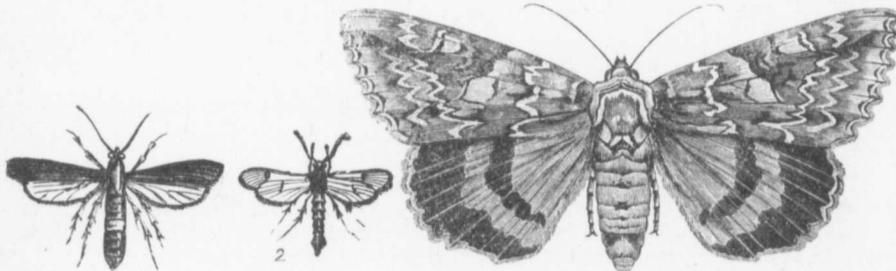


Fig. 41. Female moth on left, male on right.

Fig. 42.

<sup>Potter Wasp</sup> *fraterna*, Say, *Gorites phaleratus*, Say, *Exetastes rufo femoratus*, Prov., etc., etc.—a great haul! Moths of *Gelechia gallæ-diplopappi*, Fyles, appeared from the 8th to the 15th. *Catocala parta*, Guen. (Fig. 42) was very abundant at the end of the month.

## BLISTERS ON POPLAR LEAVES.

On the 9th of August I found blisters on poplar leaves. Each blister was about half an inch across. It contained a larva which changed to a chrysalis before I could describe it. The chrysalis was attenuated and about three-twentieths of an inch in length. On the 28th of the month it produced a lovely little moth. In length of body this was only one-eighth of an inch. Its wings expanded three-twentieths of an inch. The fore-wings were golden brown, and had a set of creamy white patches bordered inwardly with black, and running transversely from either side to the middle of the wing. The hind wings were narrow but deeply fringed. The palpi were white and feathery, the eyes black, the legs were white and had feathered tibiae. This I concluded was the *Lithocolletis populiella* of Chambers.

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## MORE SAW-FLY LARVÆ.

On the 9th of August, the light shining on a leaf of *Populus tremuloides*, revealed to me a number of cuts, each about one line in length, on the under side of the leaf. I knew them to be vacated saw-fly cuts, and immediately looked for the young larvæ. On several leaves near by a number of round holes were seen, and looking closely into these I found in every one a black larva extended along the edge inside the opening. When disturbed the larvæ threw up their tails in true *Nematus* fashion. They grew rapidly, and in the night of August the 14th they threw off their dusky covering, and presented themselves in a splendid new garb of dark navy-blue with black dots, and with large yellow spots in a line with the black spiracles. The head was glossy black. The legs and underside were of a neutral tint. The length of the full-grown larvæ was seven-tenths of an inch.

On August the 20th the larvæ descended and spun loose brown cocoons under the leaves in the bottom of their cage. I obtained from these, on the 8th of September, some very handsome saw-flies, of which the following is a description:—

Length of body, three-tenths of an inch; expanse of wings, seven-tenths; length of antennæ, two tenths.

Head black, but with clypeus, hypoclypeal plate, labrum and palpi yellow. Clypeus emarginate rather short. Eyes round and prominent, black. Ocelli black. Cheeks rounded and protruding. Antennæ with a somewhat moniliform scape; the second, third and fourth joints rather long and nearly of equal length, the other four smaller and slightly tapering; the whole one coloured—black.

Tegulæ and pronotum flavescent; lateral lobes of scutum dark chestnut-red; the rest of the thorax and the base of the abdomen black. The abdomen, for the most part, is of a clear, chestnut-red without dorsal markings, but the cerci and ovipositor are black and the last joint is clouded.

The first and second pairs of legs are flavescent throughout. The hind pair have the tibia—except the knee, which is yellow—and the tarsus black. The tibiæ are thickened, and the tarsi end with extended claws.

The wings are beautifully clear, and in some lights iridescent. Their venation is remarkably distinct, and is of the normal type.

## SAW-FLY LARVÆ ON CORNUS.

In the beginning of September there were handsome larvæ in great numbers feeding upon *Cornus stolonifera* Mich. and *C. alternifolia* Linn. When they first came under my notice they were curled, helix-like, under the leaves, lying in clusters. The head was glossy black, the body pale yellow; but down the back were eleven rectangular patches resembling buckles, blue black with yellow centres. There was also a terminal patch, rounded, and of the same colour. The creatures had just changed their skins. They moulted again on the 14th of September. The empty skin was held by the claspers and stood upright. The head-case and second segment were split, and the rest of the skin was intact. The larvæ after the moult were more highly coloured than before. The rectangular markings on the back were deep navy-blue, and the inner mark and dividing lines were pale blue. The yellow of the rest of the body was of a deeper shade. They moulted again on the 30th of the month, and at intervals in October they retired into the earth. I found specimens on the *Cornus* bushes after the frosts came.

## CAPTURES IN SEPTEMBER.

On the 1st I took *Plusia brassicæ*, Riley (Fig. 45. a, caterpillar; b, cocoon; c, moth), and *Petrophora testata*, Linn., at the Gomin. On the 3rd I found *Feltia venerabilis*, Walker; *Agrotis redimicula*, Morris; *Plusia brassicæ*, Riley, and *Drasteria erectea*, Cramer (Fig. 44), on panicles of *Solidago nemoralis*, Ait., in the open fields. On the 11th



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*Orgyia nova*, Fitch, was flying in the sunshine at the Fort Woods, and *Cleora semiclusaria*, Walker; *Plagodes fervidaria*, H. & S.; *Petrophora truncata*, Hbn. (second brood), and *P. diversilineata*, Hbn. (Fig. 45), were plentiful on the boles of spruce trees. On the 22nd *Epirrhita dilutata*, Bork, was out at the Fort Woods. On the 24th *Callocampa curvamacula*, Morris, was abundant at sugar, and *C. parva* was still out but much worn.

## CAPTURES IN OCTOBER.

October the 15th was very mild. The thermometer stood at 64° on my verandah at 8 p.m. *Xylina georgii*, Grt., was abundant at sugar. On the 20th of the month a fine, fresh specimen of *Pyrameis Atalanta*, Linn, was taken on the streets of Levis. On the 23rd the wind was in the south, and the day bright and balmy. *Teras ferrugana*, Schif,

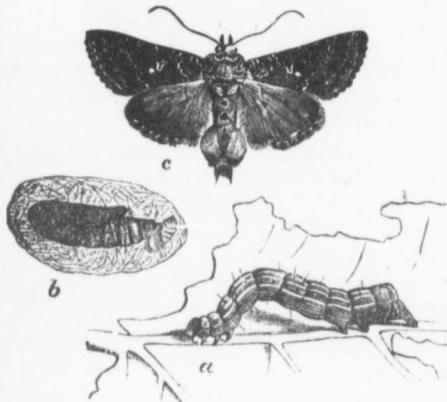


Fig. 43.



Fig. 44.



Fig. 45.

was plentiful among the willows, and *P. fervidaria* was still out. On this day I found the full-grown, onisciform larvæ of *Syrphus ribesii*, Fab, feeding upon *Schizoneura lanigera*, Hausm. They spend the winter in the larval stage, and go into pupa early in the spring. The flies appear in April.

And now the winter storms are come, and we must be content—like schoolboys in their contemplation of the holidays—to think for half the dreary time of entomological pleasures past, and to anticipate in the other half pleasures to come, cheered in the meanwhile by the monthly visits of the *Canadian Entomologist*. May no unkind blizzard detain the mails that convey it!

## A FEW NOTES ON THE SEASON OF 1897.

BY ARTHUR GIBSON, TORONTO.

The season of 1897 in the neighborhood of Toronto was, entomologically speaking, a comparatively poor one, as far as "good things" were concerned. Indeed, most of the commoner lepidopterous insects, especially the butterflies, were rather scarce, and those which are usually scarce were in most cases not to be seen at all.

The season of 1896 was a very good one in this district, several species of lepidoptera having been observed and taken for the first time in this locality.

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During the past season the only diurnals which I know of as having been taken in this neighborhood, and which are really worth mentioning are :

*Feniseca Tarquinius*.—One specimen observed at Forks of Credit on 1st July.

*Lycaena Comyntas*.—Very rare, only a few specimens taken, one of which I took on 26th June.

*Lycaena Scudderii*.—Fairly plentiful on and about 15th June, but very local around the food plant,—Lupin.

*Pieris Napi*.—Two or three specimens of a variety of this butterfly were taken on the 24th May, the only specimens observed.

Last season, on the 1st July, the variety *Oleracea-aestiva* was very common at the Forks of Credit, but on paying a visit there on the same date this year, not a single specimen was to be seen. In fact, very few butterflies of any species were noticeable.

*Papilio Cresphontes*.—A worn specimen of this butterfly was taken on the 24th September, at Weston, a few miles from Toronto, by Mr. Donald Wilby.

Collecting by electric light was also very poor this season. I do not know what has come over the Sphingidae. For the last four seasons they have been very scarce. In 1893 as many as seventeen different species were to be taken, and most of these species were fairly common, while some of them were very plentiful. *Deilephila Chamaenerii*

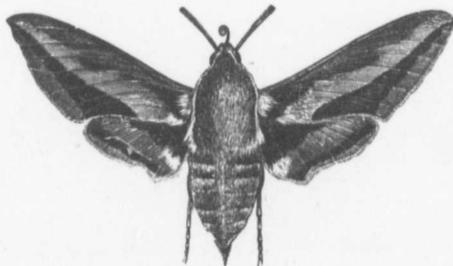


Fig. 46.

(Fig. 46) especially was very common in 1893. Even around the electric lights in the heart of the city numbers of specimens of *D. Chamaenerii* were to be taken. During the last two seasons I have not seen a single specimen of this sphinx. *Actias Luna* was frequently observed this season, and as many as ten specimens were taken on the 27th May. Regarding the other moths which come to light, they were in most cases very scarce.

"Sugaring" also was poor, up to July 1st hardly a specimen being attracted to the sugar. After that date, however, several good noctuids were taken, but up to the present time I have not got them identified.

#### NOTES ON THE SEASON OF 1897.

By C. E. GRANT, ORILLIA.

The season of 1897 was not a very good one from an entomological point of view, though, as is often the case in such seasons, some good captures were made here in Orillia, of which I made some notes.

*Brephos infans* was taken by me this year on April 11th for the first time in thirty years. Others were seen at a later date, but were too wild to capture. The locality was a road through a birch woods.

*Thecla laeta*—One specimen of this rare insect was taken by my friend, Mr. James Walker, in a cedar swamp not far from a running stream; the specimen was a female in good case. As the insect was taken on a cedar bush, it would have been interesting to know if this is the food plant of this species. I believe it is not known. I intend, if all is well, to thoroughly search this locality next May for a duplicate. The date of capture was May 12th.

*Melitæa Harrisii*.—Three specimens of this species were taken in the first days of July beside the railway track passing through a piece of low land. This insect is rare here.

*Papilio troilus*.—Took my first Orillia specimen of this butterfly on *Asclepias* in the month of August.

*Lycæna comyntas*.—This is also an addition to our fauna. The one I took this year was in a clover-patch at the side of the railroad. Date August 4th.

*Colias philodice* variety *nigra*.—On the afternoon of August 12th I was watching a large number of *C. philodice* disporting themselves in a clover field when I was suddenly aware of the presence, amongst them, of a butterfly, which I was sure I had never seen before. I was much puzzled at the time as to what genus it belonged to. After a hard and long chase, and I am afraid to the detriment of the gentleman's clover, I captured it, and

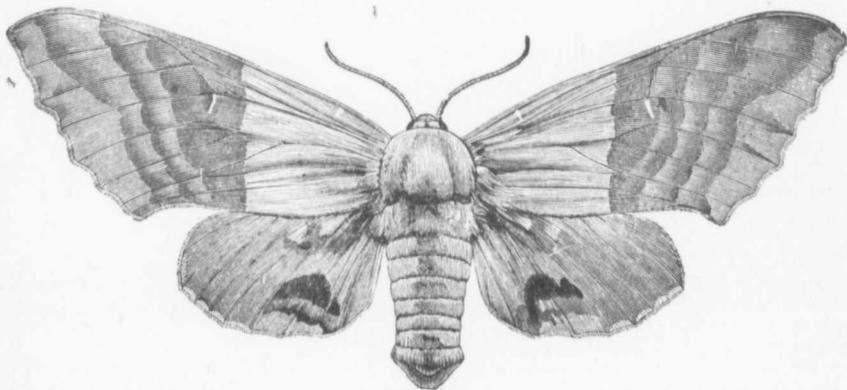


Fig. 47

on examination I at once recognized it from the painting in "Edwards's Butterflies" in one of his plates of *Philodice*. Of course it was not an exact reproduction, the bases of the wings on the underside being darker olivaceous, and the upperside being covered with long greenish hair near the bases, producing a pretty effect; it was altogether a handsome insect. *Philodice* was remarkably abundant this season, and the female in great variety. The albino specimens were nearly as numerous as the yellow type, and differed greatly in markings from each other.

*Megalostoma casonia* (Fig. 39).—I searched in vain for this eccentric butterfly this season, which last year was moderately common, but did not see a specimen. It will probably be due again in thirty years, as it is about that length of time since I captured it in my father's garden when a boy.

I had good success among the Sphingidæ, and captured no less than nineteen different species; most of these were taken at flowers in June and July, from one to three of each, with the exception of *Triptogon modesta* (Fig. 47), which was found at the base of a poplar, newly emerged from cocoon, and some which were taken at light; the abundance of *Smerinthus exocatus* (Fig. 48) was remarkable, eight specimens coming into the house one evening in July, attracted by an incandescent light.

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The long cold rains that succeeded the hot spell in the beginning of July apparently were too much for most of the destructive cut worms, as their imagoes did not appear (with the exception of *Agrotis telifera*, Fig. 49,) in any numbers. *Hadena devastatrix* and *arctica* and *Leucania unipuncta*, the army worm moth, were almost scarce—in 1896 *unipuncta* was so plentiful that I have killed over 500 on one post, on which I had placed my sugar for other victims; they were a perfect nuisance, coming in clouds before dark, and this occurred in June and again from the end of July through the season; notwithstanding this fact, the army worm was not reported as troublesome in our county, though I believe Ontario county was infested to some extent.



Fig. 48.



Fig. 49.

The following noxious insects were reported as plentiful around Orillia:

The tent caterpillar, <sup>*malacosoma*</sup> *Clasocampa Americana*. Fig. 19, also its confrere (<sup>*disstrata*</sup> *sylvatica*) the former, however, only lives in the neglected orchards, but the moth was extremely abundant.

The canker worm (<sup>*aleophala*</sup> *Anisopteryx pometaria*).—I never saw such quantities of this insect in the imago state as this year; in October it was to be found, male and female, on every roadside fence—with it was also conspicuous *Hybernia tiliaria*, the November moth, Fig. 50.

*Carpocapsa pomonella*, the apple codling moth,—this insect, though not often seen as an imago, is always plentiful here, but spraying the trees has had a wonderful effect in controlling this pest, and those orchards that are sprayed regularly every year produce as sound fruit as is to be found anywhere.



Fig. 50.



Fig. 51.

The male Tussock Moth.

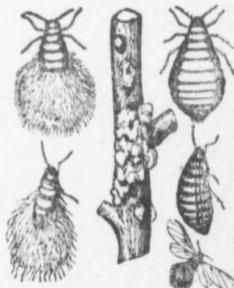


Fig. 52.

The Woolly plant-louse of the apple (*Schizoneura lanigera*).

<sup>*Heavenocampa*</sup> *Orgyia leucostigma*, the tussock moth (Fig. 51), is evidently on the increase in Canada, from observation made here by myself. It seems that each year it is rather more plentiful. <sup>*notolophus*</sup> *Orgyia antiqua*. This insect appeared in numbers this fall. I bred several females and whilst they were confined in the cage the air for yards around was literally full of the attendant males.

*notolophus*

It was reported to me in the month of July that a great number of the maple trees in this town were apparently dying. As Orillia is one grove of these trees, the appearance of a pest was viewed by many of the inhabitants with great alarm. I examined a good many trees. I supposed at first that the borers *Clytus speciosus* or *Tremex Columba*, were the cause, but I could only account for the flagging energies of some of the limbs from the fact that nearly all the trees showing distress were largely covered in places with a woolly louse (*Schizoneura*), Fig. 52, which very much resembled the alder louse. I was not certain of the species, but I recommended kerosene emulsion, which I believe finished them, as the complaint ceased.

To a person who has always been imbued with a love of nature, to whom the war of the elements, the peaceful starlight night, the songs of the birds, the growth of a plant, the chirp of a cricket, the song of the Cicada, or the sight of an insect, alike send a thrill of pleasure through his mind and bring back a flood of pleasant recollections, I say to that person who has learned to love these things, it is almost impossible to understand how it is that so few people seem to obtain any pleasure from studying nature. To many there is no enjoyment but in business, and there are others who are always complaining that they do not know what to do to kill time. Just fancy this with the book of nature open before them and half, yes, nine-tenths, of its wonders unknown. To those in business who have very little time to spare (I myself am one of these), I would say that no more pleasant relaxation can be found, when once the science of entomology, botany, or their kindred sciences, is known sufficiently to interest one to further pursue it. I am satisfied that if the study of these things was brought before the young in the proper way, it would make the youth of this country more manly, more diligent in business, more cultured and gentlemanly, and that the crime records would decrease correspondingly. This may seem a rash statement, but I claim that any one who has learned to study and love the works of nature will seldom do a deed of violence, when in tender years an occupation is found with all the elements of amusement, free from the taint of vice. The famous Dr. Johnson once said, when he heard of a man committing suicide: "He would never have done so if he had known how to hem a pocket handkerchief," implying that the want of an occupation induced the crime. And so likewise the study of entomology would keep the minds of those who take to it in pleasant occupation, which would increase, instead of failing as most other amusements do, as one by one the truths of nature were revealed; and I have every reason to believe that the interest would increase until the senses are benumbed with age, and this can be said of few earthly pleasures. The lack of interest is surely in the want of the first elements of knowledge of these sciences; but I trust that now entomology, from an economic point of view, is being studied, and the farmers and fruit growers of this country are awakening to the fact that to hold their own with their neighbors who have studied entomology, they must do so too—that ultimately the young will be taught it and the sciences of entomology and botany will form part of the curriculum of our public schools.

#### THE SAN JOSÉ SCALE.

(*Aspidiotus perniciosus*, Comstock.)

By JAMES FLETCHER, DOMINION ENTOMOLOGIST, OTTAWA.

In our annual report for 1894 there appeared a short article upon the San José scale. As there stated, the unexpected discovery in the Eastern United States and British Columbia of this scourge of the Pacific coast orchards made it all important to draw the attention of Ontario fruit growers to the subject, so that they might become familiar with the appearance of the insect and be prepared to promptly adopt active measures to eradicate it should it, as was thought more than probable, appear in our province. During the same year a further article was also published in the *Farmers' Advocate*, urging fruit growers to be on their guard against the introduction of the San José scale with nursery stock.

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Since that article was written it has been seen how well founded were the fears that this dreaded enemy might spread to Canada and be a cause of loss in our fertile fruit districts.

The San José scale, it is thought, was introduced into California about 1870; but it was not noticed as a serious enemy until 1873, when it was discovered to be in great numbers on fruit trees at San José, Cal., a fact which has given to the insect its popular name. Its original home is not certainly known, but Japan is suspected.

As far as can be learnt, it had not been scientifically described until 1880, when Prof. Comstock treated of it in his annual report as Entomologist to the United States Department of Agriculture. Dr. L. O. Howard tells us that Prof. Comstock designated it by the specific name *perniciosus* because he considered it the most pernicious scale insect known in the country. "It swarmed in countless numbers upon the trees in certain orchards, and infested all the deciduous fruits grown in California except the apricot and the Black Tartarian cherry. In the course of twelve years the insect spread through all the fruit growing regions of California, through Oregon and into the State of Washington. It is known as the worst insect pest of deciduous trees on the Pacific coast and has caused great pecuniary loss. Many crops of fruit have been ruined and thousands of trees have been killed."

The above was written by Dr. Howard in April, 1893, since which time a great deal more than was then known has been learnt concerning this insect and its capabilities as an enemy to the fruit grower. It has been introduced into the east and, contrary to expectations, has shown that the climate of the Eastern United States is sufficiently well suited to its requirements for it to have developed so rapidly and with such deadly effects upon the trees infested that it has now become of national importance. It is at the present time acknowledged to be by far the most serious insect enemy of fruit trees which has ever been studied by practical entomologists. Owing to its very inconspicuous appearance and to the fact that it passes the winter attached firmly to the bark of fruit trees, it has been distributed widely and unwittingly by nurserymen with young fruit trees and now occurs in almost every State of the Union. It has also spread up into Canada, where it has been found on two or three occasions in British Columbia and has also established itself at a few places in the peach districts of Ontario. The first specimens of this insect received from an Ontario orchard were from the vicinity of Chatham in Kent county. This was in January, 1897. Very soon afterwards it was discovered that there were other orchards near Niagara and St. Catharines which had been similarly infested through fruit trees imported from the United States. The last discovered occurrence of this insect was made quite recently near Kingsville in Essex county, where three centres of infestation were found on one fruit farm, involving upwards of 300 trees. The above are all the authentic instances of the occurrence of the San José scale in Ontario which I have been able to learn of, although at various times during the summer several reports of infested orchards have been received. Upon investigation, however, these have proved to be occurrences of some other scale insect. In addition to several kinds of scale insects which were sent in for identification under the supposition that they were the San José scale, many other insects in no way resembling a scale insect were sent. From the many kinds of these belonging to various orders, it seems advisable to state that the San José scale is not an easily seen insect, resembling a beetle, a fly or a spider, nor has it well developed wings and legs, but it is a minute creature which can be detected only by the closest search and even then requires some skill and experience to recognize it as an insect. Among the objects which have been enquired about were many things quite unlike scale insects, but there were others which certainly do present very much the same appearance. Among these were certain minute fungi found on dead wood, and particularly the small corky excrecences known as lenticels which occur upon the young bark of many trees, as the apple, pear, birch, black walnut, etc. Their different nature may, however, be generally ascertained easily by the fact that they cannot be removed from the bark without tearing the tissues, while scale insects may be easily moved by gentle pressure as with the finger nail.

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In view of the almost unanimous demand by fruit growers for protective legislation against this enemy, it became of much moment to find out as soon as possible what was the true state of affairs in the province with regard to its actual distribution and establishment in our orchards.

On June 10th a well attended meeting of fruit growers was convened at the orchard of Mr. Charles Thonger, near Niagara, when the subject was discussed at length. The necessity for everyone concerned being able to recognize the scale was brought out at this meeting and steps were immediately taken to supply an evident lack of knowledge on this point among Canadian fruit growers. Prof. J. Hoyes Panton, of the Government Agricultural College, at Guelph, prepared and issued promptly an excellent concise bulletin, which was widely distributed by the Hon. Minister of Agriculture and Arts, and at the same time a large illustrated wall poster, 2ft. 3in. by 1ft. 8in., was prepared by the Dominion Entomologist at Ottawa for putting up in Post Offices, Railway Stations, School Houses, Public Halls and other much frequented places. This was illustrated with figures of an infested pear and a piece of an infested branch, natural size, and also enlarged figures of the female insect and her scale. Warning was given that the San José scale was already in Canada and that if it were allowed to spread, great loss would surely be the result. The best way to identify the insect was given, together with advice as to the proper remedy and the way to apply it in case anyone should be unfortunate enough to find this public enemy on his trees.

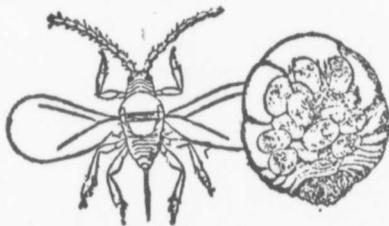


Fig. 53. Female scale, with a male adult to the left, greatly enlarged.

These sources of information were distributed widely amongst fruit growers living in those districts where the San José scale was likely to occur. In addition to the above measures, by instruction of the Hon. John Dryden, special attention was paid to this subject by Mr. W. M. Orr, the Superintendent of Spraying Experiments, and every effort was made to find out to what extent orchards were infested. Whenever the scale was found, active measures were at once put in force to secure its eradication. Collections were made of the scale upon various fruit trees and show cases were exhibited in the more important autumn exhibitions, which were attended by Mr. Orr, who was untiring in his efforts to explain to visitors the nature of the insect and warn all against neglecting it. In every instance where this pernicious insect has been found on trees in Canada the owners have done their utmost to destroy it, sparing no expense of labor or material. All were easily convinced by the fatal effects of its presence on their trees that this was no ordinary insect pest they had to fight against.

*What is the San José Scale?* The San José scale is a very small (about one-tenth of an inch in diameter), round, flattened and inconspicuous scale insect, that is, a sucking insect like the well-known Oyster-shell Bark-louse and the Scurfy Bark-louse, covered by a waxy scale which, as we find it on trees, is the only part visible except in the early larval stage, when scale insects, for a few days, have the power of walking.

The exact identification of this species is a matter of some little difficulty, for there are at least two other scales occurring on fruit trees in Canadian orchards, the Putnam Scale (*A. ancylus*, Put.), and the Forbes Scale (*A. Forbesi*, Jnsn), which superficially so closely resemble the San José scale as to render it necessary for a specialist who has studied the matter before hand, to examine the mature females under the microscope and that after boiling in caustic potash, before the difference can be made out. Moreover, both of these scales occasionally may be found in vast numbers upon an infested tree, but the exact

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identification is, nevertheless, a matter of great importance because it has been found by experience that neither of these scales causes very serious injury to fruit trees as compared with the San José scale. This is chiefly due to the fact that they seldom spread from tree to tree with anything like the rapidity of the last named species. Indeed, the occurrence in very large numbers of a scale insect upon a tree cannot always be taken as conclusive evidence that the species is a dangerous one, for it has frequently been noticed that scale insects may be present in enormous numbers upon a special tree, even killing it, and yet not be found at all upon trees of the same sort growing close by. In the case of the San José scale, on the other hand, if other trees are reasonably near, it is almost certain that they will soon become infested, and when a severe case of infestation is found, one of the first things looked for when considering whether the pest is actually the San José scale or one of some other species which superficially resembles it closely, is to notice whether the surrounding trees are infested also.

This important difference of habit in spreading and the much more fatal effects upon the trees from the presence of the San José scale, make much more stringent measure necessary to secure its eradication than with many other species, even frequently rendering it advisable, or imperative, to destroy many trees, or even whole orchards. This being the case, the very great advantage is obvious of being perfectly sure as to the identity of an infesting scale insect before valuable trees are condemned to destruction.

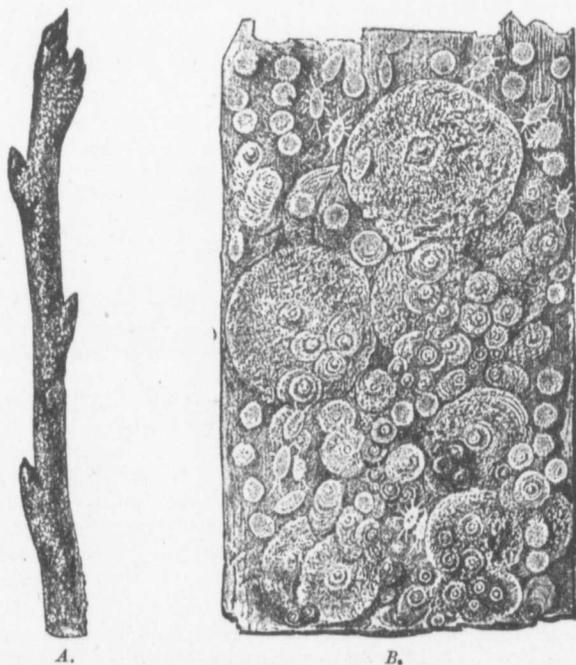


Fig 54. Appearance of scale on bark; a, infested twig—natural size; b, bark as it appears under hand lens, showing scales in various stages of development and young larvae.

The following description of the San José scale and its life history are taken from the annual report of the Entomologist and Botanist of the Dominion Experimental Farms for 1897:

*How to know it.*—The general appearance of the bark of infested trees is dirty, scurfy and grayish in color, as though dusted with ashes. The scales usually are found in enormous numbers, frequently overlapping or occurring altogether on the top of older scales; they may be found throughout the summer of all sizes, from the newly

hatched mite-like larvæ to the full-grown insects. In severe cases of infestation this massing of the scales produces a scurfy appearance of the bark, which when once seen is easily recognized. On young twigs and fruit and leaves, there is usually a well defined purplish ring surrounding each scale, and although this purpling effect is produced by a few other scales, such as the Putnam scale (*A. ancylus*, Put.), it is particularly characteristic of the San José scale, and even upon large branches, although invisible at the surface, may be found by cutting away some of the bark.

The scales of the males and females differ somewhat in shape.

**Female:**—Scale very thin, almost circular in outline, much flattened; size ranging from one-twentieth to one-eighth of an inch in diameter white at first, becoming grayish or blackish, and later much blackened by the fungus *Fumago salicina*, so common on trees attacked by many kinds of bark-lice and plant lice. In the centre of the scale is a small dark or yellowish nipple-like elevation surrounded by a distinct circular darkened depression, which, as pointed out by Prof. Webster, is one of the best distinguishing marks between this scale and some closely allied species.

**Male:**—Scale about half the size of that of the female, rounded-oblong, with the nipple-like elevation nearer one end than the middle.

**Life History.**—The winter is passed by the partially grown insects beneath their scales. With the return of warm weather next spring growth is resumed, and the males reach maturity a few days before the females. They are extremely small two-winged flies, and when examined under a magnifying glass are found to have orange-yellow bodies, iridescent dusky wings and black eyes. The minute creatures have no mouths,

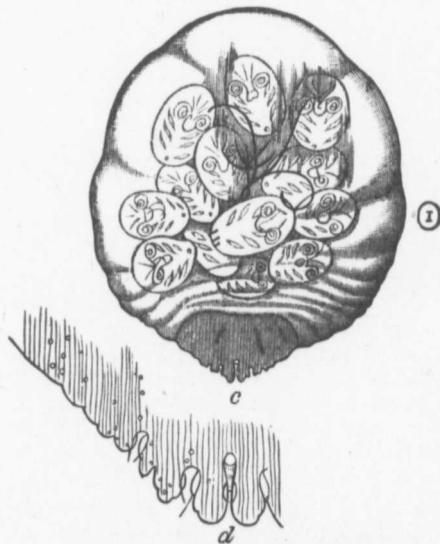


Fig. 55. Female scale much enlarged.

so can take no food; consequently, having fertilized the females, they very soon die. The date when the females become full grown and begin to produce young varies, of course, with localities and climate. In Arizona the young larvæ are recorded as appearing in March. At Washington it is by the middle of May; in the State of New York, early in June; at Amherst, Mass., they were first noticed 12th June; and, as far as I can learn, between the middle of June and 1st July in our Niagara district. Most careful observations have been made under direction of the U. S. Entomologist, by Mr. Theo. Pergande. The following condensed life history is compiled chiefly from U. S. Div. of Entom. Bul. No. 3, N.S., in which Mr. Pergande's observations are recorded.

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The adult female gives birth to living young, differing in this respect from most other scale insects. Ordinary, as with the Oyster-shell Bark-louse, eggs are laid beneath the scale, which in the course of a longer or shorter time hatch and the young larvæ migrate to different parts of the plant; but in the case of the San José scale young are produced day and night for a period of nearly six weeks before the exhausted female perishes, and this at the rate of about nine or ten every twenty-four hours.

After birth the young larva remains motionless for a short time beneath the scale of the mother, it then forces its way out and runs over the plant, seeking a suitable place to settle. It is a microscopic creature, pale orange in color with an oval body, six legs and two feelers. The long, thread-like proboscis with which it sucks the sap of the plant, is doubled on itself and lies in a groove of the body wall. After crawling about for a few hours, the larva settles down and works its bristle-like sucking tube through the bark and remains fixed, if it be a female, for life; and if a male, until fully developed, when it will have a few hours more, during which it can fly about.

The development of the scale begins even before the larva becomes fixed. The secretion starts in the form of very minute, white, waxy filaments, which spring from all parts of the body and rapidly become more numerous until within two days the insect is entirely concealed by a whitish shell or scale, which now has a prominent central nipple. The scale is formed by the matting and melting together of the waxy filaments. As in the development of most insects, there are distinct periods of the larval life, divided by moults of the skin, and in the case of the male scale insects marked by important structural changes. The first moult takes place when the larva is twelve days old. Up to this time the male and female scales are exactly similar in size, color and shape, but after the moult the insects beneath the scales bear no resemblance to each other. The males are rather larger than the females and have large, purple eyes, while the females have lost their eyes entirely. The legs and feelers have disappeared in both sexes. Eighteen days after birth the second moult occurs and the males change to the first pupal condition (pro-pupa) the small scales now assume an elongated shape, the legs and feelers have re-appeared and there are now two prominent wing pads extending along the sides of the body. About twenty days after birth the male insect changes to the true pupa, in which all the parts shown in the pro-pupa are more developed and a slender organ at the end of the body, called the style, has appeared. From four to six days later, or from twenty four to twenty-six days after birth, the males mature and back out from the rear end of their scales. This is chiefly by night or in the evening.

The changes which have gone on beneath the female scales are less striking than those described above. After the first moult, the body of the female is practically an almost circular flattened sac, with indistinct segmentation and without organs, except the long sucking bristle with which it sucks up continuously the sap of the tree it is infesting. The female moults a second time about twenty days after birth and the last segment now shows the important characters of the mature female which are of so much service in the exact identification of the species. The segmentation of the body at this stage is quite distinct.

Thirty days from birth the females are full grown and the embryonic young may be seen within their bodies. The mature female, prior to the development of the young, is  $1/30$  of an inch wide and  $1/25$  of an inch long.

The length of time necessary for the development of a generation varies somewhat, and according to the Washington observations covers a period from thirty-three to forty days from the time the young larva appears until it develops into a mature female, bearing young. The San José scale is enormously prolific. It has been calculated that a single female may be the progenitor of 3,216 million descendants in a single season.

*A most serious Enemy.*—It cannot be too often repeated that the San José scale is one of the very worst enemies that the fruit grower has ever had to deal with. Its inconspicuousness and presence upon trees in a dormant condition at the time when these or scions from them are distributed, render it liable to be overlooked. Its great

power of increase when introduced into a new locality and the fatal effects of its attacks on trees, as well as the extensive range of food plants it will attack, which includes nearly every deciduous tree and shrub, added to the difficulty of treating it effectively, all combine to make this insect what it is acknowledged by most to be, as stated above, one of the worst insect enemies we have ever had to contend with.

Notwithstanding this, there is always a tendency among those who are not well informed, to minimize the danger and neglect the necessary precautions. On this point it may be well to give the following short quotations from two of the leading economic entomologists of the United States:

Prof. Webster, of Ohio, says in his official report to the Ohio State Horticultural Society: "The statement has been made that 'the scale is not a particle more destructive than many of our native species of injurious insects or than those to which we have become used,' but anyone who is at all familiar with this pest understands that this is not at all the case, and that we have no other insect that is so deadly in its effects or so difficult to detect until it has become fully established, and certainly we have nothing in Ohio which, if it gets on to a tree, is as sure death. Besides, such talk as this only makes the enforcing of remedial or protective measures more difficult."

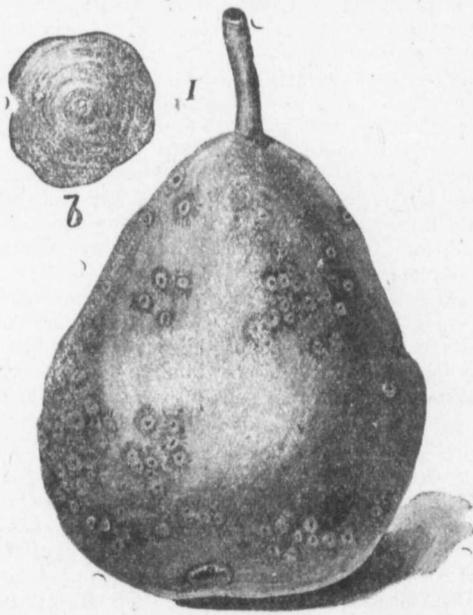


Fig. 56. SAN JOSE SCALE. a, pear moderately infested; b, female scale enlarged.

Dr. J. B. Smith, speaking before the Moorestown (N. J.) Farmers' Institute in December, 1897, says: "The San José scale is without doubt the most important of the fruit pests with which the fruit growers of this section must deal. I say 'must deal' advisedly, because developments during the latter part of last summer and even since then have made it certain that the San José scale is so firmly established in our State that its extermination can no longer be considered a possibility."

After treating of the extent of the infestation in the State of New Jersey, Dr. Smith says: "The scale must be dealt with, or you must abandon fruit culture. It can be dealt with if intelligent effort is made. The treatment is not easy and at first is expensive. It is for the fruit grower to decide whether his orchards are worth it. If not, he had better destroy them at once and plant something else."

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## REMEDIES.

*Cutting down.*—When a tree is found to be heavily infested with the San José scale, the cheapest plan will generally be to cut it down at once and burn it, for it is probable that a tree which has once been badly attacked will never recover its full vigor, even although every scale is killed.

*Whale-oil Soap.*—If, however, a tree is only slightly infested or there are special reasons for trying to save it, it should be pruned back as closely as it will stand and then washed thoroughly two or three times with whale-oil soap (two pounds of soap to one gallon of water). This is an expensive treatment, but, on the whole, it is the most effective yet discovered.

*Kerosene Emulsion.*—A treatment which has given equally good results, but a little more trouble on account of the extra labor, is to spray the trees as soon as the leaves fall in the autumn with kerosene emulsion (Riley-Hubbard formula diluted with four or five times its volume of water, and then before the buds expand in the spring apply the two pounds to one gallon whale-oil soap wash.

Dr. Howard found after many experiments that what is required for spraying purposes is a caustic potash and fish oil soap which does not contain over twenty-five or thirty per cent. of water. Mr. Marlatt of the United States Division of Entomology, states that a new brand of soap known as Good's Caustic Potash Whale-oil Soap No. 3 is one of the best which has been put on the market.

*Pure Coal Oil.*—A great deal of attention has lately been drawn to the treatment of trees with pure kerosene or coal oil to free them from the San José scale. This matter was first brought forward publicly by Prof. Webster three years ago, and pure coal oil had also been used with success previous to that in 1893, by advice of Dr. J. A. Lintner, upon the trunks of peach trees infested with the Peach Bark-borer (*Phloeotribus liminaris*, Harris). (Cent. Exp. Farm Report, 1893, p. 216.)

Prof. J. B. Smith, of New Jersey, has experimented extensively with kerosene and claims that, when the work is done carefully and as he advises, the scale insects are killed by this treatment better and more cheaply than by any others, and without injury to the trees.

My own experiments with coal oil have been too limited and irregular in results to justify me in recommending this method, and Prof. Webster, when reporting upon his experiments says: "I own that for a time I hoped it was possible to use coal oil in destroying the scale without injury to the trees; but our experiments up to date indicate that except on the apple and some of the more hardy of the other fruits, and in cold weather, it is exceedingly dangerous to attempt its use; and, until we have had time to make further investigations, I wish to warn against its use otherwise than as above indicated." On the other hand, Prof. Smith and Mr. C. L. Marlatt have found that trees can be sprayed even in summer when in full leaf with pure kerosene and no injury result to the plant. Prof. Smith's instructions are as follows: "Spraying should be done with the finest Vermorel nozzle and with force enough behind it to send out an absolutely mist-like spray. Cover fully, but no more, that there may be no running down or lodging in forks or getting around the trunk down to the roots. The whole aim should be to put on the thinnest complete film possible. Spraying should be done on a clear, dry day, that evaporation of the kerosene may not be interfered with. The oil acts at once on the insect, and as soon as its work is done, we want to get rid of it as fast as possible. The trees should be dry when sprayed. If they are wet the oil will not penetrate, but remain as a film over the moisture until it disappears."

The details of the above treatment are given here because there has been so much inquiry about it by Canadian fruit growers who have seen Prof. Smith's recommendation, and it is doubtless advisable for those having infested trees to experiment upon a few of them and if good results are obtained many valuable trees may be saved.

*Gas Treatment.*—For thorough work in treating infested trees, the fumigation with hydrocyanic acid gas seems in California to have given the best satisfaction. This

method, however, is expensive and the materials used are intensely poisonous. However, for large nurseries where many young trees have to be disinfected before being sent out, this is stated to be the best method and is very generally adopted by the large American nurseries.

The plants are placed under a canvas tent made air tight by painting it twice with linseed oil. The first coat must be quite dry before the second is applied. The size of the tent is immaterial, but must cover the trees entirely, and the edges of the tent should be long enough to lie on the ground so that the tent may be perfectly air-tight by having earth thrown upon the lower edge to prevent the gas from escaping. The latest formula for generating the gas is as follows :

Cyanide of potassium (98 per cent) .....	1 ounce
Sulphuric acid (66°) .....	1 ounce
Water .....	2 ounces

for every hundred feet of space to be fumigated. Put the acid and water in an earthenware vessel large enough to prevent spattering, then place the jar under the tent and add to it the cyanide of potassium and close the opening quickly. The trees should be treated for at least forty-five minutes, when it will be found that insects of all kinds have been destroyed.

For the treatment of nursery stock prior to shipment large air-tight chambers or boxes are made in which the trees are placed.

*Warning.*—There is at the present time a great demand on the part of fruit growers for protective legislation both from the Provincial and Dominion Governments, and it is possible that something may be done in this direction; but, in the mean time, I would urge upon fruit growers and every one else to protect themselves and the country at large by putting into practice what after all are only ordinary common-sense measures of precaution. Foremost among these are certainly the exercising of the greatest care possible in buying nursery stock. As far as we have been able to learn, none of our Canadian nurseries are yet infested. Therefore, stock purchased at these nurseries, if grown in Canada, must be much safer than any that can be imported from nurseries in the United States which are known to be infested. Owing to the difficulty of detecting the scale on trees when it only occurs in small numbers, and to the fact that it infests almost every kind of plant likely to be imported, I do not consider it safe to accept for this insect the guarantees sometimes given by nurserymen that stock is free from infestation. It will be far better for Canadian growers to do without imported trees altogether, for a year at any rate, until we see the effects of the wise and active measures towards the eradication of this pest which are now being taken by the Department of Agriculture and Arts of Ontario, rather than by purchasing from United States nurseries to run the risk, however slight that may be, of bringing in more infested stock. Every effort is being made to discover and wipe out all cases of infestation, and I feel confident that, if energetic measures are adopted now, even the San José scale, as it now occurs in Canada, can be controlled.

#### NINTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, DETROIT, MICH., AUG. 12-13, 1897.

The Association met in room 212, Central High School building, immediately following the adjournment of Section F. Thirteen active members were present, together with many visitors, prominent among the latter being Dr. C. A. Dohrn, Prof. E. B. Poulton, Dr. C. P. Hart, Dr. C. S. Minot, and Dr. C. W. Stiles. The Association was called to order by the President, and in the absence of Secretary Marlatt, Mr. A. H. Kirkland was

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chosen secretary *pro tem*. The address of the retiring president, Prof. F. M. Webster, treated of "The Present and Future of Applied Economic Entomology in the United States," and contained, among other very interesting features, an admirable tribute to the value of the systematist and a somewhat caustic criticism of the "species maker," helpful suggestions for the Experiment Station worker, and a very frank discussion of the unfortunate results which attend the attempts sometimes made to combine politics and science.

The following were elected to active membership :

- A. T. Britton, New Haven, Con.  
 G. B. King, Lawrence, Mass.  
 Gerald McCarthy, Raleigh, N.C.  
 E. P. Felt, Albany, N.Y.  
 A. F. Burgess, Malden, Mass.  
 W. B. Barrows, Agricultural College, Mich.  
 R. H. Pettit, " " "  
 W. S. Blatchley, Indianapolis, Ind.

The following were elected foreign members :

Claude Fuller, Richard Helm, both of Perth, West Australia, and W. W. Froggatt, Sydney, New South Wales. These additions increase the numbers of this Association to 93 active and 31 foreign members.

Prefacing his remarks with a brief review of the damage by the larvæ of *Orgyia leucostigma* in Washington during the summer of 1895, and the important influence of parasites in controlling this outbreak, Mr. Howard presented the following papers :

#### ADDITIONAL OBSERVATIONS ON THE PARASITES OF ORGYIA LEUCOSTIGMA.

In Bulletin No. 5, Technical Series, Division of Entomology, United States Department of Agriculture, entitled "A study in Insect Parasitism," it was shown that following an extensive attack by *Orgyia leucostigma* upon the shade trees of Washington, which culminated in August, 1895, there was an extraordinary development of parasites. Thirty-five true parasites were reared, of which fifteen were primary hymenopterous parasites and six primary dipterous parasites, fourteen species being hymenopterous hyper-parasites. In the autumn of 1895 about 90 per cent. of the caterpillars were destroyed by primary parasites, the vast majority of these being hymenopterous and the bulk of the work being done by *Pimpla inquisitor* and *Chalcis ovata*. In the spring of 1896 so many of these primary parasites had successfully hibernated that they were in position to almost annihilate the first brood of caterpillars, already weakened greatly in numbers by the extensive parasitism of the previous autumn. In the later months of 1896, however, an extensive hyper-parasitism began to be effective, and the principal primary parasite, *Pimpla inquisitor*, was almost killed off by its own hymenopterous parasites and principally by *Dibrachys boucheanus*. Tertiary parasitism was noticed at this time, but was not especially effective, and the *Orgyia* had begun to recuperate in numbers at the close of 1896. Several careful accounts in July, 1896, showed the percentage of parasitism to be 98.8 per cent., and the numerical details of the parasites concerned were found in one instance to be as follows :

On June 30 and July 8, 1896, 624 cocoons of the tussock moth were collected

without discrimination from the trunks of trees in the United States Department of Agriculture park. From these 624 cocoons issued the following parasites :

	Specimens.
<i>Pimpla inquisitor</i> .....	729
<i>Bathytrix pimplæ</i> .....	13
<i>Limneria valida</i> .....	1
<i>Theronia fulvescens</i> .....	1
<i>Chalcis ovata</i> .....	69
<i>Dibrachys boucheanus</i> .....	50
<i>Asecodes albitarsis</i> .....	1
<i>Frontina aletisæ</i> .....	7
<i>Frontina Frenchii</i> .....	14
<i>Tachina mella</i> .....	12
<i>Euphorocera claripennis</i> .....	15
<i>Exorista griseomicans</i> .....	4
Total .....	916

The part played by dipterous parasites up to the winter of 1896, when the bulletin in question was published, had not been great, only 187 specimens in all having been reared. All the species were well-known *Tachina* flies of wide distribution and general parasitism.

A recuperation in numbers of the *Orgyia* was quite marked in the spring of 1897, and additional and heretofore unreported observations were made. So great had been the destruction of *Pimpla inquisitor* that in these observations this species did not appear in a single instance! Another hymenopterous parasite, *Chalcis ovata*, became prominent, and it is worthy of note that while secondary parasites of this species are strongly suspected, it is not absolutely known to have any. A striking feature, however, was the great increase in the number of the dipterous parasites. The rearings were conducted on a large scale, and the following table affords an interesting comparison to the one just given.

Five thousand larvæ and pupæ of *Orgyia leucostigma* were collected July 6 to 9, 1897. From these there had issued up to August 2 the following parasites :

	Specimens.
<i>Tachina mella</i> .....	220
<i>Frontina Frenchii</i> .....	355
<i>Euphorocera claripennis</i> .....	464
<i>Exorista</i> sp. ....	13
<i>Helicobia heliciis</i> .....	4
<i>Phorocera</i> sp. ....	45
<i>Chalcis ovata</i> .....	551
<i>Apanteles parorgyisæ</i> .....	3
<i>Dibrachys boucheanus</i> .....	10
Total .....	1,665

Of these it will be noticed that more than two-thirds (1,101) were dipterous, while the previous summer dipterous parasites had constituted only about one-twentieth of the number reared.

From the 5,000 cocoons there issued also 321 male moths and 764 female moths; 146 of the caterpillars or chrysalids died from a disease which we have for convenience called "black rot," and 33 from another disease which for the same reason we have called "red rot."

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In percentages the result may be expressed as follows :

	Per cent.
Moths .....	21.07
Dipterous parasites .....	22.02
Hymenopterous parasites .....	11.02
Disease. ....	3.58
Total .....	57.69

This leaves about 2,000 chrysalids dead from causes not yet ascertained. From careful examination of a small proportion of them it seems probable that from 400 to 500 have been killed by parasites which have died without emerging. There still remain also about 200 dipterous puparia in the rearing cages, from which the adults may still emerge. That the majority of the remainder have died from disease seems probable. The mortality ratio was, therefore, 79 per cent., as against 98.2 per cent. at a corresponding time last year; and, while last year hymenopterous parasites were responsible for nearly the whole of the mortality, this year they brought about not more than 15 per cent.

These additional observations only accentuate the extraordinary features of the parasitism of this lepidopterous insect. The multiplicity of factors upon which its increase and decrease depend and the important interrelations of the species concerned are astonishing to one who has not especially studied this phase of insect life.

#### TEMPERATURE EXPERIMENTS AS AFFECTING RECEIVED IDEAS ON THE HIBERNATION OF INJURIOUS INSECTS.

It is a well-known fact among agriculturists and horticulturists that winter weather of a steady degree of severity is more favorable to plant growth than an open winter with alternating freezes and thaws. With regard to certain injurious insects it has become an accepted idea among economic entomologists that this same principle will hold, yet the question comes to all of us from farmers and others with a considerable degree of frequency as to whether a given winter which has been unusually severe will not have resulted in the destruction of injurious insects to such an extent as to promise comparative immunity the coming season. We have been obliged, or at least the writer has been obliged, to answer such questions theoretically. There has been no exact experimentation, so far as he is aware, along this line. It is, therefore, with pleasure that he calls attention to the results of recent experimentation by Dr. Albert M. Read, of Washington, the manager of the cold storage department of the American Security and Trust Company, and the same gentleman who conducted the experiments on the effect of cold storage upon household insects referred to in a paper read by the writer before the last meeting of this association. Dr. Read has found in the course of his experiments, which have now extended over two years, that a constant temperature in the neighborhood of 18° F. will not destroy the larvæ of *Tineola biselliella* or of *Attagenus piceus*, but that an alternation of a low temperature with a comparatively high one invariably results in the death of the larvæ of these two insects. For example, if larvæ of either which have been kept at a temperature of 18° F. are removed to a temperature of from 40° to 50° F. they will become slightly active, and when returned to the lower temperature and kept there for a little time will not revive upon a transfer to the warmer temperature.

It is thus rather satisfactory to have experimental proof in support of previously accepted but more or less theoretical ideas.

Mr. Rolfs had noticed that after severe frosts and cold in Florida there was an abundance of northern insects, especially Orthoptera.

Mr. Craig described the severity of the winter of 1896-97 in Canada, when there was severe cold but little snow. This year, throughout southern Canada, plant-lice were present in tremendous numbers on apple, plum, cherry, and other trees.

In the general discussion which followed, the fact was brought out that plant-lice had been particularly abundant throughout Canada and the United States during the past summer.

Mr. Howard pointed out the fact that this abundance was probably due to the wet weather of late spring and early summer; which had checked the feeding and multiplication of the natural enemies of the plant-lice.

Mr. Minot stated that in the vicinity of Milton, Mass., injurious insects had been quite scarce during the past summer; fewer potato beetles had been noticed than for many years, while rose-chafers and tent-caterpillars were equally scarce. He also had noticed the great abundance of plant-lice early in the season, but after the extreme hot weather of the first week of July their numbers greatly diminished.

Mr. Howard emphasized the fact that hot weather played a very important part in controlling plant-lice. He cited an instance where, several years ago, Mr. Barrows had called his attention to the extraordinarily large number of plant-lice upon certain shade trees of Washington, D.C. The following day the temperature reached the maximum of 100° F., and as a result the plant-lice disappeared like magic.

Mr. Ashmead called attention to the fact that the family of plant-lice was not extensive in the tropics, thus supporting the theory previously discussed.

Mr. Barrows stated that the condition in Michigan regarding plant-lice was probably the same as that in Canada. He was of the opinion that the great abundance of these insects in Michigan during the past summer was probably due to the large number present last year. While examining the orchards for the San José scale last winter his attention was attracted by the remarkable quantities of plant-lice eggs deposited on young nursery stock and on orchard trees. So numerous were these eggs in some cases that the trees had the appearance of being varnished. His experience agreed with that of Dr. Howard, that hot weather was a most important factor in controlling the increase of plant-lice. Referring to Mr. Howard's first paper, Mr. Barrows spoke of the general lack of appreciation of the value of such experiments as those described and the lack of careful observations concerning the relation of temperature effects to the increase or decrease of injurious insects in connection with the abundance or absence of their natural enemies. A man might have observed a decrease or increase over the normal of the temperature for the winter of 1895-96 and arrived at the conclusion that this had been the chief factor in checking the outbreak of the *Orgyia* caterpillar, thus neglecting to take into account the action of the parasites. There was great need for careful and exhaustive observations whenever temperature effects are associated with the abundance or scarcity of any insect.

Mr. Webster called attention to the fact that the great numbers of aphides in Ohio nurseries this year had seriously injured a large quantity of young, rapidly growing stock.

An abstract of "Notes on Certain Species of Coleoptera that Attack Useful Plants," by F. H. Chittenden, was read by the Secretary *pro tem*. These notes treated chiefly of the food plants and habits of certain Chrysomelids. "An Experience with Paris Green," by T. D. A. Cockerell, was also read by the acting Secretary.

A letter from Miss E. A. Ormerod called particular attention to the fact that the house sparrow had been very abundant and very obnoxious in certain parts of England, and it seemed probable that some legislation or public measures would need to be adopted to control this bird. The arrival from Tripoli of a cargo of wheat, badly infested by the Angoumois moth, was recorded and reference made to the occurrence in injurious numbers of *Xyleborus dispar* at Toddington.

Prof. P. H. Rolfs presented notes on "A Fungus Disease of the San José Scale." This disease seems to be confined to the southern part of the United States, but is very

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helpful to fruit growers there. The scale has been almost eradicated from several orchards by means of it. Laboratory and field experiments now in progress promise hopeful results, but it does not seem probable that this disease will be of value in the northern part of the United States, since warmth and moisture are necessary for its development.

The next paper, treating of the same insect, was presented by Mr. Barrows :

#### THE PRESENT STATUS OF THE SAN JOSÉ SCALE IN MICHIGAN.

So far as we have any knowledge, the San José scale first came to the notice of the State Experiment Station May 14, 1896, when it was found on a single fruit tree in Jackson, and the tree was destroyed soon after. The origin of the affected tree was not ascertained, and as no other occurrences were reported from the vicinity it was supposed that no further trouble would result. In December following, however, it became evident from its invasion of the States adjoining Michigan on the south that our own State was in serious danger, and on application to the New Jersey nurserymen who were supposed to have sent out infested stock, a list of several hundred Michigan addresses was received by the horticulturist of the station, and a circular letter describing the scale and its work was sent to each address. Comparatively few replies to this letter were received, but among them were some which indicated the presence of the scale, and further enquiries showed its presence in several places.

During the winter many different parts of the State were visited in quest of the pest, but the severe weather, the lack of time, and especially the number and extent of the suspected orchards, made anything like thorough inspection impossible. The scale was located in greater or less abundance at half a dozen widely separated points, and this number has been increased by as many more through correspondence and the transmission of specimens. At present the scale is positively known to have existed in the ten counties, and in no case is there positive proof that it has been entirely eradicated.

In Ottawa County the infested stock was received from New Jersey in the spring of 1890, and thus had been established almost seven years before it came to the knowledge of any entomologist. During this time it had killed all or nearly all the trees on which it was brought, and had spread to all the other fruit trees in the immediate vicinity, some of which also had succumbed. Probably at this place several acres were badly infested, and of course it is to be feared that the scale has been carried to other orchards in the neighborhood.

In Ingham County one locality was found in the city of Lansing where the fruit trees about two houses and in their gardens were badly affected, and the scale had overrun rose bushes, currant bushes, grape vines, and even one or two shrubs of *Spiræa*. In this case the scale was originally brought on pear trees which were bought from a resident dealer in 1888 or 1889. The trees were said to have been obtained in New York State, but, as the dealer is known to have been unreliable, and as very few trees were true to name, it is not likely that any dependence can be placed on the statement. It is more than probable that the stock came from New Jersey, and that other parties in the vicinity have introduced the scale through the same dealer.

In still another case (and county) a dealer is known to have handled stock which was infested with the scale, and that at least five or six years ago, so that it is fair to assume that this pest is now pretty widely and thoroughly distributed through the fruit-growing parts of the State, and we may expect to find it in large quantities in all the counties of the four southern tiers, and yet farther north along the west side of the State. Since the scale thrives in Ingham and Ottawa counties it is likely to winter safely still farther north, and as yet the life zones in Michigan are so poorly defined that it is impossible to draw any line beyond which we may safely predict that the scale cannot live. \*

\* \* \* When we know more of the geographical distribution of life in Michigan, it may be possible to define with precision the limits beyond which the San José scale will

not become established, but at present we must consider the entire southern half of the Lower Peninsula as in danger of serious infestation, together with a strip of uncertain width bordering Lake Michigan at least as far north as Grand Traverse Bay.

It is too early yet to make any predictions as to the ultimate success or failure of attempts to limit by legislation the spread of the scale in Michigan. The last legislature passed a bill which takes effect late in the present month (August) requiring the inspection of all nursery stock offered for sale in the State, whether home grown or from outside, and compelling inspection and treatment of all suspected orchards or fruit trees wherever found. The bill as originally drawn was not, of course, altogether satisfactory, either to the nurserymen or the fruit growers, and during its passage through the legislature its strength was still further impaired by sundry concessions which seemed to be necessary in order to secure its adoption. It is hoped, however, that its provisions may be thoroughly enforced and its efficacy tested during the coming year, so that, if necessary, better measures may be provided by our next legislature.

In the discussion which followed these two papers, Mr. Craig stated that the condition in Canada relative to the San José scale was quite similar to that of Michigan. This insect had been found in British Columbia and in Ontario. In the latter Province there were seven well authenticated occurrences, these being probably in the upper austral region. Mr. Craig's investigations showed that the San José scale had been present in Canada for at least four years and came originally from two New Jersey nurseries, whose proprietors had kindly enabled him to trace the shipments of infested stock. Mr. Craig was of the opinion that the scale would do the greatest damage in the peach-growing region where, as early as July 1, 1897, he had found the young scales securely fixed on young, growing wood. Fungus cultures, received from Professor Rolfs, had been used in inoculation tests in the laboratory, but with no practical results as yet. It seemed probable that an endeavor would be made to obtain legislation with a view to preventing the shipment of infested nursery stock to Canada.

Mr. Howard inquired as to the known geographical distribution of the fungus disease. Mr. Rolfs said that, to the best of his knowledge, this disease was chiefly confined to the southern part of the United States. It had been found in Alabama, Georgia, South Carolina, and in one instance in Pennsylvania. It was most abundant at Auburn, Ala.

A paper from Prof. C. P. Gillette on "Insects taken at Light and Sugar," evoked considerable discussion, and was followed by "A Study of the Possible Origin and Distribution of the Chinch Bug," by Prof. F. M. Webster. The author advanced the idea that this insect had originated in the southern part of the United States and spread by two diverging streams up the Mississippi valley and along the eastern Atlantic coast. In the former region the long winged form predominated, while the coast form was short winged. In the discussion following this paper the general opinion seemed to be that the length of the wings depended upon environment rather than heredity. Mr. C. W. Mally recorded the capture at Ohio of a specimen having one long and one short wing, thus throwing additional light upon the relationship between the two forms.

"Notes on the Common House Fly," by Mr. Howard, gave the negative results of a series of experiments with lime, land plaster, etc., used to destroy the larvæ of the house fly. He emphasized the necessity of greater cleanliness in the management of horse stables.

A paper from Mr. Gillette on "Vernacular Names of Insects," was read and referred to a committee consisting of Messrs. Howard, Fernald and Lintner. A communication from C. P. Lounsbury, giving very interesting notes on "Cape of Good Hope Insects," particularly the locusts of that region, was then read.

Mr. H. G. Hubbard presented an account of the "Insect Fauna of the Giant Cactus," recording the capture of a large number of insects on this plant and giving notes on their habits.

Mr. Howard described "A Valuable Coccid," lately discovered in Arizona and New Mexico, from which, by suitable treatment, a good grade of white wax could be obtained.

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"Notes on Insects of the Year," by Messrs. Webster and Mally, recorded interesting experiences with several of the common insect pests. The negative results of a series of experiments with kainit, against the insects attacking the roots of the grape, caused considerable discussion, and the need for further experimentation along this line was pointed out.

A paper by A. H. Kirkland on "Preparation and Use of Arsenate of Lead," detailed a method of preparing this insecticide at a cost of about seven cents per pound. Work against the gypsy moth was mentioned, and the condition of the infested region was reported as generally better than that of last year. This undertaking, however, is still handicapped by insufficient financial support.

"A Malodorous Carabid," by Mr. Barrows, gave extensive notes on the annoyance and discomfort caused by the almost unbearable odour of this insect, *Nomius pygmaeus*.

Among the papers read by title only, owing to the absence of their authors, but afterwards presented in the official report of the meeting, was a very valuable one by Mr. Marlatt, of the Division of Entomology, Washington, entitled "Notes on Insecticides," from which the following extracts are taken:

#### SOAP AS AN INSECTICIDE.

There is no more unsatisfactory substance to work with against insects than soap, for the reason, previously pointed out, of the extreme uncertainty of the composition and characteristics of any brand that is secured. The most earnest efforts on our part to get manufacturers to make a definite brand of soap which approached our ideal, and to keep the stock at a uniform and reliable strength and character, have been entirely unsuccessful, and we have not been able to get any two consecutive lots of soap having the same characteristics or value for insecticide purposes.

#### PURE KEROSENE.

The discussion of this substance at the last meeting of the Association led to some additional experiments on our part with the use of pure coal oil or kerosene on plants. Various trees, including young and vigorous peach, pear, cherry and apple trees, euonymus bushes, and some old bearing peach trees, were thoroughly sprayed with pure kerosene early the past spring, with one exception, before the buds had begun to swell. In the case of two large bearing peach trees the blossom buds were swelling and opening and these trees were also badly infested with *Diaspis lanatus*. The other plants, with the exception of the euonymus bushes, were healthy and free from all insects. Much to my surprise and astonishment, no ill effects of any moment resulted in the case of any of the trees sprayed with kerosene. In the case of all the trees spraying was continued just long enough to moisten the plants thoroughly, but not to cause the oil to run down the trunks and collect about the base, and with the young trees the soil was carefully mounded up and pressed about the crown to avoid all danger of the oil collecting at that point.

The pear trees treated, and also the peach, came out in full bloom, the opening of the blossom buds not being at all interfered with by the oil bath. After the bloom fell the peach trees treated with pure oil made much finer growth than untreated trees. This may have been in part due to the more favorable location of the trees, and possibly also to the fact that in the treatment with the coal oil the eggs of Aphides on the trees had been entirely killed, whereas on the untreated trees a very bad infestation with plant lice developed early and checked the growth of the trees, killing some of them. No Aphides, however, appeared on the sprayed trees. In the case of the pear trees particularly, and also the apple, the unfolding of the leaf buds was very noticeably delayed as compared with untreated plants, the buds seeming to open up much more slowly, and for two weeks at least the difference was very marked. Very soon thereafter, however,

the treated trees overtopped the others both in abundance of foliage and amount of new growth, and at the present writing, July 20, there seems to have been no injury whatever as a result of the treatment.

The large peach tree sprayed showed no ill effects, and all of the scales on the tree were killed except where they had been protected in a few instances by masses of leaves webbed about the limbs. At least 99 per cent. of the scales were killed. On the euonymous a similar result was shown, at least 99 per cent. of scales having also been killed by the oil.

These results are so greatly in contrast with those previously attained in the experiments conducted in practically the same way that it seems difficult to account for them. That spraying with pure oil will often kill trees can not be doubted, even when applied in the dormant condition in winter, as demonstrated by experiments on a number of apple and peach trees two or three seasons ago. It is possible that with these earlier experiments the same care was not employed to prevent the collection of oil about the trunks of the trees and the trees were not mounded up, but the work was as carefully done as would ordinarily be the case in actual practice, and probably much more so. It is possible, therefore, that the death of the trees in some instances was due to the collection of the oil in the cavity formed about the trunk by the swaying of the trees in the wind, which, as will be shown later, has had disastrous results in California with the emulsion even. Others have reported the use of oil on trees without injurious effects in some instances and in others with injurious effects, so that pure oil as an insecticide is one to be used with caution and with full appreciation of the fact that the death of the plant may result.

#### USE OF KEROSENE EMULSION IN CALIFORNIA.

This insecticide is used to a very considerable extent in California, much more so in recent years than formerly. It is the principal insecticide used in the district about San Diego, and is also used extensively at Santa Barbara and to a less extent elsewhere in the State. The necessity for the use of very large quantities of insecticides in California has led to the establishment by private parties in several instances of steam or gasoline plants for the wholesale production of this insecticide. Probably the first extensive manufacturing plant of this sort was set up by Mr. W. R. Gunnis, county horticultural commissioner, of San Diego, who manufactures the emulsion by the aid of a small engine, doing all the work of heating, churning, etc., by this means. With coal oil at 11 cents per gallon, he is able to produce the emulsion at a charge of 13 cents per gallon in the undiluted state, which makes the wash as applied to the trees, diluted 7 times, cost a little over 1½ cents per gallon. In his district, Mr. Gunnis claims that the loss from scale insects has been reduced from 79 per cent. to 7 per cent., chiefly by the use of this wash.

At Santa Barbara the superintendent of the Las Fuentes ranch, Mr. Frank Kahler, has set up a very large plant for the manufacture of kerosene emulsion for the use of this ranch alone. The plant is similar to that devised by Mr. Gunnis, and the capacity is such that the emulsion can be made in quantities of 150 gallons at a time and very rapidly. He uses a formula slightly different from the Hubbard. The proportions are 35 gallons of whale-oil soap, 100 gallons of kerosene oil, and 50 gallons of water. This is diluted for application to trees with seven parts water, costing in the diluted state 1½ cents per gallon.

Kerosene emulsion has probably been given its most extensive trial on the Pacific Coast at the Las Fuentes ranch. Two years since Mr. Gunnings sent his excellent spraying apparatus to Santa Barbara, together with some 8,000 or 10,000 gallons of emulsion, and thoroughly sprayed the lemon plantings, comprising upward of 25,000 trees.

In some of the earlier work many trees were killed, owing probably to the accumulation of oil in the bottom of the reservoir or tank, so that the last three or four trees with each filling received an unusually heavy dose, which, running down the trunk, col-

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lected in the cavity about the crown caused by the swaying of the trees in the wind. The accumulation of oil in this way may be prevented by giving the tank a conical bottom, so that the liquid may be thoroughly exhausted each time before refilling, and as a further precaution, before treating, the trees may be mounded up about the base and the earth thoroughly compacted. With these precautions no injury has resulted from the later sprayings. The treatment kills the young of the black scale and the fungus breaks up and soon peels off.

#### LIME, SALT, AND SULPHUR WASH.

As the members of the Association are aware, this is the almost invariable remedy for the San José scale on the Pacific slope, and as a rule it is undoubtedly effective. Our experience with this wash in the East had thrown doubt on its real efficiency as an insecticide, and it has been clearly demonstrated that under the climatic conditions east of the Alleghanies it is almost valueless. In California, however, after a careful study of the facts in the field, I am compelled to admit that the demonstration of its usefulness against the San José scale is complete and the benefit of its application to orchards is most manifest. In the vicinity of Pomona, Cal., unsprayed orchards were badly infested with San José scale, while in adjoining sprayed orchards the scale was entirely killed and the trees were rapidly recovering and showing vigorous and healthy new growth. In contiguous orchards, also, of the same kinds of trees, similarly treated so far as cultivation is concerned, the trees which had been subjected to yearly spraying were at least one-third larger than untreated trees. This wash is of value also as a fungicide, protecting stone fruits from leaf fungi, and is also a protection against birds, the common California linnnet doing great damage to buds in January and February. The wash is almost invariably made and applied by contractors, and costs about 5 cents per gallon applied to the trees. It is a winter application, being applied in January and February.

Along the coast region and in northern California, where moister conditions prevail, this wash is very much less successful, bearing out somewhat the experience of the East, and doubtless explained by the similarity of climate in the districts mentioned with that of the Atlantic seaboard. In making this wash the chief consideration seems to be prolonged boiling. The wash itself is practically a sulphide of lime, with much free lime and salt carried with it. Prolonged boiling will result in taking up temporarily additional sulphur, and will perhaps add to its caustic properties if it is applied very hot; on cooling, however, it reverts to the simpler tri- or bi-sulphide of lime. The proportions of the ingredients and the method of combining them vary slightly in different sections. The following is the ordinary formula: Unslaked lime, 40 pounds; sulphur, 20 pounds; salt, 15 pounds; one-fourth of the lime is first slaked and boiled with the sulphur in 20 gallons of water for two or three hours; the remainder of the lime is slaked and together with the salt is added to the hot mixture and the whole boiled for half an hour or an hour longer. Water is then added to make 60 gallons of wash. This wash is applied practically every year, or as often as the San José scale manifests itself in any numbers. In the coast region and in the northern part of the State it is necessary to apply it with greater frequency than in the interior districts.

#### ARSENICALS AND LIME.

The advantage of the employment of lime with Paris green or London purple having been called in question at the previous meeting of this association, the matter was again made the subject of experimental test, and the old belief of the decided protective value to the foliage of the addition of lime was fully and strikingly demonstrated.

At the final adjournment of the session it was voted to hold the next meeting at Boston, Mass., Aug. 19th and 20th.

Several resolutions were passed, among which were (1) a resolution requesting the publication of the proceedings as a bulletin of the Division of Entomology, U. S. Dept. of Agriculture and (2) expressing familiarity with the efforts of the State of Massachusetts to exterminate the gypsy moth and commending the results already accomplished.

The election of officers resulted as follows:—President, Herbert Osborn, Ames, Iowa; 1st Vice-president, Lawrence Bruner, Lincoln, Neb.; 2nd Vice president, C. P. Gillette, Ft. Collins, Colo.; Secretary and Treasurer, C. L. Marlatt, Washington, D. C.

JAMES FLETCHER, LL.D., F.R.S.C., F.L.S.

We are happy to be able to prefix to our twenty-eighth Annual Report, an excellent portrait of DR. JAMES FLETCHER, whose name is a household word among Entomologists not only in Canada, but throughout North America, and in many parts of the world besides. Born and educated in England, Dr. Fletcher came to this country when a young man as a junior officer in the Bank of British North America, and soon began to devote his leisure hours to the study of insects and plants. Find the work of a bank by no means congenial to his literary and scientific tastes, he obtained a position as assistant in the Library of Parliament at Ottawa. It was not long before his talents and attainments in botany and entomology became widely known, chiefly through his contributions to the *Canadian Entomologist* and the Annual Reports of our Society. His first paper in the latter was an article on Canadian Buprestidæ, which was published in 1878, while his first contribution to the Magazine appeared in January 1880. During all the years that have followed no volume of either publication has been issued without some valuable articles from his pen.

In 1878 he became a member of the Council of the Entomological Society of Ontario and every year since has been elected to hold some office in the Society, being four times Vice-president and for three years, 1886-8, President. In 1879 he was one of the originators of the Ottawa Field Naturalists' Club, the most successful society of the kind in the Dominion, and more recently he suggested, and by his influence and energy, accomplished the formation of the important Association of Economic Entomologists of North America.

The first official recognition of his attainments was in 1885, when he was appointed Honorary Entomologist to the Department of Agriculture at Ottawa, and in that capacity, though much hampered by his duties in the library, he published a valuable report on the injurious insects of the year. Two years later his present position of Entomologist and Botanist to the experimental farms of the Dominion was conferred upon him. In the ten years that have now gone by, he has done an enormous amount of valuable work as shown in his Annual Reports and Evidence before the Standing Committee of the House of Commons on Agriculture, his voluminous correspondence with farmers and fruit growers all over the Dominion, and his addresses to Farmers' Institutes and other gatherings. No one in this country has done so much as he to instruct the people in a practical knowledge of their worst insect foes and the best methods of dealing with them, while probably no one but he could have given the Province of Manitoba the information and the advice that he has repeatedly afforded by his lectures, addresses and publications on the noxious weeds of that portion of the Dominion. All his friends will, we are sure, unite with us in the earnest wish that he may long be spared to carry on his admirable work which is of such vast importance, not only to those directly interested in the products of the soil, but to all the dwellers throughout this wide Dominion.

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## BOOK NOTICES.

INSECT LIFE ; AN INTRODUCTION TO NATURE-STUDY AND A GUIDE FOR TEACHERS, STUDENTS AND OTHERS INTERESTED IN OUT-OF-DOOR LIFE : By John Henry Comstock, Professor of Entomology, in Cornell University and in Leland Stanford Junior University, with many illustrations engraved by Anne Botsford Comstock. New York, D. Appleton and Company, pp. 340, with 6 plates and many figures. Price \$2.50.

In this little book Prof. Comstock has given us a treatise, not only of practical value to teachers and amateurs, but also one that the professional worker will find very handy to have just within reach in order to settle some minor point that may suddenly present itself. Best of all, however, is the fact that the work is correct, a feature quite in contrast with some of the ordinary text-book entomology. There need be no hesitation about recommending this book to anyone, as its style, while not especially technical, is even more or less poetical, yet is never flippant or slipshod in expression. The illustrations are fine and are not simply pictures, but help to simplify the text; almost anyone who is at all versed in entomology will at once recognize the Katy-did on the cover. There is just one fault to be found with the book, and it is very doubtful if this is to be attributed to the author, and this is the title. A fascinating title may help to sell a novel, or some such work as that, but publishers should learn that this is not true with such books as this. However, it is no discredit to the author that his book should be found better than its title. For the present, and until there is something much better, I shall recommend this book to those who wish a simple and accurate introduction to the difficult study of entomology.

F. M. W.

STORIES OF INSECT LIFE : By Clarence Moores Weed, Ginn and Company, publishers, Boston, U.S.A., and London, pp. 54, with many illustrations. Price 25c.

The title indicates the nature of the book, and no one will mistake the figure of the well known "Mourning Oloak" Butterfly on the front cover, even though no attempt was made in the way of colour. This is for the young people, and just the thing for boys and girls who are romping and playing over the fields and meadows, securing that most important element in an education, health. The insects treated of are the most common, and this is a great advantage because it is usually the things that are the nearest to us that we know the least about. Get the children to observe the common things carefully, and they will be all the better prepared to look after the uncommon later on in life. I only wish that some philanthropist would buy up the whole edition of this work and present them to the school children of the country. Surely it would help to make better men and women of many boys and girls, and open up them a world of wonders that are to be seen by any, no matter how lowly, provided they only know how and where to look.

F. M. W.

GUIDE TO THE GENERA AND CLASSIFICATION OF THE NORTH AMERICAN ORTHOPTERA : By S. H. Scudder. 8vo. pp. 89. W. H. Wheeler, Cambridge, 1897. Price, \$1.00.

The above volume, like all of Dr. Scudder's books, is exactly what the title states. It is simply a guide for the use of students of the Orthoptera by means of which they may determine the genera of their specimens. It consists of excellent and most carefully prepared tables of the seven families into which the Orthoptera of North America are divided. These are followed by most valuable bibliographical notes in which the student is referred under the head of each family of insects to all the works which refer to it. Then follows a full list of all the works which refer to North American Orthoptera, arranged alphabetically by authors and a complete index. All who have attempted to study Orthoptera know how badly such a book was wanted, and it is well for the science of entomology that the work was done by such a careful and experienced hand.

J. F.

THE GENERA OF NORTH AMERICAN MELANOPLI: By S. H. Scudder. (Proc. Am. Acad. of A. and S. V. 32, pp. 195-206, January, 1897.)

Almost simultaneously with Dr. Scudder's "Guide to the Genera of Orthoptera" two other important and extremely useful papers appeared, one on "*The Genera of North American Melanopli*," and the other on "*The Species of the Genus Melanoplus*." These are both really advance issues of chapters in Dr. Scudder's great work on the Melanopli, which is to be published by the U. S. National Museum. The *Melanopli* are divided into thirty genera, seventeen of which are new and four have been previously published by the author. The genus *Melanoplus* is characteristically American and is widely disseminated. There are 131 species recognized, grouped under twenty-eight series. The name *furcula* is given to the processes of the last dorsal segment of the male abdomen.

J. F.

THE BOOK OF BRITISH BUTTERFLIES: A practical manual for Collectors and Naturalists; 1 vol. pp. 247 (3s. 6d.)

THE BOOK OF BRITISH HAWK-MOTHS: A popular and practical Hand-book for Lepidopterists; 1 vol. pp. 157 (3s. 6d.)

By W. J. Lucas, B. A. London: L. Upcott Gill, 170 Strand, W. C.

Many excellent works on British butterflies have been published during the last twenty-five years and one would naturally suppose that there was little need of another book on the subject. Mr. Lucas, however, has succeeded in producing a very useful and excellent popular manual, which will be a welcome aid to those who wish to study the life history of butterflies as well as to identify the specimens they may collect in the British Isles. As it is intended for those who have made no previous study of the subject, the author begins at the beginning, telling the reader what an insect is, what place the butterfly takes in nature, how to capture, set and care for specimens, and then describes each British species from the egg to the imago in clear and simple language, and in almost every instance gives admirable drawings of the caterpillar, chrysalis and both surfaces of the imago. As there are no less than 266 figures in illustration of sixty-eight species, the collector should have no difficulty in determining any specimen of butterfly in any of its stages (except the egg) that he may chance to find. A book such as this should give a great impetus to the study of the preparatory stages of British butterflies, a section of entomology which is usually neglected in favor of the mere collection and arrangement of the perfect insects. A volume such as this on Canadian butterflies would be a very welcome aid to a large number of young people whose interest has been aroused by the beauty and variety of our species, but whose enthusiasm is dampened by the difficulty of obtaining any information about them.

"The Book of British Hawk-moths," by the same author, deals with a somewhat less familiar group, and gives much useful information that it would otherwise be hard to find. The plan of the work is similar to that of the butterfly book, and it is written in the same clear and simple style. As there are only seventeen species to deal with, the writer is able to go more fully into details respecting them and to make his work all the more complete and popular. He has also provided artificial keys to the larvæ and imagines, and tables for distinguishing the species where there is more than one representative of the genus. The fifteen plates with which the volume is illustrated are very beautiful and are admirably drawn by the author himself. Each species is represented life size, and is shown as a caterpillar on its food plant, chrysalis and imago. There are eighteen wood cuts for the most part illustrating details of structure. It is to be hoped that the author will continue his good work until he has completed the British lepidoptera, or at any rate the more conspicuous and familiar families. C. J. S. B.

LIFE HISTORIES OF AMERICAN INSECTS: By Clarence M. Weed. 1 vol. pp. 272. (\$1.50). New York: The Macmillan Company.

¶The publication of a popular book on insects is so rare an event on this side of the Atlantic that we heartily welcome an addition to the number, especially when it is so

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INSECTS AND vol., pp.

In the attention was paid schools, and the assistance of needed, if only lessons" are a are required to of exact observation on the phenomenon the hands of the useful than the insects, and no advantage is traced. Mr. J. lessons of this their internal species of each facts of interest plates and wood instruction and which to frame

excellent and satisfactory as the volume before us. Dr. Weed has selected some five and twenty more or less familiar insects, and in a pleasant manner has given some account of their life histories. The chapters are quite independent of each other and arranged in no particular order; the book may therefore be opened at random, and the sketch that may be hit upon read without any detriment to the continuity of the work. Some of them which deal with such creatures as the leaf miners are naturally very brief since so little is known about these tiny foes to vegetation, but of other species which have been subjects of particular study on the part of the author we find long and full descriptions. Among the latter may be mentioned the interesting account of the hibernation of aphides, the chapter on "harvest spiders, the "army worm," etc. Anyone, young or old, who has any desire to read about the wonderful creatures that inhabit the world and to know something about their modes of life cannot fail to be pleased with this book, and to be led on we should hope to make his own observations of their curious habits and strange doings. The volume is handsomely illustrated with twenty-one full page plates and nearly 100 figures in the text.

C. J. S. B.

INSECTS AND SPIDERS: Their Structure, Life Histories and Habits. By J. W. Tutt. 1 vol., pp. 116. (1 shilling). London: George Gill & Sons, Warwick Lane, E.C.

In the annual report of the Entomological Society of Ontario for 1896 much attention was paid to the subject of teaching natural history, and especially entomology, in schools, and the desire was expressed that some hand book might be drawn up for the assistance of teachers in rural schools. The volume before us is the very book that is needed, if only it dealt with Canadian instead of British insects. In England "Object lessons" are a compulsory part of the curriculum in elementary schools, and the teachers are required to give their pupils a series of simple lessons "adapted to cultivate habits of exact observation, statement and reasoning." These lessons are to be "on objects and on the phenomena of nature and of common life," and a wide discretion is thus left in the hands of the teacher. In the country schools of Ontario no subject could be more useful than the study in this way of the commonest species of injurious and beneficial insects, and no subject is likely to compare with it in interesting the pupils. A further advantage is the ease with which specimens can be obtained and their life histories traced. Mr. Tutt's volume is admirably adapted for the use of teachers in providing lessons of this kind. After giving a general account of the external structure of insects, their internal organs and metamorphoses, he devotes the "lessons" to typical common species of each order, giving similar particulars regarding the individuals and any general facts of interest that bear upon them. Each insect treated of is also illustrated with plates and wood cuts. It is not, however, a text-book for pupils, but is meant for the instruction and equipment of the teachers, affording them an excellent foundation upon which to frame the instructions they are to give to those committed to their charge.

C. J. S. B.

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## SUPPLEMENT.

AN ACT TO PROTECT CANADA AGAINST THE INTRODUCTION OF THE  
INSECT PEST KNOWN AS THE SAN JOSÉ SCALE.

Assented to March 18th, 1898.

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows :—

Short title.

1. This Act may be cited as *The San Jose Scale Act*.

Importation of nursery stock from certain places prohibited.

2. The importation of any trees, shrubs, plants, vines, grafts, cuttings or buds, commonly called nursery stock, from any country or place to which this Act applies is prohibited.

Penalty.

3. Any nursery stock so imported shall be forfeited to the Crown, and may be destroyed, and any person importing nursery stock from any such country or place, or causing or permitting it to be so imported, shall be deemed to be guilty of an offence under section 6 of *The Customs Tariff, 1897*, and shall be liable to the penalty prescribed by that section.

Application of Act to be regulated by Governor in Council.

4. The Governor in Council may from time to time declare that this Act applies to any country or place as to which it has been made to appear that San José Scale exists therein ; and, when satisfied that the importation of nursery stock from any country or place to which this Act has been applied may safely be permitted, he may in like manner declare that this Act no longer applies to such country or place.

Exemption of plants which are not liable to San José Scale.

5. The Governor in Council, upon its being made to appear to his satisfaction that any class of plants is not liable to the attack of the San José Scale, may exempt plants of such class, and grafts, cuttings or buds thereof from the operation of this Act.

Importation for scientific purposes.

6. The Governor in Council may from time to time, notwithstanding anything contained in this Act, permit the importation from any country or place to which this Act applies, of any such nursery stock as is required for scientific purposes.

Publication of Orders-in-Council.

7. All Orders in Council made under sections 4 and 5 of this Act shall be published in *The Canada Gazette*.

## ORDERS IN COUNCIL.

At the Government House at Ottawa,

Friday, the 18th day of March, 1898.

PRESENT: HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

His Excellency, in virtue of the provisions of section 4 of the Act passed during the present session of Parliament, cited as "The San José Scale Act," and by and with the advice of the Queen's Privy Council, is pleased to declare that the United States of America, Australia, Japan and the Hawaiian Islands shall be and the same are hereby declared to be countries to which this Act applies owing to the existence of the San José Scale in them.

JOHN J. MCGEE,  
Clerk of the Privy Council.

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At the Government House at Ottawa,  
Friday, the 18th day of March, 1898.

PRESENT: HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

His Excellency, in virtue of the provisions of section 5 of the Act passed during the present session of Parliament, and cited as "The San José Scale Act," and by and with the advice of the Queen's Privy Council, is pleased to order and declare that the following plants which are not liable to the attack of the San José Scale, viz. :—

1. Greenhouse plants, with the exception of roses,
  2. Herbaceous perennials,
  3. Herbaceous bedding plants,
  4. All conifers,
  5. Bulbs and tubers,
- shall be and the same are hereby exempted from the operations of the above mentioned Act.

JOHN J. MCGEE,  
Clerk of the Privy Council.

ONTARIO DEPARTMENT OF AGRICULTURE.

AN ACT TO PREVENT THE SPREAD OF THE SAN JOSE SCALE.

Passed January 17th, 1898.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows :

1. This Act may be cited as *The San José Scale Act*. Short title.
2. In this Act the word "Minister" shall mean the Minister of Agriculture for the Province of Ontario. Interpretation  
"Minister."  
The word "plant" shall mean any tree, vine, shrub or plant, or any part of a tree, vine, shrub or plant, or the fruit of any tree, vine, shrub or plant. "Plant."  
The word "scale" shall mean the San José Scale insect in any of its stages of development. "Scale."
3. No person shall import or bring, or cause to be imported or brought into the Province of Ontario, for any purpose whatsoever, any plant infested with scale. Importation of diseased plants prohibited.
4. No person shall keep or have, or offer for exchange or sale, any plant infested with scale. Having in possession or selling.
5. For the purpose of scientific investigation the Minister may from time to time, by writing given under his hand, except such persons as he may deem proper, from the operation of the two preceding sections, and, while acting under such permission, such persons shall not be subject to the penalties imposed by this Act. Scientific investigation.
6. Any person having reason to suspect that any plant in his possession, or in his charge or keeping, is infested with the scale shall forthwith communicate with the Minister in regard to the same, and shall furnish the Minister with all such information in regard to the source or origin of the said infestation and the extent and nature of the same as he may be able to give. Notice to Minister on discovery of disease.

Investigation  
and report.

7. Whenever the scale exists, or is supposed to exist on any plant, the Minister may direct a competent person to make an examination and inspection, and may order that any plant so infested, or such part as he may deem advisable, shall be immediately destroyed by burning, either by the person appointed to make the inspection or by the person owning or having possession of the said plant, or some other person so directed in writing, and the person so directed shall make a full report to the Minister in writing as to the nature and extent of the work so performed, together with a fair estimate of the value of the plant destroyed.

Destruction  
of diseased  
plant.Duties of  
inspectors ap-  
pointed under  
Rev. Stat.  
c. 280.

8. For the purpose of enforcing this Act, it shall be the duty of every inspector appointed under *The Yellows and Black Knot Act* to make careful examination and inspection for the occurrence of the scale within the municipality for which he is appointed, and to report forthwith every case of infestation, and neglect to make such report shall render the inspector liable to the penalties imposed under section 11 of this Act.

Right of access  
to places  
where tree is.

9. Any person appointed by the Minister under this Act to inspect or to destroy any plant for the purpose of enforcing the provisions of this Act, shall, upon producing his authority in writing, have free access to any nursery, orchard, store, storeroom or other place where it is known or suspected that any plant is kept.

Compensation  
for destruction  
of plants.

10. Upon the recommendation of the Minister there may be paid out of the Consolidated Revenue Fund of the Province to the owner of any plant so destroyed a sum not exceeding one-fourth of the value thereof (not including fruit) as reported upon by such officer or other competent person appointed as aforesaid; but nothing in this section shall apply to any plant imported into the Province within a period of one year prior to the examination by the officer aforesaid.

Penalty.

11. Any person neglecting to carry out the provisions of this Act, or any person offering any hindrance to the carrying out of this Act, shall, upon summary conviction, be liable to a fine of not less than \$20 nor more than \$100, together with costs, and in default of payment thereof shall be subject to imprisonment in the common gaol for a period of not less than ten days nor more than thirty days.

Extension of  
Act to other  
scale insects.

12. The Lieutenant-Governor in Council may by order direct that other scale insects than the San José Scale may be included in the provisions of this Act, and thereafter during the continuance of such Order-in-Council the word "scale" in this Act shall include all such other scale insects. Public notice of such Order-in-Council shall be given by publication in two successive issues of *The Ontario Gazette*.

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