

ENTOMOLOGICAL BRANCH
DEPARTMENT OF AGRICULTURE
OTTAWA - CANADA

ENT

PRINTED B

FIFTEENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

1884

ONTARIO.

ENTOMOLOGICAL BRANCH
DEPARTMENT OF AGRICULTURE
OTTAWA - - CANADA

Printed by Order of the Legislative Assembly.



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1885.

Abia caprifoliae
 " *cerasi*
 " *kennicotti* .
Acordulecera do
Egeria acerni . . .
 " *tricincta*
Agrotis declarata
 " *devastato*
 " *fennica* . .
Aletia argillacea .
Allartus basillaris
 " *leucoston*
Alypia MacCulloch
 Annual Address o
 " *meeting E*
 " *statemert*
 Ant, concerning . . .
 Ant-lions, notes on
Apatela Americana
Aphis radicum
Aramiges Fulleri . .
Arma spinosa
 Ash saw-fly
Asparagus beetle . . .
Atta barbara
 " *providens*
 " *structor*
Attacus cecropia

Blaps mortisaga
 Bowles, G. J., article
Buprestis consularis .
 " *maculivent*

Caddis-fly larvæ
Callosamia angulifera .
Calosoma frigidum . . .
 " *tepidum*
Camponotus inflatus . .
Carabus tædatus
Carpocapsa saltitans . . .
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To the Honourab

SIR,—I have
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William Saunders,
Present: Mr.
Alston Moffatt, H

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ENTOMOLOGICAL BRANCH
DEPARTMENT OF AGRICULTURE
OTTAWA - - CANADA

FIFTEENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO.

To the Honourable the Commissioner of Agriculture :

SIR,—I have the honour to submit for your consideration the Fifteenth Annual Report of the Entomological Society of Ontario in accordance with the provisions of our Act of Incorporation.

The annual meeting of the Society was held in the city of London on October 15th, 1884, when the officers for the ensuing year were elected, and the necessary business of the Society transacted.

I also submit herewith our audited financial statement and the minutes of the annual meeting.

The publication of the *Canadian Entomologist*, the organ of the Entomological Society, is still well maintained.

I have the honour, sir, to remain,

Your obedient servant,

EDMUND BAYNES REED,
Secretary-Treasurer.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The annual meeting of the Society was held in London, at the Society's Rooms, Victoria Hall, on Wednesday, October 15, 1884, at 7.30 o'clock p.m. The President, Mr. William Saunders, of London, in the chair.

Present : Mr. James Fletcher, Ottawa; Rev. Thos. W. Fyles, Quebec; Mr. J. Alston Moffatt, Hamilton; Mr. John W. Denton, London; Mr. Wm. H. Harrington,

Ottawa; Dr. Burgess, Mr. A. Puddicombe, Mr. H. B. Bock, Dr. Woolverton, Mr. L. B. Reed, and Mr. Chas. Chapman, of London; Mr. Macdonald, of the *Farmers' Advocate*, London, and the Sec.-Treas. Mr. E. Baynes Reed.

The President welcomed the members present, and expressed the regret they felt at the absence of some of those who in past years had attended the meetings, but were this year unavoidably absent, referring especially to Rev. C. J. S. Bethune, of Port Hope, and Mr. G. J. Bowles, of Montreal.

The report of the Council, the audited financial statement of the Secretary-Treasurer, and the report of the Librarian for the past year, were then submitted to the meeting, and on motion, duly received, discussed and adopted.

REPORT OF COUNCIL FOR 1884.

At the close of another year it becomes again the duty of the Council to present their Annual Report on the state and condition of the Society and the work it has been able to accomplish during the past year.

The report from the Montreal Branch, which will be laid before the meeting, testifies afresh to the zeal and energy which are displayed in furthering the objects and designs of the Society.

The Sixteenth Annual Volume of the *Canadian Entomologist*, the organ of the Entomological Society of Ontario, is now in course of publication, and as a record of original observation, maintains the standard of scientific interest and researches which for so many years has earned the favourable opinion of Entomologists in various parts of the world. The thanks of the Society are due to those gentlemen who contribute, for our information, the result of their investigations. The Council most cordially invite all the members of the Society to use the pages of the *Entomologist* as a medium of communication of any Entomological matter of interest that may come under their observation. The Council also desire to place on record their hearty appreciation of the services of the Editor, Mr. Wm. Saunders, under whose judicious management the publication of the *Canadian Entomologist* is so well sustained.

During the past year the Society has published, in pamphlet form, the very excellent description, by Kirby, of the insects of the northern parts of British America, contained in the fourth volume of Richardson's *Fauna Boreali-Americana*, published at Norwich in 1837. These descriptions were compiled, with much care and labour, by the Rev. C. J. S. Bethune, M.A., the first editor of the *Entomologist*, in whose pages they appeared from time to time.

By the kindness of Dr. G. H. Horn, of Philadelphia, the well-known Entomologist, the Synonymy of the Coleoptera, has been corrected and brought in accordance with the investigations of competent authority. The publication forms a convenient little volume and cannot fail to be useful to those interested. It is furnished to members at the price of publication.

The Council are gratified to be able to report that a very handsome silver medal has been awarded to the Society for the valuable collection of insects exhibited by them at the Fisheries Exhibition. The collection has been returned to the Society's rooms in perfect safety.

Mr. James Fletcher, the duly appointed delegate of the Entomological Society, attended the session of the Royal Society which was held at Ottawa in May last, and will present his report to the Society.

The President, Mr. Wm. Saunders, and Mr. G. J. Bowles, the President of the Montreal Branch, were present at the session of the American Association for the Advancement of Science, at Philadelphia, in the month of September, and attended the session of the Entomological Club. Mr. Saunders' report of their proceedings will be laid before the annual meeting and published in the Annual Report.

From press of work the Secretary-Treasurer, Mr. E. Baynes Reed, has been unable to complete the Index to the published volumes of the *Entomologist* which he had been

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LONDON, Ont.,
October 1

requested to prepare; but the Council trust that the work will be ready for publication at no distant date.

The Council have carried out the wishes of the Society, as expressed at the last annual meeting, and through the assistance of the special committee that was then appointed, have prepared for distribution to members, blank forms for description of larvæ—a form of which is appended to this report.

During the year many interesting specimens have been added to the cabinet, including a collection of *Lepidoptera* from the North-West and British Columbia.

The Librarian, Mr. E. B. Reed, has prepared a report on the state and condition of the Library, which will be laid before the Society.

The audited annual financial statement, shewing a balance on hand of \$99.36, will be submitted to you as usual.

Presented on behalf of the Council,

E. BAYNES REED,
Secretary-Treasurer.

LONDON, Ont.,
October 15th, 1884.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

FORM FOR THE DESCRIPTIONS OF PREPARATORY STAGES OF INSECTS.

Name of Species (if determined).....

Egg.

Size..... Form..... Colour..... Markings.....
 Arrangement..... Duration..... Where laid..... Date.....
 Mode of exit of larva..... Drawing of larva.....

Larva.

(Description taken on.....188., after.....moult.)

Length—when at rest..... When in motion.....
 Attitude—when at rest... When disturbed... Form..... Head—(Segment No. 1.)—
 Size and form..... Colour and markings..... Appendages.....
 Body—(Segments No. 2—13).—*Upper surface*—General colour and texture of skin.....
 Markings..... Appendages..... Spiracles—shape and colour.....
Under surface—General colour..... Markings..... Appendages.....
 Thoracic feet..... Prolegs..... Food plant..... Habitat (or
 (mode of concealment)..... Duration of each moult and succeeding changes.....

Pupa.

Shape..... Dimensions..... Colour and markings.....
 Mode of pupation..... Duration..... Cocoon (if any).....
 Mode of attachment..... Locality.....

REMARKS.

.....
 Observer.....
 Date

INSTRUCTIONS.—In describing Larvæ, the description should begin with the head, which is the first segment (making the total number 13). Note first its size, whether large, medium, or small; next its form, whether flattened, rounded, or pointed, etc.; then the colour, markings, appendages, etc. Beginning the description of the body with the upper surface, give first its general colour, then the longitudinal lines, beginning with the dorsal. Where other markings occur, begin with the anterior and finish with the posterior segments, following the same order with appendages, such as hairs, spines, horns, tubercles, protuberances, granulations, etc., giving their size, form and colour. In describing the under surface, note first the general colour, then markings and appendages in the same order as above, finishing with the colour and number of thoracic feet and prolegs, giving their characteristics and markings.

In speaking of the marking of larvæ, a *line* is so called when thin; if thick, it is termed a *stripe*; if extra broad, it is called a *band*. The mark down the middle of the back is known as the *dorsal line*: this is sometimes merely a pulsating vessel seen through the skin. The stripe along the side, at the bottom of which the spiracles are usually situated, is called the *stigmatal line*. When there is an intervening line between the two lines mentioned, it is called the *sub-dorsal line*. The space between the dorsal and sub-dorsal lines is called the sub-dorsal space, and between the sub-dorsal and stigmatal lines the stigmatal space.

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ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE
ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE
YEAR ENDING OCTOBER 15TH, 1884.

Receipts.

Balance from previous year, 1883	\$ 8 47
Members' fees, sale of <i>Entomologist</i> , etc	174 94
Provincial grant, 1884	1000 00
Collectors' material—pins, cork, etc.....	14 80
Interest on Savings' Bank account	6 99
	\$1205 20

Disbursements.

<i>Canadian Entomologist</i> , printing, paper, stationery, etc.....	\$446 83
Library account.....	103 58
Expenses of report for 1883, including engraving, electrotypes and woodcuts.....	134 75
Annual vote to Editor and Secretary.....	175 00
Rent.....	80 00
Caretaker.....	5 00
Insurance—2 years to Sept. 30th, 1885	32 00
Collectors' material—cork, etc.....	51 92
Expense of deputation to A. A. A. S., Philadelphia	37 00
Sundries—postage, etc.....	39 76
Balance	99 36
	\$1205 20

We certify that we have examined the above account with books and vouchers and found the same to be correct. Balance in hand and in Bank, ninety-nine dollars and thirty-six cents.

H. P. BOCK, }
W. E. SAUNDERS, } *Auditors.*

London, Ont., Oct. 15, 1884.

The Report of the Librarian and the Report of the Montreal Branch of the Society were read.

The delegate to the Royal Society of Canada next submitted the report which he had presented to that honourable body.

Report of the delegate of the Entomological Society of Ontario to the Royal Society of Canada :

It affords me much pleasure, as delegate from one of the Societies honoured with an invitation to send a representative to the meetings of the Royal Society of Canada, to report that,—

During the past year the work of the Entomological Society of Ontario has been vigorously prosecuted on the same plan as that heretofore followed with satisfactory and evident results.

The monthly organ of the Society, the *Canadian Entomologist*, has been regularly issued, its pages having been entirely filled with original contributions from members of the Society on scientific and practical entomology. The volume which closed with the year 1883, No. XV., consisted of 246 pages and contained a number of papers on descriptive entomology, embracing descriptions of no less than four new *genera* and sixty-seven species of insects new to science; also papers on practical entomology, including life-

histories of species, some of which have been minutely described in all their stages, and among them many injurious to agriculture.

With a view to popularize the Science of Entomology and to encourage beginners in the study, a special series of illustrated articles has been published which we hope will have the effect of increasing the numbers of observers in this important branch of biology. To further this end and to systematize the descriptive work being done in such a manner as to secure uniformity in this department of research, the Council have prepared forms containing instructions for describing insects in their different stages.

There has also appeared during the year in the *Canadian Entomologist* much valuable information in reference to the geographical distribution of North American insects.

For the benefit of those interested in agriculture and horticulture, the *Annual Report*, which is always devoted to this practical aspect of the study, has recently been published covering 83 pages and embracing the report of the Council, the treasurer's statement, the president's inaugural address, in which a review is given not only of the work of the Society during the year, but also of most of the important events of interest to entomologists in North America, as well as popular articles giving descriptions of, and remedies for, such insect foes as may have been found particularly injurious to our forest trees and field crops.

In addition to this a circular is being now prepared for circulation among the farmers and agriculturists of the province, requesting them to report as promptly as possible on any insects which they may find injuring their crops, with a view to the suggestion of appropriate remedies.

The membership of the Society still increases and now stands at about 400, and we have on our roll members who are working for us in every province in the Dominion, as well as many of the leading entomologists in the United States. We have, however, to deplore with the whole scientific world, the loss by death during the past year of some of our most active members. Of these special mention may be made of Prof. Croft, the founder of our Society, and Dr. J. L. LeConte, the celebrated coleopterist.

The large collections of the Society have been further added to and the library considerably augmented, their usefulness for purposes of reference and study thus being much increased.

At the request of the Dominion Government, the Society undertook the preparation of a collection of specimens designed to illustrate insects injurious and beneficial to fish, to be exhibited in the International Fisheries Exhibition held last year in England. This collection consisting of forty cases was prepared and sent forward to London, where it formed a most useful and attractive feature of the Canadian exhibit, and its merits were recognized by the award of a silver medal.

The Council of the Entomological Society of Ontario are glad to learn that the suggestions contained in their Report to your Honourable Society last year, with regard to increased facilities for the transmission of Natural History specimens by mail, are, in response to a petition from the Naturalists and students of Science in Canada, receiving favourable consideration from the Hon. the Postmaster General, and they trust that the Royal Society of Canada will continue to use its influence in this direction on behalf of the students of Natural History.

JAMES FLETCHER,
Delegate.

Mr. Saunders then presented the following exceedingly interesting report of the meetings of the Entomological Club of the American Association for the Advancement of Science recently held in Philadelphia, which he had attended as a delegate from the Entomological Society of Ontario. In submitting it he stated that this was one of the fullest reports which had ever been prepared of the discussions of that important body—a result arising from the fact that it embodied a large proportion of the minutes taken by the excellent secretary of the club, Mr. John B. Smith, of Brooklyn, N.Y., who had taken down the remarks of the members in shorthand and afterwards written them out in full. Through the kindness of Mr. Smith a copy of these minutes had been placed at his disposal.

MEETING OF
ASSOCIATION

Pursuant
at 2.30 p.m.,
Herbert Osborn
Henry McCool
Orono, Maine;
Riley, B. P. M
Underwood, M
London, Ontario
Merriam, Locust
Messrs. Moore,
In the absence
of the president,
Herbert Osborn,
regretting his inability
to attend,
The election

President
Vice-President
Secretary

Dr. G. H. ...
at a spot where the
the City of Phila
corner occupied
mammal. Here
to go, put up his
there also he con
The Secretary

At the Meeting
species, the substance
appeared in the
placed and protected
the egg-placing
Committee of the
extract the following
the paper mentioned
rows of eggs.

Figure 2 requires
Explanation is seen
constituting a corner
base, terminating in
curved downwards
groove (g) leading
passed by the ovipositor
ridge with saw-like
heavy hard band
two stout chisels
"saws" of the last

I have not succeeded
kept in an abandoned
was approached by
Day by day I could

MEETING OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Pursuant to notice, the members of the Entomological Club of the A. A. A. S. met at 2.30 p.m., September 3, 1884, at the Hotel Lafayette, in Philadelphia. Present: Herbert Osborn, Ames, Iowa; Dr. John G. Morris, Baltimore; Dr. G. H. Horn, Dr. Henry McCook, Eugene M. Aaron, E. T. Cresson, Philadelphia, Pa.; C. H. Fernald, Orono, Maine; Rev. G. D. Hulst, John B. Smith, E. L. Graef, Brooklyn, N. Y.; C. V. Riley, B. P. Mann, Washington; J. H. Emerton, G. Dimmock, Cambridge, Mass.; L. M. Underwood, Mr. Larkin, Syracuse, N. Y.; Dr. P. R. Hoy, Racine, Wis.; Wm. Saunders, London, Ontario; J. A. Lintner, Albany, N. Y.; Dr. Maclosky, Princeton; Dr. Harte Merriam, Locust Grove, N. Y.; H. H. Lyman, G. J. Bowles, Montreal; Prof. Martin, Messrs. Moore, Hunt, Casey, Wenzell, and others.

In the absence of the President, D. S. Kellicott, of Buffalo, N. Y., the Vice-President, Herbert Osborn, was called to the chair. A letter was read from Mr. Kellicott, regretting his inability to attend.

The election of officers was then proceeded with, and resulted as follows:—

President	Dr. John G. Morris.
Vice-President	Herbert Osborn.
Secretary	John B. Smith.

Dr. G. H. Horn made some remarks on the historic associations connected with the spot where the present meeting was held. Many years ago when this site was far out of the City of Philadelphia, the Museum of Natural History was there erected, and in the corner occupied by Parlor C of the hotel, stood the skeletons of a horse, ox or other large mammal. Here Thomas Say, poor in pocket, though rich in brain, having no other place to go, put up his bed under these skeletons, and that for many months was his only home; there also he contracted the illness which eventually caused his death.

The Secretary then read a short paper by D. S. Kellicott, as follows:

A NOTE: OVIPOSITING APPARATUS OF *NONAGRIA SUBCARNEA*.

At the Minneapolis meeting of this Club, I read a note on the life history of this species, the substance of which, together with a brief description of the moth, has since appeared in the *American Naturalist*. Since then I have ascertained how the eggs are placed and protected through the winter, and have examined somewhat the structure of the egg-placing apparatus. I have submitted an account of this moth to the Publication Committee of the Buffalo Society of Natural Sciences, from which I am permitted to extract the following remarks. I enclose also a tin-type of the drawings accompanying the paper mentioned, together with a fragment of a *Typha* leaf with the edges rolled over rows of eggs.

Figure 2 represents the ovipositing apparatus as seen from one side and below. Explanation is scarcely necessary. The last two abdominal joints are strangely modified, constituting a complex apparatus. The last joint is laterally broad, chitinous, except at base, terminating in two finger-like processes (*c*); these are rounded at the apices and curved downwards as represented in the drawing; at *b* are two concave discs with a deep groove (*g*) leading up to the anal orifice; it is evidently along this channel that the eggs are passed by the ovipositor; on either side and below the groove there is a strong chitinous ridge with saw-like teeth pointed backward (*e*). The other modified ring consists of a heavy hard band (*a*) with stout posterior processes for muscular attachment; below are two stout chisels (*d*) pointing backward and overlapping the first basal teeth of the "saws" of the last ring.

I have not succeeded in witnessing the act of oviposition. Numerous females were kept in an abandoned aquarium with *Typha* leaves, and the same watched faithfully; it was approached by day and by night, but all were concealed and quiet whenever observed. Day by day I could find additions to the stock of eggs, but the manner of performing the

delicate operation of folding over and cementing down the leaf edge, forming a secure tube for the eggs, I was not permitted to see. The eggs laid in September remained unhatched in the tubes until spring.

Fig. 3 of the tin-type represents the remarkable frontal "spine" of the moth, by means of which it rips open the pupa cell in the stem of the *Typha* and escapes. Fig. 4 represents the same of *N. typhae*, and fig. 5 that of *N. subflava*. That of the last is hardly bilobed; under an inch objective, however, the apical notch appears. Only one examined.

The tin-type showing the structural details was examined by the members.

Mr. J. B. Smith said that the clypeal modification referred to was not peculiar to this species, but was shared by all others of the same genus. Clypeal modifications were very common throughout the Noctuidæ; indeed almost universal in species living in the stems of plants where the insect had obstructions to overcome in emerging from the pupa.

Mr. Smith exhibited six large photographic plates of *Agrotis*, illustrating a large number of species, and made some remarks on the great structural variability of the group *Agrotis*. Fully 26 groups, based mostly on structural characters, were indicated. Spinulation of tibiae, structure of front, vestiture, form of wings, antennal structure and general habitus, all are variable, and so gradual are the gradations that generic types can not be well founded on them. The plates were examined by the members, and it was agreed that they were fine specimens of the photographer's art as applied to this branch.

Dr. Morris asked whether the tendency had not been of late to an unnecessary increase of genera in all orders.

Mr. Smith said that as to the Noctuidæ undoubtedly genera were based upon apparently insufficient characters, but less so than in Coleoptera.

Dr. Horn said it was a principle long since laid down by Lacordaire that characters scarcely of specific value in one group formed excellent bases of even higher divisions in others; in his view genera are established for convenience merely and have no existence in nature. Nature has only species, and genera were simply useful in dividing the mass of species to facilitate recognition. However, of late, as new material was becoming more scarce, persons seized with the *mibi* itch were taking to describing genera; for some 12,000 species of N. A. Coleoptera, fully 2,000 genera were described.

Dr. McCook said that in ants and spiders there is plenty of opportunity for persons afflicted with that itch, as there was a very large unworked field there, and plenty of new forms. About 200 species (American) are thus far described. Of spiders a somewhat larger number.

Mr. Emerton said there were some 400 described species, and that naturalists generally had no idea what a very great variety of spiders really existed.

Mr. Mann read a letter from O. S. Westcott, of Maywood, Ill., suggesting the formation of a stock company for the purpose of publishing an American entomological journal, and after a lengthy discussion the question was referred to a special committee consisting of Messrs. Mann, Osborn, Horn, Aaron, and Smith.

Prof. Fernald presented an invitation from the Agassiz Association, received by him, inviting the members to be present at a lecture by Dr. McCook, in Franklin Institute this evening. This invitation was accepted by the Club.

Prof. Fernald then asked for the opinions of the members on the following points:—

1. Where a name has once been published by an author, shall we change the mode of spelling to one more consistent with the derivation? e. g., Treitschke, Schmet. viii., established the genus *Cochylis*. Shall we adopt his spelling, or the more correct *Conchylis*?

Dr. Horn said he would not change it; that generic names are mere aggregations of letters representing a living thing, and that at least one well known entomologist habitually formed generic names by coining words without any meaning whatever, merely with a Grecian sound, and generally euphonious. If such names were accepted, so should misspelled names be. Some purists would make every name correspond with its origin, and it had been proposed to change the well-known and universally accepted term, *Bembidium*, into *Bembicidium*; this was displaying learning without adding to knowledge.

Mr. Mann agreed with Dr. Horn. Dr. McCook thought a manifest error might be corrected, but would not make the correction if thereby an author's right of priority were

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destroyed, i. e., if the name thus changed were pre-occupied at the time it was originally proposed.

2. When an author once publishes a name which is manifestly incorrect in orthography, and in a later work corrects his own error, shall we adopt his correction? e. g., Treitschke published the genus *Pendina*, but later corrects it to *Penthina*.

Dr. Horn thought that where the derivation of a name was stated, a manifest error might be corrected by the author, but it would depend somewhat upon how general the use of the name had become; he was inclined to adhere to the name as originally written.

Mr. Mann also thought it would depend upon how much the name had entered into use. If it had not become known or used as erroneously written, and the author's correction was made in a reasonable time, it should be adopted.

3. Should the termination of the specific name be made to agree with the generic in gender? e. g., Zeller and some others write *Tortrix viridana*, *Ecartema permundanum*, and *Lophoderus ministranus*. Shall this rule be adopted, or shall we adopt the ending *ana* irrespective of the gender of the genus?

Dr. Horn said that in Coleoptera the rule was that specific and generic names should agree in gender, and he thought the rule should be universal. Where, however, a termination had some special signification, where it indicated the group to which the species belonged, there, if it had come into general usage, he would favour uniform terminations.

Mr. Mann did not believe in uniform terminations.

4. When a Tortricid species is described with a name not ending in *ana*, should this be changed to *ana*? e. g., *Carpocapsa pomonella* Linn. Prof. Fernald himself was opposed to such a change. Dr. Morris suggested that Linne's names be left as he made them.

5. To what extent should the law of priority be made use of? Shall we make use of the oldest name, even if the species has been known under another for a long time? If not, for how long a time must a name universally or generally be in use to take precedence over an older name?

The sentiment of the meeting was strongly expressed that so much discussion without agreement had been hitherto had on that question, that no universally accepted conclusion could be reached.

6. What should be taken as the starting point in nomenclature? Some have taken the 12th Ed. of Linne's Syst. Nat., while others have taken the 10th Edition.

Dr. McCook thought the rules heretofore adopted by the British Association covered that point in favour of the 12th Edition.

Prof. Fernald replied that many of the subscribers to that rule had now changed their opinions on that point, and had taken the 10th Edition as a starting point.

Mr. Smith said, the Noctuidæ alone considered, it made no practical difference which edition was used, and so far as Tortricidæ were concerned, he did not think that any practical difficulty would arise, whichever edition was used.

Prof. Fernald expressed surprise that so much discussion should have arisen over Hübner's works, and that his names should have been so universally rejected, while Gueneé's names in the *Index methodicus*, unaccompanied by a word of description, were recognised and used without question. Hübner at least gave some sort of definition to his divisions, genera or *coiti*, so called.

Dr. Horn suggested that there might be some analogy to the cases of Erichson and Motschulsky; both of these had created some genera, not, or incompletely described, but while Erichson's genera had been universally adopted, those of Motschulsky had been as universally discarded. The reason was, Erichson's genera usually meant something and had some solid foundation, and he himself had credited to Erichson some genera first described by him (Dr. Horn) under the names proposed by Erichson. Motschulsky's genera, on the contrary, were based upon the flimsiest characters as a rule, and had no value whatever.

Mr. Smith said that as to the Noctuidæ at least, the parallel would hold. Hübner's genera were very largely devoid of all foundation, while Gueneé, as a rule, made pretty good genera and mostly described them.

Prof. Fernald thought this not true of the Tortricidæ; that quite as many names of Gueneé were baseless as of those proposed by Hubner.

Mr. J. H. Emerton announced that the types of a large number of the species described by him in his work on the "New England Spiders of the Family Theridiidae," and all the types of a paper now in press, were at the Academy of Natural Sciences, and he would be happy to exhibit them to any who would make an appointment with him for that purpose.

On motion, the meeting was adjourned until 2.30 p.m., Sept 4th, to meet then at the Entomological Rooms in the Academy of Natural Sciences, the use of this room having been offered by Messrs. Horn and Aaron on behalf of the A. E. S.

Pursuant to adjournment, the Club met at the rooms of the Am. Ent. Soc. at 2.30 p. m., Sept. 4th, Dr. Morris in the chair. The minutes of the previous meeting were read and adopted.

The committee appointed at the last meeting reported that they did not consider that the scheme proposed by Mr. Westcott for the publication of an entomological periodical, a practicable one for the Club to undertake.

Mr. Smith gave an account of the secondary sexual characters of the Noctuidæ, illustrated by blackboard sketches, showing peculiarities of leg structure in the male butterflies and some analogous variations in the Deltoids, in which latter group the tibiae often become aborted, while the first tarsal joint is often so abnormally developed that it is usually mistaken for the tibia. The peculiar brushes of the fore legs were noticed and some modifications commented on. The abnormal development of the last tarsal joint of *Palthis* was illustrated, as was also the peculiar palpal structure of the ♂ of that genus; so of antennæ, the peculiar bends and tuftings of the ♂, especially of the group *Hermimino*, were noted, as were the more usual pectinations. In conclusion, Mr. Smith mentioned the varying practice of systematists as to what generic value these characters should have. In some instances these male characters were wanting, while in all other respects the species agreed with others in which all these peculiar structures were well developed; on the contrary, occasionally a species would be found which offered some peculiar character in the ♂ not usually found in its near allies, instancing *H. paradoxus*, in which the ♂ has a pellucid impression in the fore wing, around which the venation is somewhat modified. What shall we do with such a species? The ♀ well fits into *Heliothis*. Shall the ♂ then authorize a genus where the ♀ offers no basis for it? Students of other groups should give their experiences.

Prof. Fernald said that in the Tortricids, generic, and even higher value, had been given to these characters. The costal fold was a prominent ♂ character, abnormally developed in many exotic forms. In a South India form it extends full two-thirds across the wings, while in other Indian and Japanese species it is very wide, but not so abnormally developed. Families have been based upon these characters, and one genus has been based upon a character peculiar to the ♀ only. This genus he thought would have to be abandoned.

Dr. Horn said that in systematic work and in characterizing a species both sexes should be considered. It requires two individuals, a ♂ and a ♀, to make a single complete example of a species, and classification should consider these individuals together in assigning positions to them. Synoptic work has a higher purpose than a mere aid to a recognition of species.

Prof. Fernald was interested in Dr. Horn's view of the case; he had been interested in the view that nature had no genera, but species only. For his part he thought he would be satisfied if he had a good definition of a species.

Dr. Maclosky said that birds sometimes offer remarkable differences in sex, and species can be distinguished only by a reference to both. The flickers, for instance, of the two sides of the continent were very distinct, but in some intermediate localities the species approached so closely that it was difficult, if not impossible, to distinguish the females, while the males were separable. There was no anatomical difference between the species, but he thought there must be physiological characters not yet discovered which separated them.

Dr. Morris thought it a curious classification that would place male and female in different genera if separately considered.

Mr. Osborn read a paper on *Mallophaga* and *Pediculide* of N. A., illustrated by

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drawings of specimens and slides containing specimens mounted for microscopic examination. (This paper will appear separately in the C. E.)

Miss Cora H. Clarke exhibited a specimen of the work of some Caddis Fly larvæ (*Hydropsyche*), consisting of an aggregation of mud cells on a small stone, beyond which were the nets spread by the larvæ. They were always found in running water, and always had an opening toward the current, probably to enable the larva to catch the food coming down the current. In reply to a question from Dr. Morris, Miss Clarke said the nets were often solitary, but not unfrequently aggregations were found. Another species, of *Plectrocnemia*, builds a vertical tube of mud, sometimes with a number of branches; a specimen was exhibited. Dr. Hagen thinks it an undescribed form. Reference was made to figures in a paper entitled "Description of two interesting houses made by Caddis Fly Larvæ, by Cora H. Clarke." The larvæ living in running water were difficult to raise.

Mr. Mann remarked that *apropos* of raising larvæ living in running water, Prof. Barnard, of the Dept. of Agriculture, had contrived an arrangement with which he had great success with larvæ of that kind. It consists of a glass tube, the bottom closed by a porous cloth, the other end fastened to a faucet; the water could be thus kept steadily flowing with any desired rapidity.

Dr. Morris exhibited a gall recently collected, the inclosed larva not bred, and asked for information as to the probable producer.

Mr. Mann said the subject of galls had puzzled him in his bibliographical work, especially as to the proper method of indexing them. He had referred to them under the head of systematic botany, but doubted his correctness.

Dr. Morris asked what orders of insects contained gall producers. Mr. Osborn thought about all orders except Neuroptera and Orthoptera. Mr. Smith said that at least one American species of *Apion* is known as a true gall producer, and in Europe several species are known to produce root galls. Mr. Osborn said that many plants, especially the *Rosacea*, were much subject to galls, while others were rarely if ever so infested. He thought them abnormal products so far as plants are concerned, and as rather belonging to insect economy since they are caused by insects; not only that, but insects were often most readily distinguished by the form of the galls, and in the case of mites those of the maple and ash were much alike, but produced very easily distinguishable galls.

Dr. Hoy thought the galls were pathological appearances, and were rather diseases of plants and should be classed as such. In descriptive botany they had no place, any more than in a description of the lips cancer should be treated of.

Mr. Mann stated he had also indexed them under pathological botany and under insects, but the chief difficulty had arisen through a descriptive paper treating galls from a botanical standpoint.

Dr. Morris said that he had seldom seen such a dearth of larvæ of all kinds, and butterflies were exceedingly scarce.

Mr. Saunders thought there had been no unusual want of insects in Canada. *Turnus* has been common, and so was ^{*canadensis*} *cardui* L. the latter, indeed, had been extremely abundant in Manitoba, where it had destroyed large quantities of thistles, and caused great alarm on the part of farmers, who thought it would also attack their crops. *Thecla niphon*, usually rather a rare form, was found in some abundance this season, and in the early part of May quite a number of specimens were captured.

Dr. Hoy said that as compared with previous seasons, *cardui* has appeared in immense numbers, fifty for one. It had never previously to his knowledge attacked the hollyhock or sunflower. This season it has literally stripped the leaves from these plants, preferring them apparently to thistles. Other butterflies had been scarce.

Prof. Osborn said in Iowa butterflies had been unusually common.

Mr. Underwood said he had found butterflies unusually common in Central N. Y., *turnus* especially, but for five weeks spent in Connecticut everything was scarce excepting *cardui*.

Prof. Fernald said in the first part of the season insects were very rare. Butterflies alone appeared about as common as usual, *turnus* unusually common; *cardui* had been rare until this summer, when it was common. Last season Mrs. Fernald had collected

both at sugar and at flowers cultivated because of their attraction to insects, and flowers had proved most productive; this season the reverse has been the case.

Mr. Mann, referring to a remark made that cold winters were favorable to insect life, said that seemed to be the generally accepted theory now, and appeared borne out by facts.

Mr. Aaron said that everywhere insects are reported as exceedingly scarce. His brother from Texas so writes; from Florida, Arizona and California come the same complaints. The remarks on the abundance of *cardui* reminded him of a saying of Mr. Ridings that he was always afraid of a season in which *cardui* was common, for then nothing else would be found.

Mr. Smith said he believed cold winters favorable to insect life, but this year there was not only a cold winter, but there were several very severe frosts late in spring, one as late as June 14th-15th; it was rather these late frosts that were to be blamed for the dearth of insect life. On Cape Cod insects were unusually rare; in Vermont, where hundreds of good insects were last year taken at sugar, scarcely one-fourth the number of common forms were this year found.

Dr. Hoy said that in his vicinity, far north as it is, he has taken many insects usually considered southern—more than were taken on the east of the lake. There seems to be a northern extension of the thermal line on the west of the lakes. Last season he found four specimens of the black variety of *turnus*; before only a single specimen had been found.

Mr. Saunders had never known this black variety to occur in Canada.

Dr. Merriam had found *turnus* in the central Adirondack region nearly as far north as Racine, three to four thousand feet above the sea. There were often hundreds at puddles, and among them many of this black variety.

Prof. Fernald reported the capture in Maine of a suffused form, partially yellow and part black.

Dr. Hoy asked whether all the food plants of *P. ajax* were known. He has found perfectly fresh specimens, and no pawpaw within 200 miles of the place. The butterfly is often common, but he has never found the food plant of the larva.

Mr. Larkin had noticed at his station, south of Syracuse, that insects were unusually scarce. The potato beetle even was very rare—not found at all in some fields. He had noticed that when they have winters that kill wheat, then usually the apple crop is good and there are few insects.

Mr. Aaron said, in reply to Dr. Hoy's query, that *ajax* would feed on either spice-wood or upland huckleberry, as well as pawpaw.

Dr. Hoy said they had the huckleberry, not the spice-wood.

Mr. Osborn said he had seen *ajax* in Iowa where they had neither pawpaw nor the huckleberry, and he thought no spice-wood. He also reported a statement from Sioux City that there, *Chrysochus auratus* was so common that they were crushed under foot on the streets. Was not this unusual?

Mr. Mann said in the woods he had seen them piled in great heaps upon the stones.

Mr. Saunders said *Hyphantria cactor* had this season been found in great abundance on all kind of trees. *Can. prognis* had been sent from one locality in West Ontario, where it was so common on currants that fears had been entertained for the crop. No great damage had been done, however.

Mr. Graef exhibited some species of Lepidoptera, rare, or typical of recently described forms.

On motion, the meeting adjourned to Monday, Sept. 8, at 2.30 p.m., same place.

Sept. 8th, 1884. Pursuant to adjournment, the Club met at 2.30 p.m., President Morris in the chair. The minutes of the previous meeting were read, corrected and adopted.

Prof. Martin exhibited some insects imbedded in copal, all representing types of post-tertiary forms, mostly small Hymenoptera and Diptera, but some Coleoptera, Lepidoptera and Hemiptera. The specimens were obtained by seekers of the resin of which copal varnish is made, not far from the sea coast, a little north and south of the equator. The same sort of gum is now found on growing trees, but soft, and not good for varnish, used

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only for the purposes of adulteration. The true gum in which these insects were found was obtained in districts where the trees had long been extinct, and was found only by digging. All the species were post-tertiary forms, and he had especially noted types of *Cleri*.

The specimens, which were very clear, were handed to the members for examination.

Dr. Horn said that the Coleoptera all represented existing generic types: 1. Carabid, allied to *Callida*; 2. Chrysomelids, 2. Clerids, *Clerus ocyinatodera*; 2. Longicorns, allied to *Clytus* and *Leptura*, and an Elaterid much like one of our species of *Cardiophorus*.

Mr. Smith said the Lepidoptera were all of very recent types; one specimen was almost surely a *Mamestra*. The Hemiptera were also very like species known to him, and at least one Dipteron represented a very common Muscid type.

Prof. Lintner gave some notes of observations made during the past year.

Orygia leucostigma, else very common and destructive at Albany, was this season very rare, and did no damage. Usually they defoliated the elms and horse chestnuts, and sometimes when a heavy storm came on so many were destroyed that they became offensive. This rarity is explained by a severe frost which occurred in spring just as the larvæ were hatching.

An interesting note came from Prof. Cook, of Michigan, where thousands of a Noctuid larva created fears for crops. The larva was bred, and proved to be *Agrotis fenicia*, usually considered rather a rare insect. So common were they that they were called the black army worm.

From Jamestown, N. Y., an Hemipterous insect, *Podisus cynica*, has been received, and it was there observed destroying the currant worm in numbers. Its variety, *P. bracteata* Fitch., was associated with it.

From the vicinity of Rochester *Lygus lineolaris* has been recorded as injurious to young peas, piercing and blotching them, a fact not previously noted.

At Geneva, N. Y., *Poecilocapsus lineatus* has seriously injured gooseberry plants, stinging the branches at tip so that they died off two or three inches downward.

In Coleoptera, the Clover-leaf Beetle has spread westward, and has nearly reached the western limits of the State. Some three years since it was recorded from Yates and adjoining counties, and since has spread rapidly; moreover, a new habit has been acquired, i.e., it now has attacked beans. The insect is *Phytonomus punctatus*, an imported species.

The Asparagus Beetle, *Crioceris asparagi*, has made its appearance at Geneva, N. Y. Heretofore it has been confined pretty closely to the sea shore, and though known for many years on Long Island, it has never before manifested any tendency to spread.

From Sycamore, Oswego Co., an interesting attack of *Otiiorhynchus ligneus* was reported; there a house which for four years had been closed, was opened and found swarming with these beetles; they were everywhere, and in many rooms nearly a quart was swept up. What did they feed on? There was nothing eatable in the house; they had been recorded as feeding on the roots of strawberries, but what they could find in the house puzzled him.

The Elm-leaf Beetle, *Galerucella xanthomelaena*, has been very destructive in Long Island and in West Chester, many of the noble elms being so entirely stripped that their death is expected. Nothing entirely new has presented itself during the year.

From Mexico had been received specimens of seed, probably of a *Euphorbia*, known as the jumping seeds. The seeds apparently are formed in a pod, three in one inclosure. When placed on a hard surface they begin a series of the most erratic movements, tumbling from side to side, and sometimes making leaps of an inch or more. Inclosed in the seeds is a white, somewhat flattened larva, and the seed itself, a mere shell, is lined with reddish silk. Westwood has raised the larva to maturity and found an insect very closely allied to *Carpocapsa pomonella*, which he called *C. saltitans*. At about the same time Mr. Lucas, in France, also received the insect, and not knowing of Westwood's work, re-named the species. The entire life history of the species is not yet known; it is supposed that the insect deposits its egg on the young seed, and the larva, when very small, makes its way into it. No trace of an opening was now visible. Westwood and Lucas report the insect as obtained in February, but only a few days ago a specimen was caught flying in the room. The curious thing is the close resemblance to our *C. pomonella*, which

has no such habits. Referring to Mr. Smith's remarks on tuftings of the feet of Noctuidæ, *C. saltitans* is peculiar in having the tarsi hidden by long tufts of scales.

Mr. Dimmock says that *C. leucostigma* has not been abundant near Boston, and that the spring frosts affected the eastern rather than the western portion of the State.

Mr. Smith replied that on Cape Cod he had found the larvæ so abundant that they stripped the trees everywhere, and there had been frost enough to kill a large quantity of vegetation.

Dr. Horn said it is a remarkable fact that all of the Coleoptera mentioned by Prof. Lintner are imported species, and for the most part they have kept pretty close to the sea shore. It is interesting that they have commenced their journey toward the interior; it was to be expected, however, that eventually they would travel along the lines of their food plant, as did the potato beetle from west to east. At Washington he had noticed the elm tree stripped of their leaves. Another species, *Crioceris 12-punctata*, has of late been taken by Mr. Lugger around Baltimore. It is rather curious that the neighbourhood of Baltimore and Alexandria, with comparatively a very limited commerce, should still have yielded a proportionately very large number of imported species. Two species of *Blaps* have been introduced and first found near those cities, one *mortisaga*, and another not yet determined. Of *B. mortisaga* a friend said that a bushel could be taken from a single cellar in Alexandria. Another very curious matter is the very sudden spread of insects. When working over the Ryncophora some years since with Dr. LeConte, every collector was applied to for material, and from Mr. Fuller was obtained a little species, marked Montana, which was named *Aramiges Fulleri*, and was then the only known specimen. Suddenly, a year or two afterward, specimens were received for determination from all parts of the country, and everywhere complaint was made of injuries caused by the species, especially in hot houses. How happened it that for ages the beetle was unknown, an inhabitant of some remote locality, and suddenly it should spread all over the States?

Prof. Lintner said he had the species since 1876; that year it was abundant in green houses.

Mr. Dimmock had known the species for some years as very destructive to roses in hot houses.

Dr. Horn said he first obtained the beetle in 1874, or perhaps a little earlier.

Mr. Hulst, referring to Prof. Lintner's remarks on *O. leucostigma*, had noticed its comparative scarcity on Long Island. The elm beetle was common. Another pest not mentioned was a small insect apparently of the frog spittle nature on maple. Sometimes the trees were white with it, and many appeared dying off. A species of *Chrysops* was also common, and seems to have been destroying the pest.

Prof. Lintner had noticed the same insect; it is a Coccid, *Pulvinaria innumerabilis*.

Prof. Osborn said it is very abundant on maple. It can be subdued by cutting the infested branches before July. The young go first to the leaves. The female lives until spring, the male dies in the fall. No less than seven different species of insects prey upon this form.

Mr. Saunders said the insect had appeared in Canada and Michigan in large numbers, the trees being sometimes completely covered. On some trees the larvæ of *Chilocorus bivulnerus* were found feeding on them in such numbers that they had caused alarm; persons finding them supposed that they were the parents of the pest.

Mr. Underwood inquired whether this insect was not also found generally on elm.

Mr. Rathvon had published an article on the subject, and had referred to its feeding on elm as a rarity. It had been observed also on grape and *Ampelopsis*.

Mr. Saunders had not observed it on elm in Canada.

Dr. Horn made some observations on secondary sexual characters of Coleoptera. He had been interested in Mr. Smith's studies on the external anatomy of Lepidoptera, and especially in the remarks on secondary sexual characters. Somewhat similar antennal structures were sometimes found in Coleoptera, but their uses in this order seemed better known. In *Collops* was a structure closely resembling that of *Renia*. Here there was the same excavated curved joint, at the base of which was an articulated slender spine-like appendage, and the upper part of the antennæ was capable of being folded backward.

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The use of this was in copulation; the ♀ antennæ were grasped in this curve, the articulated spine closed the curve by being directed forward, while the anterior part of the antennæ was folded backward, thus tightly holding the ♀ antennæ. The form in *Meloe* is similar to that of *Herminia*, and without the articulate spine still serves the same purpose. In *Sphalera* and *Tomoxia* there is a double-jointed appendix to the last joint of the maxillary palpi which probably served the same purpose. These structures are explainable. Others are more obscure and not yet explained. For instance, *Lebia* has a notch on the inside, near the end of the middle tibia in the ♂. A species of *Aphodius* has a very curiously hooked first tarsal joint to the hind leg. Another species has a peculiar club-shaped appendage to the inner side of the fore tibia. What use these served was not yet satisfactorily ascertained.

Mr. Cresson said that except in the parasitic forms, there were no such characters in the Hymenoptera, and that group he had not studied.

Mr. Osborn stated that very interesting characters occurred in the Mallophagidae, and especially one in *Lipeuris*, which much resembled that of *Tomoxia*.

Mr. Smith moved the appointment of a committee of three to arrange a programme and secure papers for the next meeting; seconded and carried. The committee appointed consisted of Mr. J. B. Smith, chairman, and Messrs. Herbert Osborn and B. Pickman Mann. On motion the Club then adjourned, to meet again under the rules at the next meeting of the A. A. S.

The President then delivered his annual address as follows:

ANNUAL ADDRESS OF THE PRESIDENT.

GENTLEMEN,—The working entomologist, ever on the watch and ready to note the many items of interest in connection with insect life, will seldom pass a season without finding many facts worthy of record, which, if not of general interest, are at least of local importance. While the year 1884 has not been marked by any unusual invasion of destructive insects, affecting our country as a whole and exciting general comment, yet many localities have suffered either from the unusual development of familiar forms of insect life, or from the introduction of new pests.

Early in the year some excitement was caused in the Ottawa district by the appearance of a very destructive caterpillar in great numbers in the clover fields, which rapidly devoured the foliage. This was at first supposed to be an invasion of the veritable army worm, but on inspection it proved to be a very different insect. On the 23rd of May I had the opportunity of examining some of the affected fields in company with our Vice-President and Mr. W. H. Harrington. The caterpillars were exceedingly numerous, and much of the clover had been seriously injured by them. They were a species of cut-worm, the progeny of a moth known as *agrotis fennica*. This larva measured from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length, had a dark yellowish brown head with a black stripe down the front, and a black body with two yellow stripes on each side, the upper one composed of streaks and dots of yellow, the lower, which was near the under surface, formed of two crinkled yellow lines which approached each other on the anterior segments and diverged posteriorly; on the upper part of the second segment was a black horny shield, the breathing holes on the sides were also surrounded with black.

The underside was brownish black, the feet and the fleshy prolegs, pale brown.

At the time of this visit the caterpillars were nearly full grown and it was observed that many of them were affected by a singular disease of a fungoid character which was destroying them very rapidly,—the diseased insects after death remaining extended on the leaves of clover or blades of grass in a natural position but somewhat discoloured. On handling them the skin was found to be quite tender and the body filled with a thin dark-coloured fluid, the result of the decomposition of the tissues. This disease spread very rapidly and was no doubt contagious. I collected some fifty or sixty specimens, all appar-

W. Saunders

ently in a healthy condition, for the purpose of rearing them ; these were placed in two separate boxes with a liberal supply of food ; within twenty-four hours a large number of them died, all apparently from this disease ; they were frequently examined, the diseased and dead were separated from the living, but within three days only four remained alive ; of these four only one survived to enter the chrysalis state, and this one did not mature the perfect insect, hence I am indebted to Mr. James Fletcher for the determination of the insect, who, being on the spot, succeeded in rearing several specimens of the moth.

A few days later complaints were made to me of the depredations of the caterpillar of another of our cut-worms, a species, usually very common, the larva of a moth known to entomologists as *Hadena arcica*, which was very destructive to corn and other crops. A few days sufficed to mature the swarms of both these devastating armies, when these caterpillars, which had escaped both disease and enemies, buried themselves in the ground and changed to chrysalids which subsequently produced the winged moths.

Every season these cut-worms are a source of great annoyance to gardeners and farmers who find their young corn, cabbage, tomatoes, melons and other plants of succulent growth suddenly cut down by an unseen enemy and withered. Stalks of wheat and other grain are often cut in a similar manner by the same enemies, and they being universally distributed and extremely voracious, inflict enormous losses every year. They have received the name of cut-worms from their habit of cutting off near the base tender and succulent plants, and under this common designation there are included a number of species having similar habits, belonging chiefly to the genera *Agrotis*, *Hadena*, and *Mamestra*, some of which possess striking points of difference in the moth state, although they much resemble each other while in the caterpillar condition. The general history of these cut-worms can be given in a few words : The eggs are laid by the parent moths during the latter part of the summer, sometimes on the ground about the roots of grass and other plants, and sometimes on the leaves near the ground. Within two or three weeks young larvæ hatch from these eggs and by the time autumn sets in the caterpillars have attained the length of half an inch or more, when they burrow into the ground deep enough to protect them from injury by severe frost, and there remain in a torpid condition all the winter. The warmth of spring arouses them to activity, when they seek the surface of the ground feeding at night on almost any green thing they meet with, eating with apparently insatiable appetite as they approach maturity, and burying themselves during the day under the surface of the ground in the neighborhood of their depredations. When full grown they burrow in the earth to varying depths, and there change to chrysalids from which the mature insects escape in two or three weeks.

These insects are hurtful only while in the larval condition. As remedies, showering the plants with Paris Green and water, sprinkling them with air-slacked lime or powdered hellebore, or strewing lime or soot, or mixtures of these substances around the plants on the surface of the ground have all been recommended and in some cases have been found useful. Plants have also been protected from injury by these caterpillars by strewing around them a little dry sand impregnated with coal oil, in the proportion of a teacupful of coal oil to a pailful of sand thoroughly mixed ; the application should be renewed every week. This method of warding off the attacks of injurious insects by the use of odorous substances repugnant to them is rapidly growing in favour on account of the success attending its use. This coal oil remedy for cut-worms is said to be very effectual, and the cost of the application being so trifling its usefulness should be extensively tested. It is manifest that none of these measures are feasible where field crops are invaded, as the area would be too great for any one to undertake to cover with such material. In such cases nature has provided efficient remedies to reduce their numbers. Besides the disease to which I have referred, there are armies of parasitic insects which prey on them. Some of these directly devour their living prey, others deposit eggs within the bodies of their victims, which, hatching into grubs, consume them. Hence it often occurs that an insect which is very abundant one season is scarce the next.

These cut-worms are very widely disseminated. Early in July I received specimens from Manitoba from the Deputy Minister of Agriculture of a caterpillar belonging to this group, which was found to be seriously injuring vegetables, and in some localities

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oats and barley also. This was a greyish-brown caterpillar with a semi-transparent skin, a brown horny head, and a shield of the same character on the upper part of the second segment. There was a pale line down the back, two similar lines along each side, and a white band lower down, close to the under surface. One of them was reared through all its stages, and produced a neat and rather pretty moth, known to entomologists as *Agrotis declarata*. *Wck.*

That destructive pest, the wheat midge, *Cecidomyia destructor*, which has entailed so much loss on our farmers in years gone by, has prevailed during the past season to a considerable extent throughout the western part of our Province. Alarming reports were sent to me from various districts, and on the 16th of July a tour of inspection was undertaken for the purpose of ascertaining the extent of the injury. During a drive of over 100 miles, in company with Mr. J. M. Denton, one of the members of our Council, the wheat fields were examined, and midge was found generally distributed, but nowhere in any very great numbers. Some varieties of wheat were much more injured than others, that known under the names of Michigan Amber and Egyptian seemed to suffer much. Among the varieties almost free from this trouble the Democrat wheat was one of the most esteemed. The selection of some of the best of the so-called midge-proof sorts for seed, the kernels of which harden so early in the season that the larva is unable to feed on them is assuredly one of the most practicable methods of lessening the depredations of this troublesome insect.

The Colorado potato beetle, *Doryphora decemlineata*, is still further extending its ravages. Having reached the Atlantic seaboard in the east its further progress in that direction has been arrested ; it is now extending its domain over the fertile fields of the North-West. Specimens have been sent to me this season from Portage La Prairie, where they are said to be confined to the neighbourhood of the town, and having been vigorously assailed with Paris green it is hoped that they have been pretty well exterminated. Through the kindness of Acton Burrows, Esq., the efficient Deputy Minister of Agriculture in Manitoba, I have received information of the appearance of this pest in the counties of Manchester and Dufferin in the same Province, but in none of these localities has the insect yet made much headway.

Grape growers in some sections of Ontario suffered much early in the season from injuries caused by the grape-vine flea-beetle, *Capitona chalybea*. This insect, which is about three-twentieths of an inch long and varies in colour from a steel blue to green, passes the winter in the perfect state, hibernating under dead leaves and other rubbish, and awaking from its long slumber in early spring proceeds to satisfy its vigorous appetite by consuming the tender buds of the grape-vine just as they are swelling. These insects have been so plentiful in some vineyards that the crop has been almost destroyed. Where they prove troublesome they may be collected by spreading sheets on the ground under the vines and jarring the canes early in the morning when the beetles are in a torpid condition, or they may be poisoned by syringing the swelling buds with Paris green and water.

The plum curculio, *Conotrachelus nenuphar*, continues its mischievous work in most parts of the Province where plums are grown, and the labour attending the jarring of the trees for the purpose of capturing and killing the insects deters many from undertaking the cultivation of this useful fruit. From the evidence thus far obtained it would appear that the remedy which has been found so efficacious in subduing the codling moth of the apple, namely, Paris green and water, in the proportion of a teaspoonful of the poison to a pailful of water, will also protect the plum crop from the ravages of curculio. This remedy should be extensively tried by thoroughly syringing the trees with it as soon as the fruit has set, and repeating the application in a few days should rain occur to wash it off. Should this remedy prove uniformly successful a great stimulus will be given to plum culture. During the past season the plum crop on my own grounds was a failure, the trees having had but very few blossoms. In the absence of plums the curculios deposited their eggs freely on the pears, manifesting a special fondness for Clapp's Favourite. Although I watched them carefully, I failed to find a single example where the insect matured in this fruit. The only effect observed was a slight disfigurement in the form of the fruit and the production of a hard spot where the incision was made.

While collecting moths at sugar early in the season I observed one evening about nine o'clock among the insects which came to sip the sweets two specimens of the plum curculio. I captured one of them, the other fell to the ground before I could secure it. Experiments made by me some years ago proved that this insect is active at night as well as in daylight, but this is the only instance I have known of its being attracted to sugar at night.

From one locality complaints reached me about the middle of June last of the abundance of a spiny caterpillar feeding on currant bushes, which my correspondent supposed to be a new currant worm. Specimens were forwarded and proved to be the caterpillar of the gray comma butterfly, *Grapta progné*. This insect may be found almost every season in limited numbers on the wild gooseberry and currant bushes in open woods, and occasionally on the cultivated varieties, but this is the first instance to my knowledge where the insect has appeared in sufficient numbers to cause injury. They are so very subject to parasites that it is not at all likely they will ever prove generally destructive; syringing the bushes with Paris green and water or dusting the foliage with powdered hellebore will soon make an end of them.

In the neighbourhood of Drummondville several acres of red raspberries were stripped of their foliage by the larva of the raspberry saw-fly, *Selandria rubi*; reports of injury from this pest have also been received from several other localities. It is a green worm which is so exactly of the colour of the young foliage it feeds on that it frequently escapes detection. When examined, this larva is found to much resemble that well known pest, the currant worm, but it has no black dots. If allowed to pursue their course they soon riddle the leaves, leaving little more than a network of the coarser veins. An application of hellebore mixed with water in the proportion of an ounce of the powder to a pailful of water speedily destroys them.

A new clover insect has recently invaded our Province which promises to be troublesome. It is a small curculio known to entomologists as the punctured clover leaf weevil, *Phytonomus punctatus*. It is said to have been introduced from Europe within the past few years. The late Dr. LeConte, in a work published in 1876, reports having received one specimen from Canada; but at that time nothing seemed to have been known of its habits. In 1881, Prof. Riley published in the *American Naturalist* an account of the injury done to clover fields in Yates county, New York, by this insect; in one instance in a patch of two acres scarcely a whole leaf remained. The beetle is about two-fifths of an inch long, of a dark-brown colour, marked with dull yellow, and has its wing cases thickly punctured. Each female is said to deposit from 200 to 300 eggs, which are sometimes laid on the surface of the leaf stem, but more frequently thrust into the interior of the older stems. The young larvæ may be found as early as in May, but being small they do not usually attract notice until almost a month later. At first they feed among the folded young leaves or attached to the under side of a leaf. When approaching full growth, they feed chiefly on the margins of the leaves, into which they eat irregular holes. At this period they are not easily seen as they relax their hold and drop suddenly to the ground when approached; moreover, they feed chiefly during the night and hide in the day-time among the roots and stalks of the plants. When full grown the larva spins a small cocoon, which is usually placed a little below the surface of the ground, in which it changes to a chrysalis; about three weeks later the beetle escapes. From observations which have been made on this insect at the Department of Agriculture in Washington, the average period required from the time of the depositing of the egg to the escape of the mature beetle, is three and one third months, hence in most localities there will be two broods during the summer. Mr. A. H. Kilman, one of our members, residing in Ridge-way, was the first to report the occurrence of this pest in Ontario, which he says was wafted to our shores by prevailing east winds about the 10th of August last. On this date the beetles appeared on the opposite side of Lake Erie, in Buffalo, in such multitudes that thousands of them were crushed on the pavements by the feet of passers-by. Mr. Kilman says "I picked them from the fences and sidewalks, and found them in the grass in my lawn: I am of opinion that they will go into winter quarters here, and open up a lively campaign in the spring. Whatever the sequel may show, I fear that these invaders will prove of better staying qualities than those who crossed the border in '66 and turned

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As the larvæ will be found most numerous in the latter part of May or early in June, it is recommended that the clover should be heavily rolled at that time, for the purpose of destroying them. If badly infested fields were ploughed about this period the destruction of the insects would be still more certain.

Early in the summer alarming accounts were received of another insect injuring the maple trees, especially the shade trees on streets and avenues. This was a species of coccus or bark-louse, *Pulvinaria inaequalis* which forms brown scales on the branches, from under one end of which there protrudes a cotton-like substance forming a tuft about four times as large as the scale in which the eggs of the insect are lodged. In a short time there issue from this egg-nest a multitude of minute yellowish white lice, which distribute themselves over the branches, and, locating on the succulent portions, pierce the tender bark with their sharp beaks and subsist upon the sap. These young lice soon become stationary, gradually increase in size, and reach maturity towards the end of the season. They chiefly affect the underside of the limbs and branches.

Remedies.—The branches may be rubbed with a stiff brush or broom which will dislodge many of the insects, and then washed with a liquid made of soap diluted with lye, or solution of washing soda; or with an emulsion of coal oil made as follows: take one pint of coal oil and agitate vigorously with an equal quantity of milk until the compound assumes a creamy appearance, when it should be diluted with about ten times its bulk of water and applied with a brush or syringe.

This pest has occurred in many localities in Western Ontario, also in Michigan, New York and Pennsylvania. *not account for account*

That cosmopolitan butterfly known as the painted lady, *Pyraëis cardui*, has been very abundant the past summer, not only in Canada but also in most of the northern United States. From Mr. Burrows I learn that in Manitoba the larvæ appeared in such countless hosts as to cause much alarm, and reports were current of their having injured some of the growing crops. This, however, is improbable, as it devotes its attention mainly to devouring thistles, occasionally specimens have been found feeding on mallow, hollyhock, wild sunflower, burdock and several other plants, none of which however are of any economic value.

A lively interest is being awakened in reference to the insects inhabiting our north-west Territories and British Columbia, of which we as yet know comparatively little. Captain Gamble Geddes, of Toronto, has made excursions to several of these distant points, and brought home many rarities. From the Moose Mountain district, in the Province of Assinaboia, a number of interesting specimens have been received, collected by Miss F. M. Pierce. Prof. Panton, of Winnipeg, has been collecting in that neighbourhood, and in British Columbia we have a most efficient helper in the person of Rev. G. W. Taylor, who has recently published in the *Canadian Entomologist* lists of some of his captures in the neighbourhood of Victoria. It is sincerely hoped that other observers will be induced to labour in these most interesting and promising fields.

On the 30th of January last the House of Commons at Ottawa resolved to appoint a select committee to enquire into the best means of encouraging and developing the agricultural industries of Canada. Circulars were prepared by the committee, embracing a series of questions, which were sent to most of the prominent agriculturists and scientific men in the Dominion, to which several hundred replies were received. The practical bearing of entomology on agriculture was fully recognised by the committee, and the questions so framed, that a very large amount of information on this subject was gathered. Our Vice-President, Mr. James Fletcher, was summoned to give evidence in reference to injurious and friendly insects, so also was Mr. W. H. Harrington. A report has been issued covering 218 pages containing the evidence, and a summary of the replies to the questions. It is gratifying to find that the close relationship between entomology and successful agriculture is beginning to be more fully realized, and that the work of our Society and the efforts of entomologists generally are so well spoken of as they are in this document.

Continued efforts are being made by our Society to obtain and disseminate correct

information, especially in reference to those insects injurious to agriculture; with this in view we have lately issued a number of blank forms for describing insects, which will be sent to any one desiring them on application to either of the officers in London. By this means we hope to secure fuller details and more uniform descriptions of insect pests, so that they may be more readily determined. The officers and members of the Council have also embraced every opportunity afforded them of visiting localities specially affected by destructive insects, and have endeavoured to disseminate among the sufferers practical information in regard to the most effective remedies for such evils. The demand for our Annual Reports from all parts of the world has much increased since the publication last year of the general index. It is a matter of regret that the issue of several of the earlier reports is entirely exhausted, and there is now no means of supplying the demand. Our monthly journal, now in the sixteenth year of its existence, continues also to grow in public favour.

During the past year reports of great value in reference to destructive insects have been published by the Department of Agriculture, at Washington, under the able direction of Prof. C. V. Riley; a most excellent and voluminous report from the pen of Prof. J. A. Lintner, State Entomologist, has been printed and distributed by the State of New York. Much useful work has also been accomplished in the same direction by Prof. A. S. Forbes, State Entomologist of Illinois; by Prof. Herbert Osborn, of the Iowa Agricultural College, and others. Many additional parts have appeared of that superbly illustrated work on North American butterflies, by Mr. W. H. Edwards; the same talented author has also now in the press a revised catalogue of the butterflies of North America. The recent meeting of the Entomological Club of the American Association for the Advancement of Science, held in Philadelphia, was one of unusual interest, most of the leading Entomologists on this Continent being present. A full report of the proceedings has been prepared.

In concluding, permit me to urge upon you all renewed diligence in your studies of insect life, be patient and faithful in observing, be prompt in publishing the results of your observations. The field we labour in is so vast that life is too short to permit any one of us to do much, especially when the limited time is taxed by other pressing engagements. Nevertheless, let us do what we can to unravel the mysteries relating to these much-despised atoms of existence, the opportunity is ever before us.

"Ten thousand forms, ten thousand different tribes,
People the blaze of day,"

and when the brightness of the sunshine has faded there are tribes equally numerous and attractive which rise not from their couch until their more obtrusive brethren have retired to rest. Whether it is ours to employ portions of the night or the day in this charming occupation we shall not in either case fail to find manifested in the beauty of form and in the instincts with which these tiny creatures are endowed, manifold evidence of the wisdom and goodness of the great Author of Life.

ELECTION OF OFFICERS.

The following named gentlemen were then duly elected as officers of the Society for the ensuing year:—

President—William Saunders, London, Ontario.

Vice-President—James Fletcher, Ottawa, Ontario.

Secretary-Treasurer and Librarian—E. Baynes Reed, London, Ontario.

Council—Rev. C. J. S. Bethune, M.A., Port Hope; Rev. T. W. Fyles, South Quebec; W. H. Harrington, Ottawa; J. M. Denton, London; J. Alston Moffatt, Hamilton.

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Editor "Canadian Entomologist"—William Saunders, London.

Editing Committee—Rev. C. J. S. Bethune, J. M. Denton, James Fletcher and E. Baynes Reed.

Auditors—W. E. Saunders and H. P. Bock.

Delegate to "Royal Society"—W. H. Harrington.

On motion of Mr. James Fletcher, seconded by Rev. T. W. Fyles, a vote of thanks was unanimously tendered to the President, Mr. William Saunders, for his able and interesting address.

In proposing this vote Mr. Fletcher said that he should like to make a few remarks concerning some of the subjects alluded to in the address, particularly with regard to the cut-worms referred to in the earlier part, which he had specially investigated by instruction of the President, and upon the occurrence of which he had prepared a short note for the Society. He stated that the injury done by *Agrotis fennica* at Ottawa in the month of May last was very great. He had received reports of its ravages early in the month, and in all cases those enquiring for remedies stated that the insects were new to them. The first specimens sent were taken in large numbers under strawberry plants, and were about half an inch in length. After a few days reports came in from all quarters of their devastation, which was worst about the 22nd of May, when, the President being in Ottawa, he had, together with Mr. Harrington and himself, visited one of the most seriously injured farms, two miles from Ottawa, where they had found the larva in vast numbers attacking the clover in a field of fodder, but leaving untouched the rye which was growing with it. At first it was supposed by the farmers that the insect was the army-worm, but the larva upon examination was found to be quite different, being of a deep velvety black with indistinct white lines. It was found to be chiefly nocturnal in its habits, and to possess characteristics of the ordinary cutworms, lying hid beneath the surface during the day and destroying everything within its reach at night. They were also climbing cut-worms, and had done much damage by eating out the leading shoots in some young trees. Mr. Fletcher was growing from the seed for examination, oak, black walnut, horse chestnut, elm, negundo and maple; all had suffered. It seemed that during the last stage the larvæ were much more active during the daytime, and did not hide under the surface. Just before the pupal stage an enormous fatality was caused by a fungous disease which attacked the larvæ and which caused them to decay very rapidly. In certain fields they could be seen in large numbers on stems of grasses and other plants which they had crawled up, and to which they were fixed by the fungus, which seemed in nearly all cases to develop just below the head in the shape of a small tuft of white downy matter. After a short time the bodies dried up. Large numbers had also fallen a prey to parasites, and as many as three ova of a *Tachina* fly had been found on some specimens. Mr. Fletcher had only succeeded in rearing about a dozen imagines, nor had the moth been very common during the summer, although a few had been taken.

With reference to the Manitoba cut-worm referred to by Mr. Saunders, he had succeeded in bringing to chrysalis three of the four larva sent to him by Mr. Acton Burrows, the Deputy Minister of Agriculture for Manitoba. Of these, when the moths emerged, one proved to be *Agrotis devastator*, and the other two had been sent to Mr. J. B. Smyth, of New York, for identification. They were very dissimilar in colour, but the markings seemed the same on each.

Mr. Fletcher also stated that during the month of July he had found a small *Phytonomus* committing great damage in the clover at Dalhousie, New Brunswick.

He had taken it for *P. nigrirostris* at first, but fancied it might be a different species, as nearly all the specimens bred were light cinnamon brown in colour.*

He found that its habits differed considerably from those of *P. punctatus*, as described in Professor Lintner's first report. He had brought specimens for the members, and as he had prepared a note of the insect for the Society he would not say more then. He had found a cocoon on clover at Brome, in the eastern townships.

* Since identified as *Phytonomus nigrirostris*.

Mr. J. Alston Moffatt here exhibited specimens of the true *P. punctatus*, which he had received from Mr. Kilman, Ridgeway.

Resuming his remarks, Mr. Fletcher said that he had observed enormous damage done by the larch saw-fly, *Nematus Erichsonii*; he had first noticed it near Quebec, and had traced it all down the Intercolonial Railway wherever any larch trees occurred, as far as Dalhousie, where he found it abundant. He exhibited interesting specimens of young twigs of *Larix Americana*, which he had received the previous week from the Rev. Mr. Fyles from Quebec, in which the leaves of the tree, although eaten down to the base by the larva, had later in the season, after the attack ceased, been able to grow about a quarter of an inch. Mr. Fletcher thought that this fact that the tree was able to produce this after crop of foliage was one of very great importance, as the tree might by this means be able to withstand the insect for a much longer period; he anticipated that some remedy either artificial or natural would be found before long.

He exhibited a small Hemipteron, *Podisus modestus*, which he had found destroying the larva at Brome, Que., on the estate of S. A. Fisher, Esq., M.P., who had given him assistance and provided him with facilities for examining this pest.

The Rev. T. W. Fyles, of South Quebec, said it afforded him much pleasure to second the vote of thanks to their President. Referring to the fungous disease upon the cut-worms mentioned by Mr. Fletcher, he said that he had known in England many years ago of an insect similar to this being attacked by some such disease as had been described. He spoke of the habits of the cut-worms, saying that as they did not tunnel their way from plant to plant but passed over the surface, a circle of salt placed round each plant at a short distance would probably save it: the larvæ would shun the salt. Besides this, there was the remedy of "hilling up" the plant; he had found that the larvæ would not climb a mound on account of the particles of earth giving way. He believed that salt in the early stages of the plants and the mounds of earth afterwards would amply protect corn, etc., from the attacks of the insects.

He next spoke of the potato beetle *D. decem-lineata*, and expressed his belief that its numbers and vigour were decreasing in the Province of Quebec. He stated that there were places on the Lower St. Lawrence where it had not appeared.

He next remarked that *Nematus Erichsonii*, the larch saw-fly, had extended its ravages along the Beauce Valley to the neighbourhood of Quebec where it had stripped the tamaracks (larch) bare. A second growth of leaves had appeared, and this probably would save the trees. If, however, the attacks were repeated to the same extent, he believed the trees would die. Mr. Fyles shewed specimens of the insect and of its cocoons.

Mr. J. Alston Moffatt, of Hamilton, stated that he had lately received from his friend, Mr. J. B. Hay, of Brantford, some specimens of a beetle that had been found attacking hot-house plants, *abutilon*, roses, *plumbago*, etc. The insect being new to him, he sent it to Dr. Horn for identification and received the following letter from him:

PHILADELPHIA, P.A., Oct. 10, 1884.

DEAR SIR,—The insect you send is *Asamiges Fulleri*; (Horn) Fuller's rose beetle. It is widely scattered over the country and has been reported to me as damaging many hot-house plants, particularly the thick leaved varieties. It seems a great nuisance and eight years ago appeared to be rare.

G. H. HORN.

Specimens of this insect were exhibited by Mr. Moffatt.

The President in referring to the work of the special committee appointed by the House of Commons in February last to enquire into the condition of agriculture said that the members would be much pleased to learn that as one of the results of that enquiry Mr. Fletcher had been appointed Honorary Entomologist to the Dominion Department of Agriculture. It was much to be desired that this appointment should become permanent, for the Society cordially recognized the special fitness of Mr. Fletcher for this important position, and believed that he would accomplish much good work in this connection.

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Mr. Reed exhibited a coloured photograph presented to the Society by Mr. Alfred Wailly, an English member of the Society, representing an extraordinary aberrant form of *Attacus cecropia*.

Mr. Fletcher stated that he was happy to announce that during the past summer, under instructions from Dr. Selwyn, F.R.S., Director of the Geological Survey of Canada, an interesting collection of Lepidoptera had been made in the Lake Nipigon region by Prof. Macoun and Mr. William Macoun, and that these having been submitted to him for identification he had found many very valuable insects included, among which he made special mention of two species of *Chionobas*, *Colias Eurytheme*, *Colias Interior*, a species of *Chrysophanus*, which was possibly new, and *Alypia MacCullochii*. By means of these instructions to the surveyors it was hoped that much useful information would be obtained of the insect fauna of those newer parts of the Dominion that were being explored and opened up for occupation.

Mr. Fletcher remarked that we have heard a good deal of rubbish in the newspapers, etc., about nothing being done by the members of the Geological Survey; he hoped that it was unnecessary to say that these reports were entirely without foundation, and at any rate the present action of the director would prove to all entomologists that he appreciated the value of their scientific researches.

The evening being somewhat advanced, the Society adjourned until 9 o'clock next morning.

The Society re-assembled Thursday morning at 9.30. The President in the chair.

Mr. W. H. Harrington stated that *Phytonomus nigrirostris* occurred in considerable numbers in the vicinity of Ottawa, but that he had not found any evidences of the destructive habits described by Mr. Fletcher. It was, however, known to attack clover in Europe.

He mentioned several insects found by him on Larch such as *Urocerus flavicornis* and *Buprestis maculiventris*. During the previous summer he had in company with Mr. Fletcher, noticed a grove of tamarac with trees in various stages of health and decay and the cause of the latter seemed undoubtedly to be a species of *Dendroctonus*, which was found in immense numbers under the bark of sickly and dying trees. The bark was completely undermined and riddled by its galleries and swarmed with larvæ, pupæ and beetles.

Associated with these were large numbers of a smaller bark-borer—*Hylesinus opacatus*—with one or two other species which would not be likely from their habits or numbers to do much injury. Examination of dead trees shewed that the bark had been destroyed in the same manner, but now contained no beetles.

In reply to a question as to whether such bark beetles ever attacked living and healthy trees, Mr. Harrington answered in the affirmative, and instanced a species which he had during the spring found boring into and through the terminal buds of *Pinus strobus* (white pine) and thus destroying them.

Mr. Harrington exhibited a small collection of about fifty species of Coleoptera taken by him at Sydney, Cape Breton, during a visit of a few days in September, also specimens of the Chinch bug which he had found abundant there; he also exhibited a *Chalcophora liberta* with deformed thorax, a *Trogosita mauritanica* with malformed head, and a wasp (*Vespa* ?) with one of its antennæ curiously deformed.

Rev. T. W. Fyles shewed specimens of *Colias Eurytheme*, *Pamphila Manitoba*, *Pyrgus Centaureæ*, a female of *Smerinthus Cerysii*, and other rare insects.

Mr. J. Alston Moffatt shewed a collection of rare and interesting insects both Lepidoptera and Coleoptera.

Mr. Fletcher exhibited a collection of forty specimens of *Colias Philodice*, shewing many curious variations.

Two specimens of *Colias Eurytheme*, one of which was the autumn form bred from the egg.

Two specimens of a small moth bred from larvæ found boring in the flowers and capsules of *Nelumbium luteum*, at Chicago.

A specimen of *Sphinx luscitiosa*.

An *Heptalus* taken at Dalhousie, N.B., very similar to *H. Argenteo-maculata*, but smaller, and having four spots on the primaries.

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Two specimens of a *Chrysophanus* taken by Mr. W. Macoun at Nipigon.

Specimens of *Agrotis fennica*, and other rare Lepidoptera taken during the past season.

Rev. T. W. Fyles exhibited specimens of mud wasps nests, taken at Compton, from which he had obtained grubs that produced a species of *Ptinus*.

Mr. J. M. Denton shewed some Philadelphia raspberry canes which were badly injured by some borer not determined.

The President exhibited two boxes of insects which had been lately received from Miss F. M. Pierce, of Moose Mountain, Assinaboia, who had sent the specimens as a first collection. The boxes proved of great interest to the members present.

The Secretary exhibited the beautiful silver medal which had been awarded to the Society by the International Fisheries Exhibition. The medal was much admired.

In presenting a collection of Diurnal Lepidoptera from Rev. G. W. Taylor, of Victoria, Vancouver Island, Mr. Fletcher stated that he considered one of the chief advantages of having the annual meeting at London was, that the members could see in what species the Society's reference collection was deficient, and he was sure that they all felt the necessity of making the collection as complete as possible; for his own part he would much prefer giving any unique specimens he might take, to the Society, rather than have them hidden away in his collection where only a few could see them. He had now very much pleasure in presenting a small but valuable collection of specimens to the Society from his friend Mr. G. W. Taylor, of Victoria, B.C. Mr. Taylor, although one of our new members, had already done good work. Mr. Fletcher also distributed among the members a packet of duplicates sent for that purpose by Mr. Taylor, among which were specimens of a *Melitæa*, provisionally named *rubicunda*, but which were not considered typical by Mr. W. H. Edwards. Of this species, however, Mr. Fletcher had received larvæ, some of which were in his own hands, and some had been forwarded to Mr. W. H. Edwards.

The President expressed the pleasure Mr. Taylor's liberality had given him, and the gratification he felt that the Society's collections were so much appreciated. A vote of thanks was given to Mr. Taylor for his donation.

Mr. Harrington stated that *Oberia tripunctata* had been found very abundant at Ottawa. He remembered it also as being general in 1878.

Mr. Reed called attention to an extract from a newspaper shewing that railroad cars may often be the vehicles of carrying destructive moths from one part of the country to another; the extract stated that the writer was often struck by the number of *aleticæ* on the trains, and that he had observed that there was a sort of coincidence last season between lines of railroad and abundance of cotton worms.

Mr. Reed said that he had noticed fewer specimens of *aleticæ* this year than for some seasons past, although a few had within a few days been caught in his residence.

Mr. Reed also said that *Egeria acerni* had been very prevalent in the neighbourhood of London this season.

Rev. Mr. Fyles reported that *Agrotis trilineata* had been taken at Como, P.Q., and also that he had taken two larvæ of *P. satellitia*. *Parantirene Harris*

Mr. Fletcher shewed a specimen of *Notodonta americana*,[?] bred from larva found on basswood that had emerged from the pupa in autumn instead of spring; he also reported the capture at Ottawa of *Ellema Harrisii*.[?]

An interesting discussion then took place on the transmission of insects through the mail and the best method of relaxing specimens.

In answer to Rev. Mr. Fyles, Mr. Fletcher said that we had not in Canada any plant which could be used as a substitute for the Laurel so extensively used by European entomologists, not only for killing the insects but for keeping them for a long time in a relaxed condition without spoiling. He had tried the young leaves of some of the different species of wild cherry which contain prussic acid, but had found that although it killed the insects it soon became mouldy.

Mr. Reed had found moist sand an excellent means of relaxing lepidoptera and boiling water for coleoptera.

The meeting finally passed a resolution requesting Mr. J. Fletcher to prepare for the

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use of the members a short circular giving instructions for relaxing specimens, and also the best plan of packing them for transmission through the mail.

This Mr. Fletcher undertook to do, remarking that he himself had found the process of nature-printing a very useful mode of sending lepidoptera for identification.

The Rev. Mr. Fyles read a paper describing the habits of an insect forming galls upon *Vaccinium Canadense*, and exhibited specimens and microscopic drawings of the insect.

Mr. Harrington read an abstract of a paper on the *Tenthredinidae*, or saw-flies.

Mr. Fletcher gave an abstract of a paper he had prepared, detailing some experiments he had made in breeding some *Coliads* from the egg. He said he thought that the thanks of the Society were especially due to Mr. W. H. Edwards for his most valuable papers published in the *Canadian Entomologist* during the past year, and he was of opinion that they could not fail to have important results.

Having been induced himself by these articles to take up this fascinating branch of entomology, the results had been such that he considered them worthy to bring before the members at this meeting. He had been fortunate enough to secure a very much worn female of *Colias Eurytheme*, summer form *Eurytheme*, from which he had succeeded in breeding a lovely female specimen of the autumn form *Keewaydin*.

Thinking it would be interesting to compare the larvæ, stage by stage, with *C. philodice*, he had obtained 12 eggs of that species from a typically marked yellow female, on the same day as the eggs of *C. eurytheme* were laid, and he gave a short account of the differences noted between these larvæ at the different moults, and exhibited a beautiful series of specimens of *C. philodice*, drawing attention to the different variations in the markings. The brood of 12 bred at the same time as *C. eurytheme* were very interesting, consisting of three males, four ordinary yellow females, three albino females and one yellow female with very dull markings; one larva was destroyed by the larva of a *Tachina* fly.

Rev. Mr. Fyles read an interesting paper on the *Neuroptera* and their relation to the fishing interests.

Also, a paper on the occurrence in the Province of Quebec of the Croton bug, *Ectobia Germanica*.

The President then read an interesting paper from Mr. G. J. Bowles on ants.

The meeting decided that these papers should be submitted for insertion in the Annual Report.

Mr. W. A. Macdonald, agricultural editor of the *Farmer's Advocate*, took the opportunity of expressing the pleasure he had derived from listening to the interesting discussions which had taken place during the meetings, and to the vast amount of information thus given. He had found these meetings so profitable that he hoped to have the pleasure of attending them another year. The Entomological Society of Ontario, he said, was doing a good work in gathering and distributing information in reference to the many insect pests which our farmers and fruit-growers have to fight with, and he should be glad to render it any assistance in his power.

The meeting then adjourned.

POPULAR PAPERS ON ENTOMOLOGY.

SMERINTHUS EXÆCATUS AND MYOPS.

BY W. SAUNDERS, LONDON, ONT.

Among the most beautiful of all the night-flying moths may be placed those belonging to the genus *Smerinthus*, one of the genera included in the *Sphingidae*, or Sphinx moths, a name derived from a fancied resemblance some of the caterpillars bear in certain attitudes to the famous Egyptian Sphinx. This family comprises some of the most robust and powerful among moths. Dr. Harris thus speaks of them: "In the winged state the true Sphinges are known by the name of Humming-bird Moths, from the sound which they make in flying, and Hawk Moths from their habit of hovering in the air while taking their food. These Humming-bird or Hawk Moths may be seen during the morning and evening twilight flying with great swiftness from flower to flower. Their wings are long, narrow and pointed, and are moved by powerful muscles. Their tongues when uncoiled are for the most part excessively long, and with them they extract the honey from the blossoms of the honeysuckle and other tubular flowers while on the wing."

The Blind-eyed Sphinx, *Smerinthus exæcatus*, which is well shown in Fig. 1, is a lovely creature which measures when its wings are spread nearly three inches across. Its

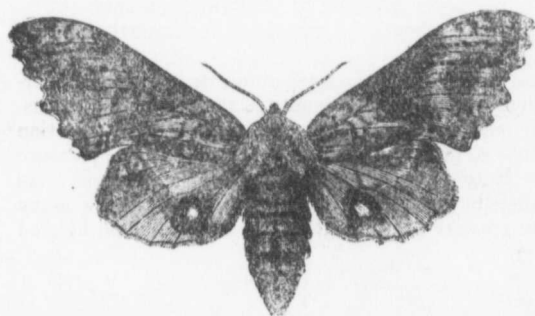


Fig. 1.

body is fawn coloured, with a chestnut coloured stripe on the thorax and a dark brown line on the abdomen. The front wings are fawn coloured, clouded and striped with a rich velvety brown. The hind wings are rose coloured in the middle, crossed by two or three short whitish lines, having a brownish patch at the tip and a black spot with a pale blue centre near the inner angle. The moth is on the wing in June and July; the eggs are laid on apple, plum and wild cherry trees, and the larva, Fig. 2, becomes full grown in September. It then measures about two and a half inches long, has a green triangular head bordered with white, and an apple green body, paler on the back, deeper in colour along the sides, with seven oblique stripes on each side of a pale yellow colour, the last one, of a brighter yellow than the others, extending to the base of the horn. The skin of the body is roughened with numerous white-tipped granulations, and the stout horn on the hinder part of the body is of a bluish green colour. This larva when irritated emits a peculiar musical chirping sound.

When full grown it buries itself in the earth, where it changes to a chestnut brown chrysalis, which is smooth, with a short, rough terminal spine. In this condition it remains during the winter, escaping as a moth early the following summer.

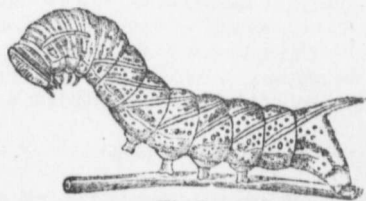


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Fig. 4.

The life history of the Purblind Sphinx, *Smerinthus myops*, Fig. 3, is very similar to that of the species just described. It appears in the perfect state also in June and July.



Fig. 3.

The caterpillar much resembles Fig. 2. It is green with two rows of reddish brown spots on each side and six oblique yellow lines, with two shorter lines of the same colour on the anterior segments. The head is bluish green, margined with yellow, and the curved horn at the tail green, tinged with yellow at the sides. When full grown it measures about two inches in length, and is nearly cylindrical in form. It feeds on the leaves of the cherry tree, both the wild and cultivated varieties.

The insect passes the winter in the pupa state under the earth; the chrysalis is smooth and of a dark brown colour. Both these insects are comparatively rare, and have never, as far as we know, appeared in sufficient numbers to prove injurious to the trees on which they feed.

PULVINARIA INNUMERABILIS—Rathvon.

This insect, which has commonly been known as the Grape-vine Bark-louse, might with perhaps greater propriety be now designated the Maple-tree Bark-louse, for the reason that it has been more frequently found on maples, and has inflicted more injury on these trees than it has on grape-vines. The great abundance of this insect during the past season has called general attention to it and elicited many enquiries in reference to its history and habits; indeed, in many sections of Western Ontario, as well as in the adjoining States of Michigan and New York, it has appeared in such swarms as to endanger the lives of the trees attacked. Branches have been sent to us so thickly covered with the insect in its various stages of growth that they could not be handled without crushing some of the numerous population.

The earliest description of this insect was given by Dr. S. S. Rathvon, of Lancaster, Pa., in 1854, who at that time gave the results of several years' observation on this species, which had occurred in his neighbourhood on Basswood or American Linden trees (*Tilia americana*). He found them to swarm in such countless hosts that he gave the insect the significant name of *innumerabilis*. The late Dr. Fitch next published an account of it in the Transactions of the New York State Agricultural Society for 1859, since which several authors have figured and described this insect; but its life history was not fully unfolded until taken in hand by the late lamented J. D. Putnam, of Davenport, Iowa, who published in 1879, in the Report of the Davenport Academy of Sciences, a most elaborate and complete description of its life history, illustrated with two plates crowded with figures representing the various stages of development, all drawn by himself from nature. To these several publications we are mainly indebted for the facts here presented.

This bark-louse appears first in the form of a brown scale, from which, as it increases in size, there is protruded from the female scale cylindrical white filaments of a waxy nature, in which eggs are laid, and these cotton-like filaments, as new fibres are secreted, are constantly pushed further back until there protrudes a bunch about four times as large as the scale, as shown in fig. 4, which is thickly crowded with



Fig. 4.



those belonging to Sphinx moths, in certain attitudes the most robust and rounded state the sound which it makes while taking its morning and evening flights are long, when uncoiled honey from the

in Fig. 1, is a series across. Its head, with a chestnut on the thorax and fine on the abdomen wings are fawn and striped with brown. The hind wings are coloured in the center two or three having a brown tip and a black blue centre near the moth is on and July; the pupa, plum and the larva, full grown in September colour head border, of a brighter

eggs. Permeating through the nest is a quantity of powdery matter which under a high magnifying power is seen to be in the form of rings. The waxen filaments are adhesive and elastic, and can be pulled out sometimes a foot or more before entirely separating. When heat is applied these fibres melt, and their waxy nature is further demonstrated by their solubility in ether and chloroform. A single nest will seldom contain less than 500 eggs, and sometimes upwards of 2,000. The female begins to lay eggs in the latter part of May, and continues laying from five to seven weeks, until she dies from exhaustion, her entire life continuing for about thirteen months. During the laying and hatching of the eggs she secretes a quantity of a sweet liquid known as honey-dew, which attracts ants, flies and other insects, and it often happens that the young lice crawl up the legs and bodies of these visitors, by whom they are thus carried to other trees.

The newly hatched, yellowish-white lice soon distribute themselves over the branches, and attaching to the succulent portions, pierce the tender bark with their sharp beaks and subsist upon the sap. They shortly become stationary, when they gradually increase in size and finally reach maturity.

The scale of the male insect is very different from the female. It is longer in proportion to its size, and there are no waxy filaments projecting from it. When fully mature the insect escapes from its scaly covering and appears as a minute, beautiful and delicately formed two-winged fly, marked with yellowish and chestnut brown, with brilliant rose-coloured wings which also reflect the colours of the rainbow. These flies do not appear until August and September, and their lives in the winged state are very short, not exceeding two or three days.

Besides the maple and the grape, these insects are, as already stated, also found on the linden or basswood, and sometimes on the elm. Where permitted to continue their depredations undisturbed, they weaken and injure, and occasionally destroy the trees attacked. They affect chiefly the under side of the branches and twigs.

REMEDIES.

The branches of the infested trees may be vigorously rubbed with a stiff brush or broom, which will dislodge many of the insects, and then coated with a strong alkaline wash made by melting either soft or hard soap and diluting it to the consistence of paint with a strong solution of washing soda; or they may be destroyed with an emulsion of coal oil made by agitating vigorously and for a considerable time one pint of coal oil with an equal quantity of milk, until the mixture assumes a creamy appearance, when it should be diluted with about ten times its bulk of water and applied with a brush or syringe.

BRIEF NOTES OF A TRIP TO POINT PELEE, WITH ADDITIONS TO OUR LIST OF CANADIAN BUTTERFLIES.

During the summer of 1882, I paid a flying visit to Point Pelee, in company with some friends who were interested in botany. This point of land extends directly south into Lake Erie, near the eastern boundary of the County of Essex, and is among the most southerly points in the Province of Ontario. On the west side of the Point the land is chiefly marsh until near the extremity, and is a prolific hunting ground for sportsmen in search of water-fowl; it is also a breeding place for millions of Neuropterous insects. The east shore is sandy, and between this and the marsh are several farms and a considerable area of uncultivated arable land more or less covered with woods.

We reached Essex Centre, on the Canada Southern Railway, the nearest point of access by rail, at 7 p.m., on the 28th June, where we hired a vehicle and driver for three or four days, and drove that evening over an excellent road 18 miles to Leamington. The night was spent here and an early start made the next morning for the Point. A drive of about three miles brought us to the base of the Point, and after a journey of about eight miles farther, we reached the upper extremity.

The day was warm and pleasant, and during the last portion of this drive we saw more dragon-flies and other Neuropterous insects than we had ever seen in our lives before; they literally swarmed everywhere, especially in sunny spots. They flew in our faces and

buzzed about numbers. swinging them again. *Diplax intacta* there also flew or two *P.* where pursued the end of our growing by the brief chase *niana* Harris approached the multitudinous were present from every roar or buzz almost hidden.

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buzzed about our ears as we were driving, and settled on our clothing in considerable numbers. After catching all that could be conveniently carried, we amused ourselves by swinging the net in different directions, catching a few dozen and then letting them fly again. Among the most numerous species were *Libellula basalis*, *L. trimaculata*, *L. exusta*, *Diplax intacta*, and *D. rubicundula*, with some others undetermined. During the drive there also floated past us on rapid wing several specimens of *Papilio cresphontes* and one or two *P. marcellus*, but they flew with the prevailing wind directly over the swamp, where pursuit was impracticable. As we passed a sunny spot in the woods, approaching the end of our journey, a small dark-coloured insect was seen hovering about some flowers growing by the road-side, which from its peculiar jerky flight, was evidently a *Thecla*. A brief chase resulted in its capture, when it proved to be *Thecla smilacis* Boisd., = *auburniana* Harris, never before, to our knowledge, recorded as occurring in Canada. As we approached the extremity of the Point, we left the swamps behind us and with them the multitudinous hosts of the larger Neuropterous insects, but several of the smaller species were present, associated with Dipterous insects, in prodigious numbers, flying in clouds from every tree and bush we touched, the vibration of their many wings causing a loud roar or buzz. The sides of houses and barns were so thickly covered with them as to almost hide the wood they rested on, but they did not venture inside the buildings.

The next day was unfavourable for collecting; the rain poured in torrents until early in the afternoon. As soon as it had ceased, we wandered several miles along the sandy roads and shores, and found many interesting plants and trees, but there were very few insects on the wing, excepting those belonging to the Neuroptera, which were everywhere in abundance. Late in the afternoon, while beating about among the bushes on the sand hills on the eastern shore, a yellow butterfly started up which at first was thought to be a pale *C. philodice*, but there was something unusual about its appearance and manner of flight which led us to pursue it until captured. Imagine our surprise when we found it to be a female specimen of *Terias Mexicana* Boisd.

In W. H. Edwards' Catalogue of Diurnal Lepidoptera, *Thecla smilacis* Boisd. is said to be found in the Atlantic States, Mississippi Valley and Texas, while the localities given for *Terias Mexicana* are Texas to Arizona; California, occasionally in Kansas and Nebraska.

Since both these butterflies are new to our Canadian lists, we append descriptions of them.

Thecla smilacis is thus described by Boisduval: "Upper side blackish brown, with a pale whitish spot near the middle of the costal edge; the secondaries have two thin tails as in the analogous species.

"Under side greenish, often washed with a little reddish, with a transverse whitish ray sinuous on the primaries, tortuous on the secondaries, bordered in front by a ferruginous tint. Between this ray and the base, the secondaries have another short transverse sinuous ray of the same colour. The extremity is marked by two or three ashy crescents, of which the intermediary is black in front, and the third in a line with two or three small ferruginous spots, more or less distinct. The anal palette is black, and near the fringe there is a small white marginal line.

"Larva, which feeds on *Smilax*, is green, with the head and feet blackish. It has four rows of red spots, of which the two dorsal are formed of smaller spots, and one on each side composed of spots somewhat larger.

"Chrysalis grayish-brown, with the abdomen more clear and reddish."

Harris, who regarded this species as distinct from *smilacis*, thus describes it under the name of *auburniana*, and Harris' description agrees more closely with the specimens captured by us than does that of Boisduval. Harris says: "The outermost of the tails of this insect is very short, and often nothing remains of it but a little tooth on the edge of the wing. It varies considerably in colour; the females are generally deep brown above, but sometimes the wings are rust-coloured or tawny in the middle, as they always are in the males; the oval opaque spot which characterizes the latter sex is ochre-yellow. Upon the under side the wings in both sexes are green, the anterior pair tinged with brown from the middle to the inner edge; externally next to the fringe they are all margined by a narrow wavy white line, bordered internally with brown; this line on the fore wings

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does not reach the inner margin; on the hind wings it consists of six spots arranged in a zigzag manner, and the last spot next to the inner margin is remote from the rest; besides these there are on the same wings three more white spots bordered with brown between the zigzag band and the base; and between the same band and the margin three black spots, behind the middle one of which is a rust-red spot with a black centre. The wings expand from $1\frac{1}{20}$ to $1\frac{1}{10}$ inch. This pretty species is found on the mouse-ear (*Gnaphalium plantagineum*) in May, and on the flowers of the spearmint in August."

"*Terias Mexicana* Boisd. Boisd. Spec. Gén. 679. Figured on pl. 3, C. fig. 1, of Boisd. Spec. Gén.

"Wings brilliant citron yellow; primaries with a black border at the extremity, rather wide, ending squarely at the internal angle, showing near the middle a rather deep quadrangular sinus; the outer edge slightly sinuate, and whitish; secondaries, with the middle of the exterior edge prolonged to a prominent angle, in the form of a tail; a black border of moderate width, a little dentated on its internal side, not reaching the internal angle; costal edge washed with orange yellow, mingling with the ground colour.

"Under side of the primaries pale citron yellow, with a black central point, the edge intersected with brown points; the outer edge reddish near the fringe.

"Under side of secondaries yellow, sprinkled with ferruginous atoms, with a blackish central point; edge intersected with ferruginous points, and marked near the external angle with a spot of the same colour; the posterior half having four or five other spots of the same colour, of which two or three are in a line, and tending to form a transverse band; the middle of the outer edge more or less washed with ferruginous.

"Female differs from the male in the upper side being yellowish white, with a wider border, the quadrangular sinus more profound; the anterior edge of the secondaries widely orange yellow, and below, three ferruginous posterior spots form on the secondaries a narrow, transverse, ferruginous band.

"Texas—Louisiana—Mexico."

Among the other insects taken were *Papilio crespontes*, *P. turnus*, *P. troilus*, *Colias philodice*, *Terias lisa*, *Argynnis cybele*, *Phyciodes tharos*, *Pyrameis huntera*, *P. atalanta*, *Anchylozypha numitor*, *Pholisora catullus*, *Eudamus tityrus*, *Eudryas grata*, *Leucania unipuncta*, *Lucanus lentus* and *Macrodactylus subspinosus*. The latter species was very common on the flowers of the tulip tree (*Liriodendron tulipifera*), which was then blooming freely; also on the sour gum or Pepperidge tree (*Nyssa multiflora*).

The next morning we started early on our return journey and reached Essex Centre in time to take the afternoon train home. Had the weather been favourable we should doubtless have reaped a much richer harvest.

NOTES OF A JUNE RAMBLE.

BY W. HAGUE HARRINGTON, OTTAWA.

My office duties prevent me, unfortunately, from going afield during almost the entire month of July in each year, and perhaps a few notes on my last ramble, 29th June, may interest the inexperienced, and indicate some of the insects to be found at this time. The special aim of this ramble was to visit a grove of hickories, *Carya amara*, and investigate the insects occurring in these trees, but I desired also to obtain Coleoptera and Hymenoptera, especially sawflies.

My out-fit consisted of a flat beating-net constructed so as to be folded up snugly when not in use; a sweeping-net on a folding pocket-ring; a bottle containing coarse sawdust, with a morsel of cyanide for beetles; a wide-mouthed bottle lined with blotting paper, and having some cyanide in a cavity in the cork, for Hymenoptera and Diptera; a couple of boxes for larvæ, and last, but not least, a note-book and pencil. The day is favourable, the sun shining hotly, yet tempered by a slight breeze. My first capture is a half-grown *Cimbex* larva under an elm tree in the city, and in passing through the lumber yards I obtain *Buprestis consularis* and *Dicerca tenebrosa*. Along the river are seen many Neuroptera, including some fine species of Phryganidæ and Perlidæ. On the sides of a railway embankment (I am now in the Province of Quebec) grow a variety of young trees and other plants. The willows are first tried and yield very abundantly,

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Diachus catarius and *auratus*. Less numerous are *Monachus saponatus*, *Anomaea lativittata*, *Agrilus torpidus*? and *A. fulgens*. I am pleased to capture a fine pair of *Saperda mutica*, as I have only hitherto taken them once. Among other beetles are *Trichalophus alternatus*, *Rhynchites cyanellus* and *Chrysomela multipunctata*, with larvæ of the same. On some trees a sawfly larva, yellow, hairy, with rows of black spots, is very abundant, and there are also larvæ of lepidoptera, including one of a Catocala. The raspberry bushes, which a few days ago were alive with bees and wasps, are now almost deserted, but the wilted tips of many of the young shoots show that some enemy has been at work. It is found that a foot or so below the top they have been neatly girdled by two rings about half an inch apart, and that between these rings has been inserted into the pith a long cylindrical egg, that of *Oberca bimaculata*. From a small balsam poplar is obtained *Saperda moesta*, and an examination discloses the larvæ of different sizes in gall-like swellings, about an inch or two apart, along the shoots which are not half an inch in diameter. Near the root, where the stem is somewhat stouter, is found a much larger borer, which is apparently that of some moth. The hickory grove is now reached, and the first tree yields a fine *Saperda discoidea*, a very rare beetle here. From other trees the following beetles are obtained: *Dorcaschema nigrum*, *Liopus alpha*, *Lepturges querci*, *Leptostylus macula*, *Hyperplatys asperus*, *Anthaxia viridicornis*, *Agrilus egenus*, *A. otiosus*, *A. bilineatus* and *Balaninus rectus*. Several tree-hoppers occur in various stages, including *Telamona unicolor* and *T. fasciata*. There are also some large flat half-grown bugs (yellow, with blackish markings,) one of which has killed a luna caterpillar about an inch long, and is sucking out its juices. The caterpillars of this moth are quite common, but generally smaller than the one mentioned, and a few larvæ of other moths are seen. Three specimens of the pretty little butterfly, *Thecla calanus*, are observed flitting about the trees, or settled upon the foliage. Space will not permit to mention the various galls, etc., which disfigure the leaves more or less. Scattered through the groves are a few oaks, some of which have the foliage noticeably disfigured by large globular woody galls placed upon the mid-rib of the leaf, which is much distorted and curled up. From these galls are just emerging small hymenopterous flies, with ample wings, of which I do not know the name. Some of the leaves are being devoured by brownish caterpillars, half an inch long, with a black head and a pair of black spines projected forward from one of the thoracic segments. They feed side by side in rows of five or six and eat the leaf from the tip downward. Upon these trees are found also the beetle *B. rectus*, which was upon the hickory, and which is remarkable for its extremely long and slender snout. Flying about through the grove are lovely butterflies, *Limenitis arthemis*, fresh evidently from chrysalis and almost persuading one to be a lepidopterist. Descending now into a meadow, through which flows a sluggish brook, I fold up the beating-net and screw the sweeping-net into its handle, which hitherto has been only used to tap the branches with. The stream is bordered with clumps of alders, willows, etc., between which grow luxuriantly ferns and many herbaceous plants, with sedges and various grasses. Magnificent fritillaries are hovering about the blossoms of the milkweed, which are just beginning to open, while numbers of *Neonympha Boisduvali* flit about with a peculiar jerky flight. Beetles do not appear to be as common as they sometimes are here, but I take several specimens of *Scirtes orbiculatus*, three specimens of fireflies and several allied beetles, with several species belonging to the other families, as Coccinellidae, etc. Three or four kinds of sawfly larvæ are found but none of the perfect insects are seen. Two, or perhaps three, species of Chrysops are unpleasantly numerous, but are not nearly so aggressive as I find them in a pine wood, through which I return. This wood rings with the shrill music of the cicada and is enlivened by many butterflies in the more open portions, where other trees and plants occur. My captures during the ramble are perhaps fifty species of beetles and a few Hymenoptera. This number is less than half of what I frequently obtain, but the value of collecting depends not so much upon the number of species taken, as upon the observations which are made upon the habits of the various species.

SWARMING OF INSECTS.

On the 3rd of June last I saw an immense collection of insects between the Chaudiere Falls and the Canada Pacific Railway bridge across the Ottawa. A long boom-log fixed

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almost at right angles to the shore, formed with it a pocket into which were swept by the swift current chips, bark and other small drift-wood. The accumulation was literally swarming with insects which had evidently fallen, or been blown, into the river, and had sought safety upon the drift-wood floating with them. Having floated into a haven of refuge, they were crawling upon the more elevated places and drying themselves in the sun preparatory to flight. In many instances, however, they were doomed to disappointment, as sudden changes in the current and eddy would every now and then violently agitate the accumulation, wash off many of the insects, and send portions of the drift-wood again into the current to be carried further down. Beetles were most numerous, but there were also large numbers of Diptera and some Hymenoptera and Hemiptera. The Coleoptera were principally comprised of Chrysomelidæ, Coccinellidæ, Histeridæ, Nitidulidæ, Lampyridæ and Staphylinidæ, and were generally the smaller and commoner species.

THE PUNCTURED CLOVER-LEAF WEEVIL (*Phytonomus punctatus* Fab.)

BY A. H. KILMAN, RIDGEWAY, ONT.

A curculio new to Canada has appeared in this locality. Prevailing east winds about Aug. 10th wafted this new clover pest to our shores. This beetle, as far as I know, has not been mentioned in the *Entomologist*. It was introduced from Europe little more than three years ago. Appearing on the eastern seaboard, and taking the continent in the inverse order to the movement of the Colorado Potato Beetle, it is working rapidly westward. Last year no specimens were reported west of Rochester, while in Eastern New York the clover crop was destroyed by this insect. On the date above-mentioned it appeared in Buffalo in such numbers that thousands were crushed on the pavements by the feet of passers-by. Simultaneous with this was its appearance in Ridgeway. I picked them from the fences and sidewalks, and found them in the grass on my lawn. Mr. Reinecke could have gathered them by the quart along the lake shore at Buffalo, where they had stranded after being carried by the wind far out upon the water. They have the extraordinary faculty of closing their tracheæ and suspending respiration while in the water, and an hour's sunshine on the sandy beach leaves them none the worse for a good soaking.

The beetle is two-fifths of an inch long, has a stout body of a dark brown colour; sides of thorax and elytra dull yellow, a central yellow line on thorax, rows of black raised points along inner half of elytra with dashes of the same muddy yellow towards the rear. Each female has a "depositing power" of from 200 to 300 eggs. She punctures the clover stem and places an egg therein, or sometimes attaches it to the surface of the stem. The larva feeds upon the leaves, which it destroys rapidly, eating only during the night and hiding in the day time.

I am of the opinion that the advance guard of this insect invasion arrived last year and it is the main body now; and further, that those now arriving will go into winter quarters and open up a lively campaign in the spring. I am led to these conclusions by the fact that many clover fields in this and adjoining counties failed this season to blossom fully, the Clover Midge getting the blame. Whatever the sequel may show, we fear that these invaders will prove of better staying qualities than those who crossed the border in '66, and turned to the right about at Ridgeway, because Canada was not the "clover patch" they were looking for.

THE ASH SAW-FLY (*Selandria Barda*, Say.)

BY HERBERT OSBORN, AMES, IOWA.

During the summer of 1882 a few of the ash trees on the college lawn here became infested with a Saw-fly worm which for a few days threatened to be quite serious. I made a few trials of London purple on the trees most seriously infested, but before I had gained results from many trees or had completed a study of the larvæ, they suddenly disappeared. So far as my experiments went they showed the London purple to be a successful remedy, and as applicable to these worms as to any of the Saw-fly group. No

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adults were observed, and none of the larvæ I had under my observation matured ; so the matter necessarily came to a rest.

During the summer of 1883 the worms appeared in much greater numbers and distributed over many more trees. At the same time and upon the same trees with these worms I observed adult Saw-flies that I could have little doubt were the mature worms, although I did not succeed in finding the eggs and obtaining the larvæ from them, nor have I reared them as yet from the immature stage. Their presence in large numbers at the time when the newly hatched larvæ were appearing plentifully day after day, and the fact that the adult *must* be an insect of this particular kind, left little doubt as to their connection. During the present season I have observed these adults as early as April 15th, and the larvæ but little later, while the eggs from which the larvæ hatch were found deposited in the petiole of the leaf.

The adults are the *Selandria barda* of Say, the food plant of which, so far as I can find, has never been recorded.

No account of the larva or of its work is given in any of the works that I have been able to consult, and as it seems to me of too much importance to remain unnoticed, I venture to give what I know of its history with the practical results of my study, notwithstanding the doubts that rest over some parts of its life history. The pressure of other duties at the time these worms were at work prevented me from giving them the time they certainly deserved.

LIFE HISTORY.

The eggs are deposited in rows along the sides of the petiole just beneath the outer bark, and so neatly that it is almost impossible to detect any break in the epidermis. Usually there are from six to ten on a leaf. They evidently increase much in size before hatching, pushing the bark up in a blister-like elevation, and if cut out of their covering are found to be very soft, the outer membrane exceedingly delicate and easily ruptured.

The larvæ are evidently hatched within two or three days after the eggs are deposited, and are at first slender, whitish worms with black heads and thoracic legs. They crawl at once to the leaflets and appear to select the more tender ones for the commencement of their work. They grow quite rapidly and reach the first moult on the third or fourth day. Before moulting they are more whitish in colour, and the head particularly loses its ordinary colour. After the moult the head is jet black and glistens like a glass bead ; the six thoracic legs have also the same jet black colour ; otherwise the larva is clear green with a slightly darker dorsal line. There are seven pairs of pro-legs or false legs along

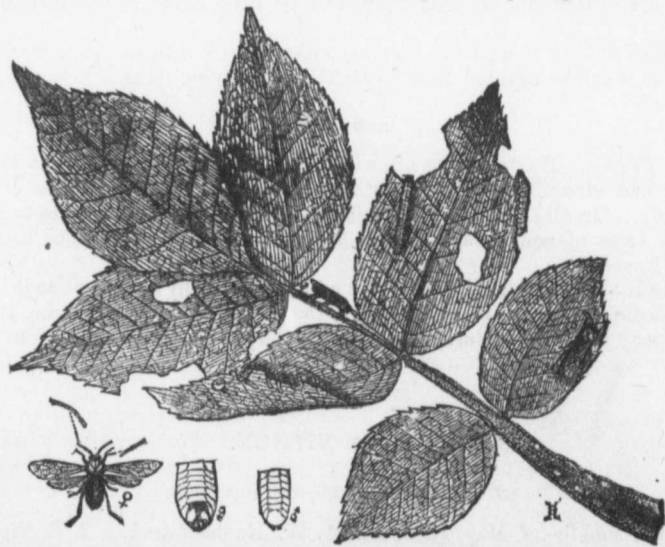


Fig. 5.—*Selandria barda* (Say). Leaf of ash showing position of eggs in petiole and work of larvæ.

the abdomen and one pair at the tail end. The body is not hairy, neither is it slimy as in some members of this genus, but the skin is somewhat wrinkled.

The worms are mostly found adhering to the under surface of the leaves, and forming a coil, though sometimes extended, especially when feeding, and as they eat away the entire leaf, cutting away at the edges or at the holes entirely through the leaf, they obtain any poisonous substance sprinkled or dusted on the upper surface.

When young they usually keep pretty well clustered together or on the same leaf, but later scatter quite generally, the early clustering being due no doubt to the eggs being laid near together and on the same leaf. The worms moult at least three or four times before reaching maturity.

The worms leave the trees before entering the chrysalis stage, and while I have not succeeded in tracing this stage, it is reasonably certain that it is passed under ground, or at least below the surface mould. It is quite certain also that the winter is passed in the chrysalis stage.

The imago has been observed abundant from April 15th till into the month of May, and also in the month of June. Whether these are two distinct broods or simply the result of great irregularity in appearance, I cannot say. It is certainly possible, however, considering the time that the first larvæ require to attain their growth that they may pupate and issue as a second brood in the month of June. These adults are black throughout, except the upper part of the thorax, which is honey yellow or sometimes orange or reddish, the amount as well as the shade differing somewhat in different individuals. The males are more slender and shorter than the females. In some specimens the front legs are partially yellowish.

They appear to be most active during the heat of the day, and can be caught without much difficulty in the hand during cool evenings.

PARASITES.

Tachina Flies. On trees where these worms were plenty I observed numerous specimens of the friendly Tachinas, and I also found their eggs on great numbers of the worms. So numerous were they indeed that I felt that the worms could safely be left to their attention.

Ichneumon Fly. A small *Ichneumon* occurred also in pretty good numbers, and though I obtained no direct evidence of their preying upon the worms, the habits of the *Ichneumons* are so well known that there can be little doubt of the meaning of their presence.

The Spined Soldier Bug (Arma spinosa) was observed with the Ash worms impaled on its beak, so it can be counted upon to assist in destroying them.

REMEDIES.

London Purple. The trials I made with this substance proved that it is deadly to these insects, and where it can be used without too great expense, it may be considered a certain remedy. On all small shade trees it can be applied as readily as to orchard trees, and even on trees of considerable height a good force pump will suffice to thoroughly sprinkle the leaves.

Hellebore is also very effective for these and other Saw-fly larvæ, but as it is no better than the preceding and much more expensive, there is no need of considering it here.

Arsenic may be used in solution like London Purple, but must be boiled to dissolve it.

Incisalia
THECLA NIPHON. Han

BY JAMES FLETCHER, OTTAWA, ONT.

About the middle of May, 1883, Mr. A. W. Hanham took a ♀ *T. Niphon* a few miles from the City of Ottawa. This was the only specimen at that time seen.

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On the 4th May last, when walking along the Chelsea Road, near the village of Chelsea, P.Q., with Mr. Harrington, he called my attention to a small butterfly which had just alighted on the bare road in front of us. This I was delighted to recognise as *Niphon*. Having no nets with us, a too near approach was only rewarded with the mortification of seeing the coveted prize flit lightly up to the top of some high pine trees. Subsequent to this date the weather was cold and wet for some time, and I had no opportunity to visit the locality until the 22nd of the month. On this date the Ottawa Field Naturalists' Club organized an excursion to the Chelsea Mountains for the purpose of entertaining the Fellows and Delegates of the Royal Society of Canada, and consequently we were honoured with the presence of our worthy President, Prof. Saunders, who happened to be in Ottawa attending the annual meeting of the Royal Society. As we passed the locality for *Niphon* on the way, the attention of all was directed to the pines as we passed. It was the President's experienced eye which detected the first examples; three beautiful tempting specimens were seen flying round the top of a white pine about 30 feet from the ground and well up out of reach; but none were obtained.

Two days later, however, Mr. Harrington, Mr. Ami and I went out again armed with a net attached to a long bamboo. Fortune favoured us at last. On the way out one female which had settled on the road was taken. When we reached the grove of white pines (*Pinus strobus*), where the three specimens had been seen two days earlier, Mr. Harrington climbed up to the top of the same tree and took two more, all in good condition. Bordering the pine grove was a field in which a great deal of the herbage was made up of *Antennaria plantaginifolia* in flower, and along the edge of this field, close to the trees, nine more were taken and two others seen. Highly elated at our success, we turned our steps homeward with twelve perfect specimens, eight ♀ and four ♂. Two days later I again re-visited the locality and met with a great disappointment. The day was intensely hot and butterflies were very plentiful. On arriving at the field I saw with delight *Niphon*, three or four at a time, in every direction, but my chagrin was great when on taking them one after another, I found there was hardly a presentable specimen amongst them. The locality is on the top of a hill, and for the past two days high and boisterous winds have prevailed, and this must have been the cause of their tattered state. Altogether, although a hundred could have been taken with ease, not a dozen were found worth collecting. Nevertheless, I boxed some females alive with the object of getting the eggs, and have succeeded in getting thirteen. Under the microscope they are objects of great beauty. The shape is round with a deep depression at the summit, almost half the depth of the egg. The general colour is pale green, and the surface is beautifully reticulated, the lines of the coarse netting being much raised above the surface and almost white. This gives the egg the appearance of having a white bloom on it. One egg laid on 26th May gave the larva to-day, June 5th.

The larva has already been described by Mr. Saunders, CAN. ENT., I., p. 95, and is also figured by Townend Glover in his plates of Lepidoptera, plate B., fig 8.

Among the specimens of the perfect insect I captured, I found there was considerable difference in the marking and beauty of the upper surface, particularly among the females. I imagine the typical colours of this sex to be a rich ruddy bronze, with a green sheen, and having a black border running round the margins of the wings. This border varied much in depth; it was sometimes almost restricted to the fringe of the wings, while in others it covered about one-fourth of the surface. These dark specimens are very handsome. There is also much difference in the size of the white bars in the fringe. The under side of both sexes is very similar and varies very little. The general colour of the ♂ is slaty black with, in some specimens, the green sheen seen on the females. A few specimens of the male had a reddish tint in the black, and a few examples had indistinct bronze eye marks where the tails are found in other species of this interesting genus. The flight of this insect is very quick and jerky, and when disturbed it often flies off to the tops of trees. When visiting the flowers of *Antennaria* for honey, it has a curious habit of slowly moving its lower wings while closed alternately up and down. The tails found in other species are represented in this one by a curve in the margin by which the long fringe

Niphon a few seen.

gives the appearance of a little tuft of down when the wings are closed. I have about a dozen specimens to spare, which I shall be glad to give to any members of the Society who will send me a box for their transmission.

NOTES ON ANT LIONS.

BY J. ALSTON MOFFAT, HAMILTON, ONT.

One day on my late visit to Ridgeway a party of four went on an entomological excursion by boat to a place about four miles west, called Point Abino. After taking a survey of the situation and lightening our lunch-basket, we went to work. Each had his specialty; one desired beetles, another butterflies. Seeing *Myrmelion* on the wing, I turned my attention to the Ant Lions. I did not succeed in securing many of them, for although the funnel-shaped pits of the nymphs were in surprising numbers, very few of the mature insects were to be seen, it being probably a little too early for them. I captured but four specimens, one *obsoletus*, and three of what was kindly determined for me by Dr. Hagen, of Cambridge, Mass., as *Myrmelion abdominalis* Say, whose figured-gauze wings are charming objects seen through a lens. The slight acquaintance I have with them has been acquired during my visits to Ridgeway, none of them having ever been seen about Hamilton, so far as I know. Mr. J. Pettit secured an *obsoletus* while he was collecting at Grimsby, but I think he never got a second, although no doubt they were there to some extent, but probably very scarce. Fine loose sand is evidently a necessity of their existence in any locality, and I would suppose comparative seclusion; both of these they have in perfection at Point Abino. I saw large patches of sand so loose that weeds could not take root upon it, and which had not been disturbed by the foot of man or beast probably for weeks, and some of these places were so occupied with their pits that it did not seem possible to get another one in without interfering with those already there. These pits were about three inches across the top, and two or two and a half deep. Their width must be in exact proportion to their depth, for the slope of the sides is just what will support the particles of loose sand. They must have their pits to make frequently during their larval existence, for every heavy shower will fill them all up. They never expose themselves to view except by accident, but lie just immediately under the surface. The larva is provided with an apparatus for throwing up the sand, which it can do with sufficient force to scatter it for four or five inches around, and with the rapidity at times of the tick of a watch, working itself downwards as it throws off that above it, the sand flowing in as it deepens, which it jerks up again, the most of which falls outside the range of the pit; and so continues the operation until the required dimensions are obtained, when it lies perfectly still at the bottom and awaits events. An industrious ant out on a foraging expedition, in the hurry of its eager search runs over the edge of the pit. The lion at the bottom seems to be instantly aware of the fact, and begins throwing up jets of sand with great rapidity, which come showering down, frightening the ant, and it makes frantic efforts to get out; but the more vigorously it scrambles for the top, the more rapidly it slides to the bottom, where it is at once seized. The struggle ensuing dislodges the loose sand, and a miniature avalanche pours down from all sides, which materially assists the lion to secure its victim, and the ant is soon taken out of sight. I am not aware that it has any means of enticing its prey, and as it does not go searching for it, but is entirely dependent on what happens to come in its way, I suspect it must have many a long wait between meals.

The mature insect is neither a rapid nor a graceful flier, but flaps its wings in a heavy, clumsy manner, quite different from what one would expect in so exquisitely delicate a creature. It prefers to alight in an upright position, and rests with its wings folded close to its sides.

I take pleasure in announcing the discovery of a moth which is an important addition to the Canadian list. When on a visit recently to my friend, Mr. Kilman, of Ridgeway, in the County of Welland, whilst looking over his Lepidoptera, my attention was arrested

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by the unusual appearance of some specimens labelled *Callosamia promethea*. As I was pondering and puzzling over them, it began to dawn upon me that it was not *promethea* I was looking at, but *angulifera*, and upon enquiring, he informed me they were his own captures in that locality. ^{wlk.}

A few years ago I was put in possession of two pairs of *angulifera* through the kindness of Mr. James Angus, of New York, the first I had seen of them. You are aware how marked the difference is between the males of the two species, the male *angulifera* bearing a strong resemblance in both form and colour to the female *promethea*, with the addition of the heavy whitish angular mark in the centre of the wings, from which I presume it obtained its name. Mr. Kilman had three specimens, two males and a female. He gave me a male, and on comparing it with the N. Y. specimens, I find it two sizes larger, and with less yellow in the general colouring. The locality where Mr. Kilman resides is particularly favourable for entomological pursuits—sandy hills and gravelly ridges, with their appropriate vegetation—marshy flats full of flowering shrubs and weeds—virgin forests with an abundance of decayed and decaying timber—belts of young second growth trees—swampy and dry ground, and long cultivated fields with their diversity of vegetable productions, all in close proximity to Lake Erie shore, whilst any and all of them are within a few minutes' walk, making an exceedingly attractive and productive hunting-ground for the collector.

RARE MOTHS AT MONTREAL.

BY G. J. BOWLES, MONTREAL, QUE.

Last fall an important addition was made to our list of Sphingidæ. A number of larvæ of *Phalanyx achemon* were discovered on cultivated grape-vines growing in the open air, at a gentleman's residence in this city. Another western Sphinx, *Deilephila lineata*, is taken here, but very rarely. I have heard of only two specimens in ten years. Last year, a specimen of *Samia columbia* was brought to me, captured in a central part of the city. A few days afterwards I received a *Hepialus thule*, Strecker, described by him in No. 12 of his "Lepidoptera," from a specimen sent him from here by Mr. Caulfield. Mr. J. G. Jack, of Chateauguay Basin, also has a very beautiful specimen of this moth. These three are, I believe, the only specimens in collections. Bel

NOTES ON THE ENTOMOLOGY OF VANCOUVER ISLAND.

BY GEO. W. TAYLOR, VICTORIA, B. C.

Since I came to this island, a couple of seasons ago, I have made a practice of capturing any insects that came in my way, and I have sometimes made an expedition purposely in pursuit of such prey. The result is an accumulation of about one thousand species of all orders, which probably represents not more than five per cent. of our insect population.

As my favourite studies are in another department of Zoology, I have neither the inclination nor sufficient knowledge to work out all this material myself, but with the help of entomological friends, resident, alas! sadly too far off, I am gradually making progress with the naming of my captures, and I propose, with your permission, to publish from time to time in the *Canadian Entomologist*, lists, with notes, of the species that have occurred to me. I hope that this will be both useful and interesting to Eastern entomologists, as I notice that hardly more than one-half of the insects I have already identified are named in the recently published check list of Messrs. Brodie & White, and many of them will prove, I think, new to science.

This month, however, I will content myself with a few general and preliminary remarks. Our climate (I am speaking only of the south-easterly portion of Vancouver Island) is supposed to resemble that of the south of England, but I should call it decidedly milder. Our spring is warm and early, and the summer hot and dry, but with cool nights and copious dews. On the other hand, the winter is mild, and for about three months exceedingly wet. All kinds of vegetation are very luxuriant. The uncultivated lands are thickly covered with heavy timber, and the cultivated lands are at present few and far between, which makes it easier to combat the attacks of our noxious insects (and of these we have not a few). All our climatic conditions, except perhaps the wet winter, are favourable to abundant insect life, and this undoubtedly exists here. There are several points about our insect fauna that cannot fail to strike an observer. In the first place the extreme abundance of Diurnal Lepidoptera must attract attention. Nearly forty species may be marked *abundant*. A patch of blossom in May, covered with *Blues* and *Pritillaries*, with an occasional *Colias* and two or three magnificent species of *Papilio*, is a sight such as an English entomologist, at least, never sees at home, and later in the year the hundreds of *Vanessa*, *Chrysophanus*, *Pamphila* and *Limenitis* make a very different but not less beautiful picture.

The Orthoptera, too, intrude themselves upon our notice. Grasshoppers in thousands exist in some localities, and do considerable mischief, and large and gorgeous species, with red or yellow under wings, astonish the uninitiated by their sudden appearance or equally sudden vanishing. Two kinds of Cricket fill the air with music in early summer, and a couple of species of *Cicada* lend them most efficient aid. Of Hemiptera, Neuroptera and Diptera, I have not collected many, perhaps only 200 species in all, but they include some remarkably fine kinds. Among the Coleoptera I am struck with the abundance of *Adephaga*, many of them, too, being of large size. The genera *Calosoma* (e. g. *tepidum* Lec.), *Cychrus* (*marginatus* Dej. and *angusticollis* Fischer), *Carabus* (*tedatus* Fabr.), *Omus* (*Dejeani* Reiche and *Audouini* Reiche), *Holciophorus* *Promecognathus*, &c., being represented by very fine species. The Longicornes, too, are abundant, and most of them are absent from Brodie & White's list. The Elateridæ and Buprestidæ are also numerous; in fact all wood-feeding insects seem to abound, as do carrion feeders, while on the other hand, Lamellicornes are very scarce.

Our Hymenoptera are fine and interesting; the *Vespas* are in fact decidedly *too* fine. *V. maculata* Fab., *V. media* Oliv., and a supposed new species, being remarkably plentiful and pugnacious. Less plentiful, but no less conspicuous and interesting, are the Uroceridæ, my first five specimens proving to belong to as many different species.

Nearly one hundred species of Hymenoptera (about half my collection) have been identified for me through Mr. Brodie, of Toronto, and they are consequently most of them included in his check list. These shall form the subject of my next communication, and in concluding for the present, I may mention that my duplicates and the loan of my type specimens in any particular family or order will be accorded with very great pleasure to any specialist who will favour me with a request for the same.

SPINNING CATERPILLARS.

BY FRÉDÉRIK CLARKSON, NEW YORK CITY.

Milton, when he wrote of Nature's bounty, and referred to the

"Millions of spinning worms
That in their green shops weave the smooth-hair'd silk."

had thoughts no doubt of the obedience due from Nature's subjects to Nature's King. A work ordered and a work performed. Were men as loyal to their King, what a garment of righteousness would each man weave wherein to appear amid the flood-light at the Court on high! The caterpillar, at the sighing of the autumnal wind, enfolds itself in its

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silken shroud preparatory to a winged flight, leaving to the world the record of a life well spent—an unbroken thread of duty done: a treasury of silk to deck the sons of men

“In courts, in feasts, and high solemnities.”

To grace man's outer life, and if in proper mood and contemplation, his inner life as well; for Nature's lessons are not learned under their external forms, but under the spiritual beauty and verities they represent.

“That not a natural flower can grow on earth
Without a flower upon the spiritual side,
Substantial, archetypal, all aglow
With blossoming causes—not so far away
That we, whose spirit-sense is somewhat cleared,
May not catch something of the bloom and breath.”

Nature has many voices. She speaks to us in joyful song amid the activities of the day, and in saddening dirges during the still hours of the night, while throughout her wide domain, in song of life and dirge of death, she whispers Resurrection.

Among the multifarious forms of insect-architecture, all of which are of absorbing interest, I purpose at this time to record a few notes relating to the cocoons of the Bombycidae. The cocoon made by the Worm of the Orient has, from the circumstance that its silk is so extensively used in manufacture, been fully described. This paper concerns those of the Polyphemus, Cecropia, Cynthia, Luna and Promethea caterpillars, and it may be regarded as an endeavour to foster an organized system of silk culture with these worms, the Cynthia worm especially favouring cultivation, as it is double-brooded, and since its introduction from the East, together with its food plant, the Ailanthus, it has become largely distributed throughout the country. The habitat of some of these species is co extensive with the Union, and silk culturers are alike advantaged in every section of the country with an abundance of food plant in our native trees. The silk produced by them, though not of as fine a texture as that spun by the Mori Worm, is yet abundant and of much greater strength. Notwithstanding the fact that the pointed end of the cocoons of the Cecropia, Cynthia and Promethea worms is left open for the exit of the moth, the threads are unbroken and the cocoons can be unwound. The Mori Worm covers the interior lining of the cocoon with a gummy secretion, and when the moth escapes, the threads, if not broken, are thought to be in such danger that cultivators of silk destroy the pupa before the period of emergence. There are entomologists, however, who deny that the threads are broken at all, for they admit having succeeded in unwinding cocoons from which the moths have escaped. The Cecropia, Cynthia, and Promethea worms line each layer of silk, as well as the interior of the cocoon, with a gummy secretion, leaving the silk at the exit opening free of agglutinating properties. This allows of a ready escape of the imago without danger to the thread. If the cocoons of these worms be divided lengthwise, and immersed in boiling water for a few seconds, a careful manipulation will permit the separation of the several layers of silk, when, by the aid of a lens, the life work of the caterpillar is beautifully presented and the continuity of the thread can be discovered. The exterior section of the cocoons of the Cecropia and Cynthia worms can be easily divided into three layers of silk, while the interior portion is divisible into six. The Luna and Polyphemus worms construct cocoons somewhat similar to the Mori Worm, and as all parts of the interior lining are sealed, it becomes prudent, perhaps necessary, to destroy the pupa.

THE HAIRY LARVÆ AND THEIR PARASITES.

It is generally acknowledged by Entomologists that the hairy larvæ, such as the Arctians and their allies, very commonly escape parasitic attack, a circumstance attributable to the fact, that in order to permit the deposit of ova, these caterpillars must be discovered by the parasites in favourable postures, or else worried by them into such, that the spines separating, give the only opportunity for the insertion of the ovipositor. This was clearly demonstrated in an attack made by an Ichneumon upon a larva of *Apatela Americana* Harris, which came under my observation in the early part of last autumn.

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This genus belongs to the family of the Noctuidæ, the larvæ of which, like the Arctians, are clothed with dense spinular hairs. The caterpillar had secured itself by its abdominal legs to the midrib of a maple leaf, having the fore part of its body elevated, similar to the attitude common to the larvæ of the Sphingidæ. The parasite displayed great energy in the effort to deposit, seemingly as if to compel the caterpillar to change its position, but as the caterpillar remained immovable for many minutes, probably a quarter of an hour, I was led to the conclusion that it realized its security in the position it had taken. After driving the parasite away, I discovered that the caterpillar, though perfectly life-like in form, was dead, and as hard as if petrified, and that the parasite, guided, as it would appear in this case, solely by sight, had been, like the Entomologist, thoroughly deceived. In view of the commonly accepted opinion, that insects are attracted by odour, not only to their own food, but to the proper food for their progeny, whether it be animal or vegetable, I have referred to this incident, as contributing to the theory that the parasite, in providing food for its progeny, seeks it by sight; for it would seem most improbable that a dead and dried caterpillar should retain a sufficiency of its natural odour to attract. The incident also illustrates, by the mode of attack and the prolonged effort at ovi-position, that the caterpillar must be brought into an attitude favourable for the reception of the egg. I am inclined to the opinion that the reduction of these moths through the instrumentality of parasites, is largely effected while in the pupa condition, having noted this peculiarity of habit during our recent extraordinary visitation of the *O. leucostigma* Smith. The full-grown larvæ of this species, collected by me, developed into moths, while from cocoons gathered it was not uncommon to obtain parasites. The cocoons of the hairy larvæ commonly consist of loose interwoven hairs, and are not so dense but that the pupa is readily discoverable by the parasite, even if the cocoons themselves do not attract them.

THE DUNG PELLET MAKERS.

The term Scarabæus, as applied by the ancients to the Sacred Beetle of Egypt, and afterwards by Linnaeus as comprehending the great division of the Lamellicornes of Latreille, is derived from Khepra, an African word, which means cipher or circle, and has reference to the orbicular shape of the pellet of dung that contains the deposit of ova. Khepr is no doubt the root word, and is analogous with the Greek word *Kapobos*, the Latin word *Scarabæus*, and the English word Crab. Any ordinary scholar can follow the slight linguistic change that produces one from the other. The *Scarabæus* is imaged amongst the hieroglyphics of the Egyptians, and was regarded by those ancient people as a symbol of the world and the sun. It is not improbable that the term *Scarabæus* is associated in the minds of the many with the idea of a Crab, not only because the Sacred Beetle of Egypt is represented under that form, as a sign in the zodiac, but also from the peculiar conformation of the clypeus and thorax of the beetle to the shell-case of that Crustacean. *Scarabæus* evidently means a ball. It seems to the writer that we apply this term to cover a larger class of beetles than the signification of the word will admit. This article, however, is not intended to suggest any limitation in the classification, but merely to ascribe to these indefatigable labourers the designation which they have earned in the very infancy of human observation.

THE ELM LEAF BEETLE (*Galeruca Xanthomelæna*, Schrank.)

I visited Flushing, L. I., July 8th, to examine the insect reported to be infesting the noble old English elms which adorn the principal streets of that village. Three weeks ago these trees were in luxuriant foliage; they have now the appearance as if they had been scorched by fire. I discovered them to be attacked with a countless host of the larvæ of this beetle. The American elm and other indigenous trees have thus far escaped, but it is not improbable, as this beetle is double brooded, that the numerous larvæ will from the force of circumstance attack them. The eggs are laid in clusters along the veins of the leaves, on their under sides. The larvæ, as soon as hatched out, begin to devour the leaves, which they render lace-like, and when full fed they do not undergo transformation by fastening themselves to the surface of the leaves, as is the habit with other species, and

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as I have seen recorded of this, but transform within the crevices of the bark. At this time, July 8th, the trunks of the trees are covered with the larvæ seeking places to transform, and there is scarcely a crevice of the bark but what is filled with the yellow pupal forms which will in a few days disclose the imagines. The ground immediately surrounding the base of the trees is covered with the pupæ, which have been dislodged from their positions in the bark by the eager efforts of larvæ crowding in the crevices to undergo transformation. As this change occurs within the crevices of the bark of trunk and limb, it becomes impossible, unless at great labour, to apply means for exterminating the pest. The evil, however, is likely to cure itself, for the larvæ are so numerous, and such insatiate feeders, that starvation will probably end the visitation. Much good, however, can be done by brushing down the trunks of the trees, sweeping the ground immediately beneath, and destroying the entire mass by fire.

Ceramia

A PARASITE ATTACKING THE ZEBRA CATERPILLAR (*Mamestra picta*, HARRIS).

BY F. B. CAULDFIELD, MONTREAL.

On July 19th, 1881, a caterpillar of this moth was found on a cauliflower which had been brought from market, and was placed in a tumbler with some of the leaves. By the 21st it had shrunk considerably in size, and was greatly changed in appearance, the black and yellow markings that make this larva so conspicuous an object having faded to a dull whitish colour. On the 22nd it was lying on the bottom of the glass and was revolving continuously. Under natural conditions it would, I believe, have entered the earth to go through its transformations, and the curious revolving motion might perhaps have been for the purpose of forming and smoothing its cell. On looking at it on the morning of the 23rd, a soft white flattened ichneumon larva had issued from it, and had commenced the construction of its cocoon by spinning a few white threads. By evening it had surrounded itself with a thin egg-shaped cocoon of a yellowish white colour, through which the movements of the enclosed grub could be seen. On the morning of the 24th the cocoon was finished and was dense and firm. It was of a reddish-brown colour in the middle, blackish-brown at each end. The perfect insect emerged on September 13th, 1881, and proved to be *Ophion purgatus* Say. *Mamestra picta* is a well-known insect, and is treated of by Harris, Riley, Lintner and others, but I do not remember seeing any account of its being attacked by a parasite.

ENTOMOLOGICAL NOTES.

BY A. W. HANHAM, PARIS, ONT.

I have to record the capture of some Coleoptera in rather an unusual manner. Last week while out in the woods on one of my collecting tramps, I was attracted to an old stump by the glittering of something in the sun. Closer acquaintance did not at first solve the mystery; the bright object seemed to be buried among some debris. Further examination revealed the dried and withered remains of a small toad, the glitter being that of some Buprestidæ partly exposed in what was once the stomach of the defunct batrachian.

I carried the remains home, and with no little trouble excavated in a perfect state the following:—

Calosoma frigidum Lec.

Platymus placidus Say. Several.

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o be infesting the Three weeks ago if they had been ost of the larvæ of ar escaped, but it rvæ will from the y the veins of the gin to devour the go transformation other species, and

Dicerca ♀ A pair.

A small weevil unknown to me.

Portions of *Cicindela repanda* Dej., other Coleoptera and some Diptera.

From the above list it would seem that toads can hardly be called useful, seeing that such a large proportion of their food—if we take this one for a standard—consists of decidedly beneficial insects. I will allow that they are very desirable tenants for the owners of gardens, but in the woods they must be formidable rivals to the entomologist. This year they have been unusually abundant, and the rarity of many of our beetles is no doubt caused by their rapacious appetites.

I have not taken *C. frigidum* before; the *Dicerca* is also new to me. I find it very difficult to determine my captures, and a serious obstacle to taking satisfactory notes. I am indebted to W. H. Harrington, of Ottawa, for the naming of a considerable number last winter. *C. calidum* Fabr. also seems to be quite rare here; I made special search for it this spring and found but one specimen. I took another on October 27th last year, from the heart of a decaying log. Is it double brooded in this part of Ontario? Or would it be possible for one attaining the perfect state in June to live through the summer and survive the winter? The specimen I captured in October had evidently prepared to hibernate. On June 15th I found under stones on dry ground a pair of *Calosomas* which are entirely new to me. I expect though I could name them from the Society's collection in London.

I should have been surprised to find so large and active a beetle as *C. frigidum* falling a prey even to the biggest of toads. The Buprestidæ must also be rather tough morsels for them to digest. It will ever remain an open question as to whether "our departed friend" lost its life through its own greediness, or met a violent death at the hands of one of its many foes. I have read of some ardent collectors who secured many rare beetles by capturing and killing the toads they found in their rambles.

ON PRESERVING INSECTS.

BY PH. FISCHER, BUFFALO, N. Y.

I have often read articles about keeping parasites out of cabinets, and have seen in many entomological papers different remedies suggested to keep them from destroying, in a very short time, even the largest collection. I will now add my own experience, and remedy which always proved to be efficient during my fourteen years' collecting, in which time I have not even lost one specimen. It will especially prove of interest to the beginner. In the first place I would advise all those who cannot afford a large cabinet with good fitting drawers, to go to any good joiner and have some boxes made after the following pattern: Take the lumber about three-sixteenth inch thick for top and bottom, for the sides a quarter of an inch. Have the box about fifteen inches long by twelve inches wide, and four inches thick outside measure, and shape it book form, the bottom and top a quarter of an inch projecting. That portion which represents the cover of the book is cut into lengthwise, so as to make two receptacles, each about two inches high. The back is made of three-quarter inch lumber, in the shape of the back of a real book, which is covered with some strong cloth or thin leather outside, and cloth inside, to act as hinges. The two parts will have to be constructed so that they will, by closing them, fold together about a quarter of an inch. Have this neatly covered and lined with a suitable soft material, and it will be a tight and handy box for any kind of insects. Before transferring insects in a new box, I put them on cork and expose them to a moderately hot oven, which I also invariably do with insects received through exchanges. After a certain time, say half an hour, I take them out, and they are placed in the box, in which is pinned a little sponge the size of a small nut, saturated with carbolic acid (crystallized), which has to be renewed every six or eight weeks. Old cabinets infested

with parasites, in drawer or box, in the oven.

Some two of the Promethea on the leaves of which attained to an immaturity, when soon joined by a sible avidity. I driven off, but on arrival an hour I been overlooked

While walking of Delanes, last J foliage of an oak as the sky was pe the noise was, and showed that quite here and there I the larvæ trying to flown to the tree tree to escape the from their Hyme

One morning Halifax, which ha who had spent tl troubled them all ness of the statem with commenced t were not beetles, r *Germanica* of the first appears 1882. I asked if answered, "in my time, so I left the

with parasites, when once introduced, can be cleared by the same method, only that the drawer or box, before pinning back the specimens, also has to be exposed to the heat of the oven.

AN INSECT-EATING BIRD.

BY W. W. HILL, ALBANY, N. Y.

Some two or three years ago I reared from the egg several hundred caterpillars of the Promethea moth. They were feeding finely upon the common lilac (*Syringa vulgaris*), the leaves of which they ate readily. The third moult had been reached and they had attained to an inch or more in length, and there seemed every prospect of their reaching maturity, when in an evil hour an oriole discovered their whereabouts. The bird was soon joined by a companion, and the pair proceeded to kill and eat with the greatest possible avidity. Discovered in their work by persons in the house, they were several times driven off, but quickly returned with increased zest to the work of destruction. On my arrival an hour later there remained but a few of the smallest specimens, which had either been overlooked or left to grow fatter.

STRANGE MOVEMENT OF CATERPILLARS.

BY EUGENE L. KEEN, PHILADELPHIA, PA.

While walking along the New Jersey shore of the Delaware River, near the village of Delanes, last July, I was startled by hearing some small bodies falling through the foliage of an oak tree, and as they struck the leaves it sounded as if it were raining, but as the sky was perfectly clear, my curiosity was aroused. I turned around to see what the noise was, and saw some black larvæ falling to the ground, and further investigations showed that quite a number of these larvæ had fallen to the ground from the tree, and here and there I saw several Tachina flies, I believe a species of *Exorista*, hovering around the larvæ trying to deposit their eggs. From this I suppose that these Tachina flies had flown to the tree in search of victims, and most probably the larvæ had dropped from the tree to escape their enemies. Perhaps many larvæ take this method of trying to escape from their Hymenopterous and Dipterous parasites.

THE CROTON BUG IN QUEBEC PROVINCE.

BY REV. THOMAS W. FYLES, SOUTH QUEBEC.

One morning last November I went to the Chaudiere Curve, to meet the train from Halifax, which had been delayed for some hours. I found two men in the waiting-room who had spent the night there. They complained that swarms of black beetles had troubled them all night so that they could not sleep. Upon my questioning the correctness of the statement, they said, "Well, here they are in all the cracks," and they forthwith commenced to poke the creatures out. The insects were numerous enough, but they were not beetles, nor were they black. They were specimens of the German Cockroach, *Blattella Germanica*. I afterwards enquired of one of the railway employes as to the time of the first appearance of the insects. The man told me that he first noticed them in 1882. I asked if they had appeared anywhere else in the neighbourhood. "Yes," he answered, "in my own house last winter; "but," he added, "I am not there in the day time, so I left the windows open and froze them out."

The enquiry is interesting, How did *Ectobia Germanica* get to the Chaudiere? At that place, which is nine miles from Point Levi, luggage is transferred from the Grand Trunk to the Intercolonial, and *vice versa*; and the creatures might have been brought by American tourists from Boston (where it abounds), or by immigrants from Germany, or other parts of Europe. The latter supposition is the more likely, inasmuch as the immigrants far exceed the tourists in number, and also are of a different class—a class less likely to be careful as to their properties and equipments. No doubt the “bug” was carried to Boston by immigrants. It is not a “Yankee invention.”

ON CERTAIN FAMILIES OF THE NEUROPTERA, IN THEIR RELATION TO THE FISHING INTERESTS.

BY THE REV. THOMAS W. FYLES, OF SOUTH QUEBEC.

In this land of lakes and streams the inland fisheries ought to be of great importance, and whatever has a bearing upon them is deserving of attention. It is well-known to anglers and to naturalists, that many species of the Neuroptera, or nerve-winged insects, in their different stages of existence form a very large proportion of the food of fresh water fishes.

Latreille classified the Neuroptera as follows:—

Subulicornes :

Libellula
Æshna
Agrion
Ephemera

Planipennes :

Panorpa
Nemoptera
Bittacus
Boreus
Myrmeleon
Ascalaphus
Hemerobius
Asmylus
Numphes

Planipennes—Continued.

Semblis
Corydalis
Chauliodes
Sialus
Rephidia
Hemerobius
Psocus
Perla
Neumora

Plicipennes :

Phryganea
Sericostoma
Mystacida
Hydroptila.

Of these families, Ephemera, Perla, Corydalis and Phryganea, especially have been long known as affording “killing” baits for the different species of fish.

Those fathers of the gentle craft—Walton and Cotton, make frequent mention of the *Green Drake* and *Grey Drake* (Ephemera); the *Stone Fly* (Perla); the *Camlet Fly* (Phryganea), and the *Caddis* (the case-worm or larva of the Phryganea).

Walton speaking of the trout says:—“He especially loves the May Fly which is bred of the cod-worm or cadis, and these make the trout bold and lusty, and he is usually fatter and better meat at the end of that month (May) than at any time of the year.—*Comp. Ang. Ch. IV.*”

He enumerates “divers kinds of caddis or case-worms,” and he sums up with, “I will tell you, scholar, several counties have several kinds of cadises, that indeed differ as much as dogs do, that is to say, as much as a very cur and a greyhound do. These be usually bred in the very little rills or ditches that run into bigger rivers; and I think a more proper bait for those very rivers than any other. I know not how or of what this caddis receives life, or what coloured fly it turns to, but doubtless they are the death of many trouts.”—*ib. Ch. VII.*

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Cotton, the disciple of Walton, surpassed his "father" in the angler's art, in fly-fishing at least. Speaking of natural flies, he says:—"We generally use but two sorts, and those but in the two months of May and June only, namely, the green drake and the stone fly; though I have made use of a third that way called the camlet fly, with very good success for grayling, but never saw it angled with by any other, after this manner, my master only excepted, who died many years ago, and was one of the best anglers that ever I knew.—*Comp. Anglers, Pt. II., Ch. V.*

In Ch. VII., under the head of "May," he tells us that "we have four several flies which contend for the title of the May-fly, namely :

The Green Drake,
The Stone-fly,

The Black-fly,
The little yellow May-fly,

And all these have their champions and advocates to dispute and plead their priority; though I do not understand why the two last named should, the first two having so manifestly the advantage both in their beauty and the wonderful execution they do in their season."

Under "December," he says: "Of all these (and I have named you a great many killing flies) none are fit to be compared with the *Drake* and the *Stone-fly*."

Of the insects, then, belonging to the Neuroptera, of which I shall now speak, these shall take precedence,—*Green Drake, Grey Drake* (Ephemera).

It is to Aristotle that we owe the name *Ephemeron*, or Day fly, as applied to the insect known to anglers as the *Drake*. The Old Greek naturalist tells how the River Hypanis brings down, at a certain season, capsules like grape-seeds, out of which, when they burst, proceed living creatures which fly about till evening, and then die.—*Hist. of Animals, Bk. V., ch. 18.*

The female lays her eggs (to the number of seven or eight hundred) in batches, here and there, on the river. They sink to the bottom and become attached to submerged objects. Here they soon hatch. The young larvæ tunnel for themselves tubular retreats in the mud of the river, and feed upon minute objects both vegetable and animal. They have a remarkable breathing arrangement on either side of the abdomen consisting of a row of fringed tracheal appendages, or gills, which are constantly agitated, to bring fresh currents of oxygenated water within reach of their respiratory action.

The nympha resembles the larva, but has the addition of wing cases in which the embryo wings lie folded. When the hour arrives for the great change from its aquatic to its aerial existence, the insect rises to the surface of the water, or ascends some object that affords vantage-ground—a post, or flag, for instance. It then rends its nymphal case, its diver's habit, and lo! the pseud-imago or *Green Drake* is presented to our view. We say the pseud-imago, for, as the rider in the circus throws off dress after dress until harlequin is revealed, so Ephemera has yet to cast aside another casing ere it can appear in full activity as the *Grey Drake*. Not only the nymphal case, but the cast-off filmy dress of the pseud-imago of Ephemera, may often be found in early summer in the insect's favourite haunts.

In its perfect form the Drake is a four-winged fly; its hind wings being very small. It carries all its wings erect. Its antennæ are short and awl-shaped (*Subulicornes*). It has no mandibles—as the fly eats nothing, it has no need of these. Its tail is furnished with setaceous filaments. Over what period the existence of the insect extends has not been accurately determined. It is supposed that its aquatic life endures till the third year; its after existence is very brief—the Green Drake stage lasts for two or three hours; the Grey Drake for not many more; for as soon as the female has laid her eggs she perishes. With regard to the name, Cotton says, the insect is called *The Drake*, because its tail is turned back, but the generally received opinion is that it is so named because the artificial representations of it are made from the feathers of the Mallard, or Wild Drake.

We are told by Réaumur, that, in France, the flights of Ephemera sometimes resemble a fall of snow when the flakes are largest. And I have often sailed on the Ottawa and the St. Lawrence when the vessel has been covered to an offensive degree

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with Ephemera and Phryganea. Dr. H. A. Hagen has quoted from a letter to the late Professor Agassiz, from Mr. George E. Woodwell, of the *Tribune* Office, Chicago, Ill., July 23, 186 (?) as follows:—

“I send you a number of specimens* of a fly which annually visits our lake-cities, and which has the present summer appeared in larger swarms than ever known before. During the recent hot nights they have poured in from the lakes in myriads, rendering it necessary in lighted buildings to close the windows and doors in order to escape their visitation. For several nights past they have thus swarmed upon us, and the morning would witness about the posts of the street lamps large heaps, in some instances three inches deep, and covering an area of two or three yards square.”

Such times are the grand festivals of the finny tribes, when they become fat and well liking.

THE STONE FLY (*Perla*).

Cotton's quaint description of this insect is as follows:—

“Having told you the time of the *Stone-fly's* coming in (from the middle of April to the end almost of July,) and that he is bred of a cadis in the very river where he is taken, I am next to tell you that this same *Stone-fly* has not the patience to continue in his crust or husk† till his wings be full grown, but so soon as ever they begin to put out, that he feels himself strong (at which times we call him a jack,) squeezes himself out of prison, and crawls to the top of some stone, where if he can find a chink that will receive him, or can creep betwixt two stones, the one lying hollow upon the other, which, by the way, we also lay so purposely to find them. He there lurks till his wings be full grown, and there is your only place to find him, and from thence doubtless he derives his name; though, for want of such convenience, he will make shift with the hollow of a bank, or any other place where the wind cannot come to fetch him off. His body is long and pretty thick, and as broad at the tail almost as in the middle; his colour, a very fine brown, ribbed with yellow, and much yellower on the belly than the back; he has two or three whisks also at the tag of his tail, and two little horns upon his head. His wings, when full grown, are double, and flat down his back, of the same colour, but rather darker than his body and longer than it, though he makes but little use of them; for you shall rarely see him flying, though often swimming and paddling with several feet he has under his belly, upon the water, without stirring a wing.” *Comp. Ang.*, Part II., ch. 8.

In England four insects at least belonging to the *Perla* bear the name of “*Stone-fly*.” Their specific names are *Marginata*, *Grandis*, *Cephalotes*, and *Bicaudata*.

The female *Stone-fly* has the habit of carrying her bundle of eggs about with her between the caudal setae (which Cotton calls “the whisks at the tag of her tail”), and this for some time before depositing it in the water. The mass is as large as a swan-shot, and black. Seen under the microscope the individual eggs resemble dark brown oval capsules, with projecting fibres at one end denoting the point of egress for the larva.

Mr. P. H. Gosse, in his *Canadian Naturalist*, speaks of the *Perlina* as “*Water-flies*,” and alludes to them, under different dates, from the beginning of April to the middle of July.

HELLGRAMMITE (*larva*). HORNED CORYDALIS (*imago*). (*Corydalis cornutus*.)

Corydalis cornutus is the monarch of the *Water-flies*. I well remember the admiration with which I first looked upon the weird beauty of this remarkable insect, Fig. 6, represents the female with the wings expanded; Fig. 7, c, the male with the wings closed. The undulating body, dark and glabrous; the plated thorax, the square head, the powerful mandibulæ; the projecting eyes, black and bead-like; the long setaceous antennæ; the wonderful wings, smoked yet transparent, flecked with white, nerved and

* The letter contained dry specimens of *Ephemera natata*.

† Observe that Cotton is here confusing the larva of the *Stone-fly* with that of *Phryganea*, to be presently described.

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barred, and measuring five inches from tip to tip—presented, *tout ensemble*, an appearance both grim and fascinating. Beholding it one could not but desire to know more of the creature's history.

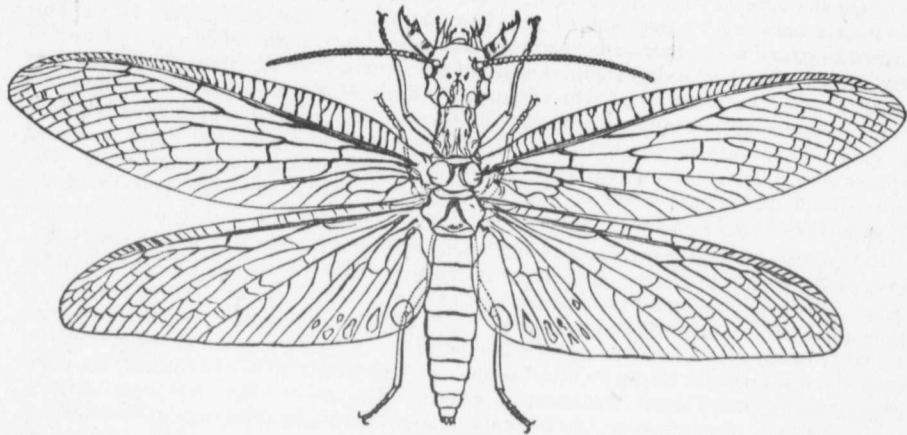


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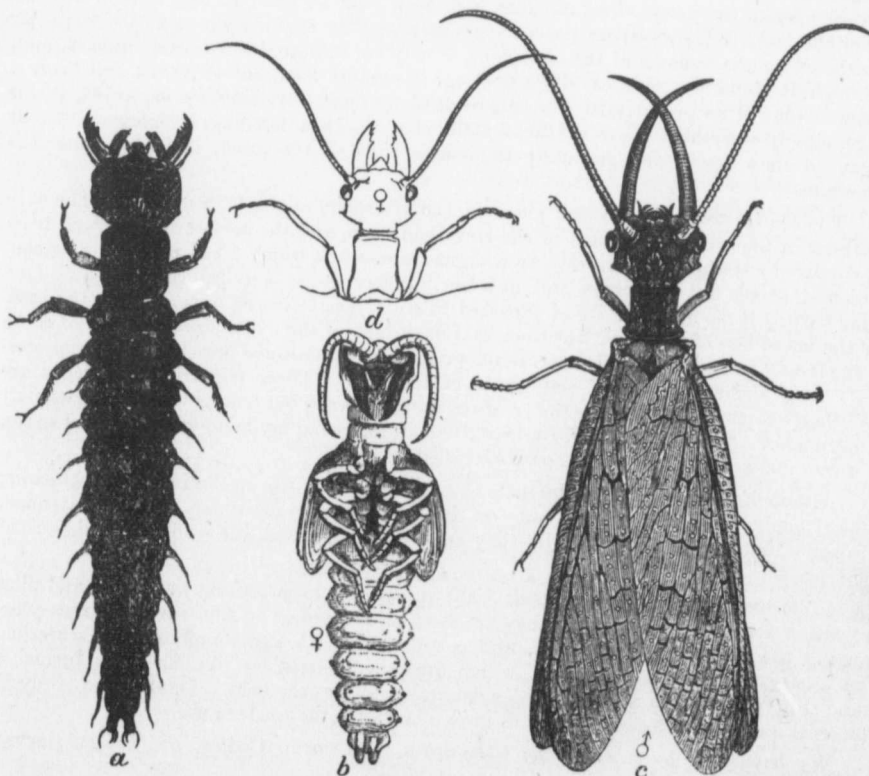


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In June and July of 1880 this desire, as regards myself, was, in a measure, gratified. I had the pleasure of watching the insect through its changes, from its larval to its pupal condition. The circumstances were these:—

On the 12th of June a lad brought me a strange creature which he had captured as it was crawling up the bank of the Yamaska River. (See *a*, Fig. 7.) It was four inches long, and about half an inch broad. Its colour was dark sepia. It had twelve segments beside the head. The first three of these were evidently thoracic, for the legs were attached to them, a pair to a segment. Each of the nine abdominal segments carried two remarkable appendages, one on either side, inclosing, I suppose, the branchiæ or gills. They were about a quarter of an inch in length, and gave the insect a fringed appearance. On the last segment they approached and overlapped the anal setæ. The square head of the insect was suggestive; and I said, "This must be the larva of the Horned Corydalis," and I took measures for its safety.

I procured a large flowerpot and half filled it with earth. In this earth I sank to the brim, a saucer full of water. I then put in the larva, and covered the pot with a pane of glass. The creature buried itself on the second day; I left it undisturbed for a week and then thought I would remove the earth carefully until I came to it, but, on lifting the saucer, I found that I had no need to do more for the larva lay exposed before me—it had formed a cist immediately under the saucer. In this cist it remained inactive until the 28th of the month, when it underwent a change. The skin of the three segments next the head divided down the back, and the pupa (*b*, Fig. 7) made its *debut* through the opening. The metamorphosis was very striking. Instead of the dark, muddy larva with all its grotesque, tag-like appendages, there lay the bright, clean, yellow pupa, with rudimentary wings and antennæ, and with eyes shewing blue through the waxen skin. Spiracles appeared along the sides; the branchiæ had been cast off; the six legs were drawn up under the body. The creature was very sensitive, either to the light or to the slight jar occasioned by the removal of the saucer, or, it may be, to both, for it became uneasy, and, although it could use neither wings nor legs it worked itself out of its cist and made a complete tour of its prison yard, drawing itself along by its formidable jaws, which, at this stage, closely resembled those of the female imago. In a few days a change of colour began to show itself, and gradually the whole body of the insect darkened with the same hue.

The change to the imago took place in the afternoon of the 12th of July. The skin was rent in the same way as that of the larva had been, and the perfect insect crept from its ruptured envelope. It crawled up a slight frame-work which I had placed for its convenience, shook out its wings, and in a few minutes assumed its full proportions. One thing surprised me greatly: I had expected to see a *female* insect appear from the case, for the mandibles of the pupa had been, as I have said, of the exact size and shape of those of the female imago; but the creature on making its appearance presented the preposterously long and scythe-shaped mandibulæ of the male. These frightful appendages are doubtless weapons of offence, for the creature showed its *vim* by striking with them viciously at my finger. So eager was it for a fray, that, in following my hand with repeated snaps, it drove the weapons through its own extended wings.

Although the mandibles of the male *C. cornutus* are of use to the insect for attacking a foe, I doubt whether this is the only or the chief purpose for which they are intended. I imagine that in the nuptial flight they are used for grasping the well-defended neck of the female.

C. cornutus lays its eggs (about 3000 in number) in masses on the stones and piles projecting from the river, where they are soon submerged or on the leaves of trees overhanging the stream. It surrounds and covers them with a white albuminous secretion. The numerous larvæ of the insect, which are called "crawlers" by fishermen, furnish a grand supply of food to our fresh-water fish, especially to the bass. I purchased lately in Montreal a clever imitation of the full grown larva for the angler's use.

We have now to consider the Case-worm, God-worm, Cadow, or Caddis, (larva), Caddis-fly (imago).

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PHRYGANEÆ.

The old English word *Cadas means a case for security. The word still lingers in tea-caddy. The case-worm or larva of *Phryganea* is a soft-bodied creature, but it has a firm head and strong jaws. It is supplied with six legs, well adapted for locomotion, and with two hooks at the end of the tail by which it secures itself in its case. It is a rapacious and pugnacious insect. It feeds upon fresh-water molluscs, larvæ, polyps, etc. As a builder it makes use of the materials at hand. The old Free Masons may have taken a lesson from it, and Longfellow might have had it in mind when he sang,—

“That is best which lieth nearest
Shape from that thy work of art.”

Sometimes the case is made of sticks, sometimes of grains of sand, and, in Great Britain, sometimes of the shells of the small river-snail (*Planorbis*), even while their proper owners have them in occupation. The cases not only serve for protection but for anchorage also, and they are found to be heaviest where the current is strongest—the creature having added materials to increase the weight.

If the caddis be deprived of its case, it will at once set to work to construct another; and, in confinement, it will build of materials supplied to it, such as small fragments of glass and coral and the broken teeth of combs. However rough the outside of the case may be, the inside is perfectly smooth, for it is lined with the same cement which binds the materials together, and which is exuded from the mouth of the creature.

It is interesting to watch the caddis shifting his ground, moving his habitation from one part of the river-bed to another. So much of the body as will allow the legs free motion is protruded and the creature strains like a horse with a heavy load, whilst its dwelling moves forward more or less steadily accordingly as it presents a smooth or roughened surface.

Before the *pupa* change takes place the caddis draws itself entirely into its snug quarters, and spins a strong netted covering over the entrance of the case. Having thus “barred the door” against intrusion, it dozes off into the long sleep, the waking from which shall be an introduction to a new life, in another element.

The Phryganidæ in their perfect state differ from others of the Neuroptera, in that they are covered with minute hairs. Hence Westwood and other English naturalists have classed them as a separate order, the Trichoptera (Gr. *τριξ*, hair; *πτερον*, a wing) or hairy-winged insects.

In dress the Phryganidæ are a sober people—browns, drabs and yellows are their favourite colours. Cross-venations give their wings a netted appearance. Their antennæ are long—in some instances very long, and the wings are carried longitudinally. The females deposit their egg masses early in August on some surface projecting from the flood. Westwood tells us (*Int. to Mod. Class. of Ins. Vol. II. page 62*) that occasionally they descend the stems of water-plants and lay them under water. The egg-mass resembles miniature frog-spawn. It is an accumulation of drops of gluten containing embryos in the form of minute green specks. The young larvæ burst forth in September, and proceed at once to construct their dwelling. They afterwards repeatedly “lengthen their cords and strengthen their stakes” according to their requirements.

“Our rivers abound with *fish* of various kinds, which at particular seasons derive a principal part of their food from insects, as the numerous species of the salmon and carp genus. These chiefly prey upon the various kinds of Trichoptera in their *larva* state called case or caddis-worms, and in their imago, May-flies.” (*Kirby and Spence, Int. to Ent. Letter IX.*)

The adult Salmon proper, *Salmo salar*, is believed by the best authorities, to eat little or nothing during its sojourn in fresh water. It leaves the ocean fat and returns to it emaciated. The above remark, therefore, does not apply to *Salmo salar*; but it does apply

*Kaddos, dim. of Kados, Gr. Parvus cadus, a small pot or jar, a ballot-box. See Schrevelii by Robertson, A. D. 1676.

to others of the genus, and especially to the English *Salmo fario*, or common trout; and the Canadian *Salmo fontinalis*, the brook trout; and *Salmo naymacush*, the Lunge. The lake shad (*Coregonus albus*), also is well known to have a keen relish for the Phryganidæ in their winged state.

CONCERNING ANTS.

BY G. J. BOWLES, MONTREAL.

Although everyone has seen ants, and thinks he knows something about them, there are not many who are well acquainted with their real history. The general knowledge of them and their habits is limited to a few facts; such as that they live in societies, seem always to be at work, and sometimes get into our dwellings, where they are regarded as a nuisance, and treated accordingly. To those, however, who have closely observed them, they have become objects of great interest. The studies, begun by Gould, De Geer, Latreille, P. Huber and others, have since been carried on by many naturalists; particularly, in our own day, by Sir John Lubbock in England, and the Rev. Dr. McCook in America, until a large amount of information has been gathered with regard to their economy. The secrets of their little lives, apparently so trivial, have been discovered, and their wonderful instincts and habits patiently unfolded, until the conclusion has been reached, that they stand highest of all the insect race with regard to intelligence. Indeed, Sir John Lubbock declares that, "when we consider their habits, their social organization, large communities and elaboratè habitations, their roadways, their possession of domestic animals, and even in some cases of slaves, it must be admitted that they have a fair claim to rank next to man in the scale of intelligence." In this respect, the Anthropoid Apes, so closely related to man in structure, and which so many naturalists would fain consider as our ancestors, sink far below these little creatures. For, until we find among the apes farmers, cattle owners, miners, engineers, builders, soldiers, and even gentlemen slave owners, as we do among the ants, we must consider the statement of Sir John Lubbock to be true.

In another aspect, ants are worthy of our notice. In all ages they have been used to "point a moral," and their industry and foresight held up as an example to the sluggard and the improvident. The Royal naturalist—the foremost entomologist and botanist of his age—places the ant among the "four things which are little upon earth," but are "exceeding wise;" and since his time, many a philosopher and moralist has drawn lessons from its proceedings.

Ants belong to the order Hymenoptera, the highest order of the insect world as regards organization and instincts. A society of ants is composed of at least three or four classes of individuals, males, females, neuters or workers, and, in some species, soldiers. The males and females, when first produced, have four membranous wings; the neuters, however, are born without these appendages. The males, after having performed their allotted part, die off and disappear. As among the bees, the female (of which there are nearly always one or more in each nest) is the acknowledged head of the community, and performs duties similar to those of the queen bee. Unlike the latter, however, when reigning she is always wingless. The four gauzy wings which she possessed when she issued from the parent nest are gone, either stripped off by the neuters, or voluntarily discarded by the insect herself. The latter operation has been often witnessed. I once saw a number of large ants (*Formica herculeana*) denuding themselves in this way. They flew to a small dead tree in my garden, and alighted on the branches. Then, by moving their wings in every direction, they at last disconnected them from their bodies. The discarded wings fell slowly to the ground, and the ants contentedly crawled down the trunk of the tree, and went off in different directions to begin their new life. The neuters or workers form the great bulk of every community. They are smaller than the males and females, and, in many species, are divided into two classes, workers and soldiers, the

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latter being larger in size and having larger heads than the others. These larger individuals are called soldiers, because they conduct the warlike operations of the community, both offensive and defensive. All the work of the nest is performed by the neuters, such as building, excavating, the procuring of food, and the care of the young.

This outline gives an idea of the constitution of an ant community as a whole, and the duties pertaining to the several classes of individuals comprised in it. It is a curious fact, however, that notwithstanding the researches of many excellent observers, and though ants' nests swarm in every field and wood, we do not know how these nests are commenced. Sir John Lubbock says, "Whether the queen joins an old nest, or associates with a certain number of workers to form a new one, or founds a new one for herself, is uncertain. Experiments have been carefully tried with single females, but they have nearly always failed, the queens, when isolated, not seeming to be capable of rearing the larvæ to maturity; and as the inhabitants of old nests usually act in a hostile manner towards females introduced into their nest, even when they are without a queen, it is probable that the founding of a new community is generally the result of a queen being joined by a number of workers. Nests have been known to exist for a long time without a queen, the society becoming, in fact, a republic; and in such a case, it is difficult to induce the ants to accept a new one, and return to the old form of government."

In the early summer large numbers of winged males and females are produced in the nests, but the pairing time does not arrive until much later in the season. If a nest be opened in midsummer, it will generally be found to contain these winged individuals, mixed with the wingless neuters,* who are said to prevent the others from leaving the nest until the proper time has come. Then they make their escape into the air, and what is called the "marriage flight" takes place. "Sometimes many nests will unite their swarms, which rise in columns with incredible velocity, and soar to a great height. Each column looks like a kind of slender network, and has a tremulous undulating motion. The noise emitted by myriads and myriads of these creatures does not exceed the hum of a single wasp, and the slightest zephyr disperses them." During this flight pairing is supposed to take place.

When a new community is formed, the workers immediately begin to prepare a habitation for it, either in the ground, or in whatever situation is in accordance with the instincts of the species. The queen begins to lay eggs, which the workers take charge of, and soon the whole business of the nest is actively in operation. Building is carried on, food is brought in, the young are safely reared, and the society quickly increases in numbers and prosperity. Unlike the nests of wild bees and wasps, which last only for one season, the settlements of ants may be called permanent, as the same nest is used year after year, and the losses by death and emigration are replaced by natural increase. This is one of the singular analogies which may be traced between the ant and mankind. During winter, in cold countries, the inhabitants must become torpid, as ants live for several years in the perfect state. Sir John Lubbock has had the same individuals in his formicaries for at least seven years, and even then they did not show any signs of old age.

Some kinds of ants feed wholly, or chiefly, on animal substances, other kinds on vegetable.

Great numbers of insects are destroyed by them, even in temperate climates, while in the tropics they devour rats and other small animals. In this way they are very useful, and the visitation of certain species in South America is looked upon by the inhabitants as a blessing. These ants travel in vast swarms, enter into the houses, and exterminate in a short time the vermin with which they are infested. To those which live on vegetable substances some of the most interesting species belong. In Canada, with its cold winters, it is not probable that we have any ants which lay up a store of food, as in the cold season the insects are torpid. But in warm climates it is otherwise. In India a species is found *Atta providens*, which not only stores up provisions, but of

* I opened a nest of *F. fusca* on the 25th June last, and found it as above stated.

which the stores consist of the seeds of a species of millet; and in the south of Europe, several species of the same genus, particularly *Atta barbara*, (See Fig. 8,) and *Atta structor*, lay up large stores of grain and seeds. Not only so, but the seeds stored up by them, seem, in some way not yet known, to be deprived of the power of germination. The history of the agricultural ants of Texas, given by the Rev. Dr. McCook in his book, is most wonderful. This species is represented in Fig. 9, and is known as *Myrmica barbata*. They make flat circular clearings from two or three to twelve feet in diameter, with roads diverging into the surrounding herbage, often of great length, and during working hours these roads are thronged by ants going and returning. In the middle of the day they take a *siesta* for two or three hours. The seeds, principally of rubiaceous plants and grasses, are gathered off the ground, and carried into the granaries, where they are shelled and the husks brought out and deposited in heaps. It seems even possible that they sow the seeds of a grass called *Aristida stricta* for themselves, though the author does not vouch for this. The supposition is not incredible, when we consider the intelligence displayed by these ants in regard to other things.

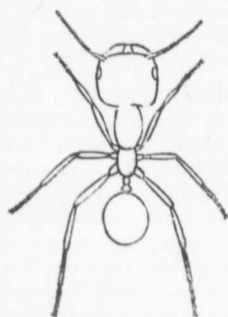


FIG. 8.

Atta barbara, worker, harvesting ant of Europe. (From Lubbock.)

Ants are extremely fond of sugar, in fact, saccharine substances are the principal food of many species. The love of ants for the *Honeydew* exuded by the *Aphides* or Plant lice is a well ascertained fact, and with this some of their most extraordinary instincts are connected. They climb the plants on which the aphides are found, that they may obtain this food, and have been seen to wait beside them for new drops, even touching them with their antennae, in order to cause the drops to flow, patting the abdomen of the aphid on either side alternately and rapidly; the ant, after the drop has been obtained, passing on to another aphid. The whole process has been likened to the milking of cattle. Even more wonderful things are asserted on this subject, as that particular ants seem to regard particular aphides as their own property, and are ready to fight in defence of their right, that, to secure them for themselves, they convey them from one place to another,—and that the *Aphis radicum*, which derives its nutriment from the roots of grass and other plants, is actually kept in large numbers in the nest of the Yellow Ant, (*Formica flava*), in order that they may have always at hand a copious supply of food, these aphides and their eggs sharing the solicitude of the ants equally with their own eggs and young. These statements, though apparently incredible, are yet the conclusions arrived at by careful and scientific observers.

In addition to aphides, ants often have as fellow-lodgers, certain species of small beetles, and even other insects.

It is not certainly known why the ants harbour and care for them, as ants are generally hostile to other insects, but the facts are well authenticated. No doubt the owners of the nests derive some benefit from their presence, or they would not be allowed to remain. In the Entomological Annual for 1857, Mr. Edward W. Jansen has an article on the ants-nest beetles of Britain, giving the names of thirty-six species which have been found in the nests of five different species of ants. About fifty species of beetles have been ascertained by continental entomologists to pass at least a portion of their lives in the nests of various species, not as mere intruders, but as cherished friends, over whom



FIG. 9.

Myrmica barbata, agricultural Ant of Texas, carrying seeds to granary. (Rev. J. G. Wood.)

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Typical nest of *F. B.*, hall; C, la E, pillars; F (From Lubbock)

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their hosts "watch with the greatest solicitude, bearing them tenderly back should they stray away, and hurrying them off to the innermost recesses of their subterranean burrows at the appearance of danger." Two years ago I examined a number of ants' nests on Montreal mountain, and found in many of them a species of small beetle which seemed to be at home, and friendly with the owners of the nests. I could not get it named in Montreal. No doubt our American species have habits in this respect similar to those of the European ants. The subject is a curious one, and worthy of the attention of our entomologists.

The nests of ants are of many different kinds. Some species make them altogether under the surface of the ground, others build theirs in the shape of a dome, the galleries and chambers being both above and below the surface level. None of our Canadian ants make nests of any great size. The largest ant-hills formed by any British species are those of *Formica rufa*, which are sometimes as big as a small hay-cock, but in South America, ant-hills are found of fifteen or twenty feet in height. Inside the nest are numerous small apartments, arranged in separate stories, and communicating with each other by means of galleries. Many of the species of those called Mason Ants construct their habitations in a much more elaborate manner, making use of soft clay which they knead and mould with their mandibles and feet. The partition-walls of the galleries and chambers of *Formica brunnea* are about one-twentieth of an inch thick, and half an



FIG. 10.

Typical nest of *Formica nigra*. A, entrance;
B, hall; C, large chamber; D, sanctum;
E, pillars; F F, entrances to sanctum.
(From Lubbock.)

inch high; the roofs somewhat arched, and pillars are made use of as supports. Fig. 10 shows the nest of *Formica nigra*. Huber saw a working ant of another species (*F. fusca*), without assistance, make and cover in a gallery two or three inches long, with a roof a perfect concave. Other species, the Carpenter ants, make their homes in the trunks of old trees, gnawing the wood into apartments and galleries, with floors and partitions as thin as card. *Formica flava* builds its partitions of a sort of papier-maché of sawdust, earth and spider's web. An East Indian species, *Myrmica Kirbii*, forms a globular nest of a congeries of tile-like laminae of cowdung, the interior exhibiting a series of apartments and galleries. And some in Australia form theirs of the leaves of trees glued together, after being first brought into position by the united strength of multitudes. Amid this endless variety, each species prepares its habitation as prompted by its special instinct, performs its task in a perfect manner, and with an industry and perseverance which cannot be excelled.

More than a thousand species of ants are known, and they are generally distributed over the temperate and tropical regions of the globe. In tropical countries they are more numerous in species and individuals than with us, and present a greater variety of instincts and habits. The ants of temperate climates are, if we may so speak, more civilized than the others: more of the species have settled habits, and they lead quieter lives than the ants of the tropics. It is true that some of the European ants are predatory and warlike, and some have a liking for making slaves of their neighbours and keeping them in bondage, but none of them can compare with the Foraging Ants of South and Central America for fierceness and bloodthirstiness. These Ants (*Eciton*) appear to have no fixed place of abode, but shift their camp at intervals of a few days, and live by predatory forays, hunting in organized bands and ravaging the nests of other species, or even attacking small animals. One of the best known species is *Eciton predator*, a small ant which hunts in dense hordes, and marches rapidly over a territory. A moving phalanx of this species will extend over from four to six square yards; and any unwary insect meeting with, or falling into the serried ranks, is soon torn to pieces and devoured. *Eciton hamata* hunts both in dense masses and in detached columns. The

nature of the prey appears to regulate the mode of march. Thus, when proceeding in columns, Mr. Belt found that *hamata* was in search of the nests of another ant of a different genus (*Hypoclinea*), the larvæ and pupæ of which they seize for the purpose of bringing them up as slaves. The *Hypoclineas*, who are of rather meek disposition, and

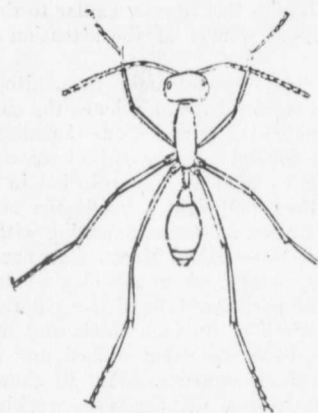


FIG. 11.



FIG. 12.



FIG. 13.

make no effort at self-defence, rush out of their nest on being attacked, and strive to escape, bearing their young in their jaws, but the *Ecitons* at once seize the young ants, although they never appear to injure the parent *Hypoclineas*. Although so cruel in disposition, these *Ecitons* are endowed with much intelligence, and in their expeditions often show a capacity for overcoming difficulties, which really merges on reason. Thus, in crossing a crumbling slope, which was gradually disintegrating under the passage of the ant-army, a portion of the band, by adhering to each other, formed a solid pathway, over which the others passed safely. On another occasion a twig formed a bridge over a



FIG. 14.

Ecodoma cephalotes, worker Parasol Ant, Brazil.
(Rev. J. G. Wood.)

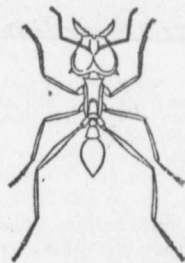


FIG. 15.

Ecodoma cephalotes,
worker Major, Brazil.
(From Lubbock.)

small rill; but this proving too narrow for the transit of the army, it was widened by ants clinging to each side of the twig, and in this way the track was broadened sufficiently to admit of the easy passage of the mass. (Fig. 11 represents *Eciton Mexicana*; and Fig. 12, *E. sumichrasti*; and Fig. 13, *E. drepanophora*.)

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The leaf-cutting ants (*Ecodoma*) are noted pests of central and tropical America, and commit fearful havoc among trees, laboriously and persistently carrying off in their mouths, piece by piece, the foliage of trees and shrubs. The orange, lemon and mango trees, in particular, suffer from their attacks. Central America is also the home of a gigantic black ant, about one inch in length, and armed with a formidable sting. These ants are notable for their solitary habits, and represent, in their family, the solitary wasps among the Vespidae. Fig. 14 represents *Ecodoma cephalotes*, worker; and Fig. 15, worker Major.

There is a remarkable species of ant found in Mexico, in which certain individuals in each nest serve as animated honey-jars, *Myrmecocystus Mexicanus*. (See Fig. 16.) To them the foragers bring their supplies, and their whole duty seems to be to receive the honey, retain it, and re-distribute it for food when required. The abdomen of these ants becomes enormously distended; the intersegmental membranes being so much stretched, that the chitinous segments, which alone are visible in ordinary ants, seem like small brown transverse bars. These individuals never leave the nest. A similar habit prevails in an Australian species, *Camponotus inflatus*, which is shown in Fig. 17.

The slave-making propensity has been carefully studied in some European species, and much interesting information regarding it placed on record. Huber was the first



FIG. 16.

Myrmecocystus Mexicanus, Honey Ant of Mexico. (Rev. J. G. Wood.)

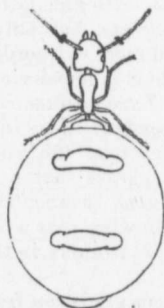


FIG. 17.

Camponotus inflatus, (Lubbock.) Honey Ant of Australia (magnified twice).

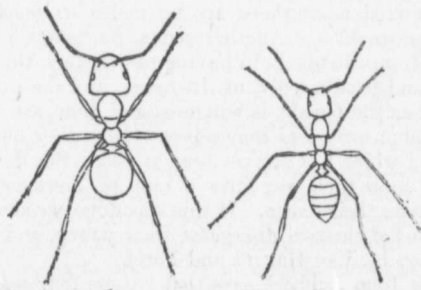


FIG. 18.

1. *Formica sanguinea*, worker. 2. *Polyergus rufescens*, worker. Both slave-making species, Europe. (From Lubbock.)

observer who discovered the existence of slavery among ants. There are several species which have the habit, some in a stronger degree than others; and it is singular that the institution has had a most degrading effect on those which seem most addicted to it. *Formica sanguinea*, (see Fig. 18,) found in the southern counties of England and throughout the Continent, is a species with which the habit has become established. They make periodical expeditions, attack neighbouring nests, and carry off the pupæ. When the latter come to maturity, they find themselves in a nest consisting partly of *F. sanguinea* and partly of their own species, the result of previous expeditions. They adapt themselves to circumstances, assist in the ordinary household duties, and, having no young of their own species, feed and tend those of the *sanguineas*. But though the *sanguineas* are thus aided by their slaves, or, as they should rather perhaps be called,

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their auxiliaries, they have not themselves lost the instinct of working. It seems not improbable that there is some division of function between the two species, but we have as yet no distinct knowledge on this point; and at any rate the *F. sanguineas* can "do" for themselves, and carry on a nest, if necessary, without slaves. The ants usually enslaved by this species are *F. fusca*, which is found in Canada.

Another species, *Polyergus rufescens*, Fig. 18, No. 2, is much more dependent on its slaves, being, indeed, almost entirely so. Even their bodily structure has undergone a change, their mandibles have lost their teeth, and become useless save as warlike weapons. They have lost the greater part of their instincts, their art of building, their domestic habits,—for they show no care for their young, all this being done by slaves; their industry,—they take no part in providing their daily supplies; if the colony changes the situation of its nest, the masters are all carried by the slaves on their backs to the new one; nay, they have even lost the habit of feeding. Huber placed thirty of them with some larvæ and pupæ and a supply of honey in a box. "At first," he says, "they appeared to pay some little attention to the larvæ; they carried them here and there, and presently replaced them. More than one-half of the Amazons died of hunger in less than two days. They had not even traced out a dwelling, and the few ants in existence were languid and without strength. I commiserated their condition, and gave them one of their black companions. This individual, unassisted, established order, formed a chamber in the earth, gathered together the larvæ, extricated several young ants that were ready to quit the condition of pupæ, and preserved the life of the remaining Amazons." These so-called workers of *P. rufescens*, though thus helpless and idle, are numerous, energetic, and in some respects almost brilliant, but their energies are devoted to the war-like spoliation of their neighbours.

In another slave-making ant, *Strongylognathus*, the workers are much less numerous, and so weak that it is an unsolved problem how they procure their slaves, a species called *Tetramorium cespitum*. Nevertheless, they are always found with the latter, and in these mixed nests there are no males or females of *Tetramorium*, but only those of *Strongylognathus*. Another genus, *Anergates*, has a history still more extraordinary. It differs from the others in having no workers, the nests in which it is found consisting of males and females only, of *Anergates*, and the workers only of *Tetramorium*. The male, as well as the female, is wingless, and they are absolutely dependent upon their slaves, and cannot even feed themselves. How they obtain the mastery over the workers is a problem which has not yet been solved. Sir John Lubbock suggests that a male and female make their way into a nest of *Tetramorium*, and in some manner contrive to assassinate their queen. If this was done, we should find the following year a community composed of the two *Anergates*, their young, and the *Tetramorium* workers, in the manner described by Van Hagens and Forel.

Sir John Lubbock says that "these four genera offer us every gradation from lawless violence to contemptible parasitism.

"*Formica sanguinea*, which may be assumed to have comparatively recently taken to slave-making, has not as yet been materially affected.

"*Polyergus*, on the contrary, already illustrates the lowering tendency of slavery. They have lost their knowledge of art, their natural affection for their young, and even their instinct of feeding! They are, however, bold and powerful marauders.

"In *Strongylognathus* the enervating influence of slavery has gone further, and told even upon their bodily strength. They are no longer able to capture their slaves in fair and open warfare. Still they retain a semblance of authority, and, when roused, will fight bravely, though in vain.

"In *Anergates*, finally, we come to the last scene of this sad history. We may safely conclude that in distant times their ancestors lived, as so many ants do now, partly by hunting, partly on honey; that by degrees they became bold marauders, and gradually took to keeping slaves; that for a time they maintained their strength and agility, though losing by degrees their real independence, their arts, and many of their instincts; that gradually even their bodily force dwindled away under the influence to which they had subjected themselves, until they sank to their present degraded condition—weak in body and mind, few in numbers, and apparently nearly extinct; the miserable representatives

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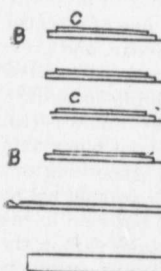


FIG. 18.
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Putting to one side, however, the slave-holding ants, we find in the different species different conditions of life, curiously answering to the earlier stages of human progress. Thus some species, such as *Formica fusca*, live principally by the chase, for, though they feed partly on the honeydew of aphides, they have not domesticated these insects. They resemble the lower races of men, who subsist mainly by hunting. They frequent woods and wilds, their communities are small, they hunt singly, and their battles are single combats, like those of the Homeric heroes. *Formica flava* represent a higher type of social life. They show more skill in architecture, have domesticated certain species of aphides, and may be compared to the pastoral stage of human progress—to the races which live on the produce of their flocks and herds. Their communities are more numerous, and they know how to act in combination. Lastly, the agricultural nations may be compared with the harvesting ants.

MENTAL CHARACTER.

Our present knowledge of the life history of ants is due not only to observations made upon them in the field, but also to close study of captive communities. P. Huber seems to have been one of the first to establish formicaries, and his account of his efforts and success are very interesting. The idea, however, has been recently carried out to a much greater extent, and with greater success, by Sir John Lubbock, the well-known English naturalist, who, for several years past, has had from thirty to forty communities under observation at one time, comprising some fifteen of the British species, and many of the foreign forms. Fig. 19 shows one of these formicaries.

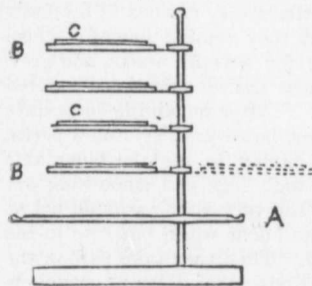


FIG. 19.

Stand for nests—A, lower platform, with moat for water; B, swinging shelves; C, nests. (Lubbock.)

His nests are formed of two plates of common window glass, about ten inches square, kept apart at a distance of from one-tenth to one-quarter of an inch by wooden slips round the edges, leaving a small space at one corner for an entrance. The space between the two panes of glass is filled with fine earth, and when the ants have taken possession, they tunnel out the earth, and thus form their chambers and galleries. These nests are placed on shelves, swinging on a central support, one above another, and some five or six inches apart. The nests can thus easily be turned round for inspection. Below all is a larger platform, with a deep groove round it filled with water, to prevent the ants wandering away from the apparatus.

It is easy to induce the ants to live in one of these nests, if the right way is known. Sir John Lubbock says, "When I wished to start a new nest I dug one up and brought home the ants, earth, etc., all together. I then put them over one of my artificial nests, on one of the platforms surrounded by a moat of water. Gradually the outer earth dried up, while that between the two plates of glass, being protected from evaporation, retained its moisture. Under these circumstances, the ants found it more suitable to their requirements, and gradually deserted the drier mould outside, which I removed by degrees."

In these nests, when they had become accustomed to their new quarters, the insects carried on their usual labours as freely as in their native haunts, and afforded special facilities to the patient naturalist for observing the internal economy of ant life. And he has not only studied them in communities, but has made careful observations on individual ants, which have afforded many new and curious facts with regard to their dispositions and habits.

Let us look at one of these nests, say of *Formica fusca* (a species also found in Canada), and represented in Fig. 20, and note the domestic economy of the inmates. They form an organized society of perhaps several hundred individuals, the head of which is

the queen ant, and all work harmoniously together for the general good. The fact, however, that their food is provided for them, releases them from a task which must take up

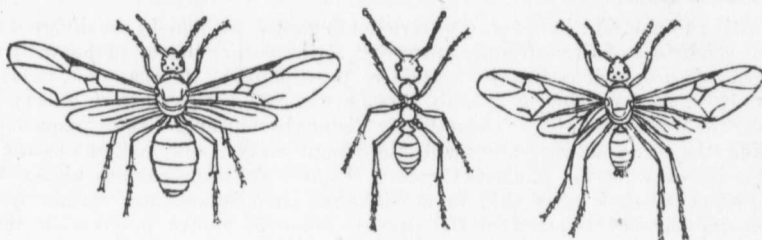


FIG. 20.

Formica fusca, Canadian and European species, female, worker and male. (From Westwood.)

a great part of the time and labour of a community living in a free condition. With a supply of honey at their very door, it is not necessary to hunt over the whole neighbourhood for something to eat, which, when found, would perhaps be no better than the "dried grasshopper's leg," immortalized by Mark Twain in his "Tramp Abroad." But this gives them more time for their other duties—building, excavating, and "cleaning up," and also for that most important work, the care of the "rising generation," in the shape of the eggs, larvæ and pupæ belonging to the nest. The eggs hatch in from two to six weeks after being laid by the queen ant, and produce small white legless grubs, somewhat conical in form, being narrow towards the head. "They are carefully tended and fed, being carried about from chamber to chamber by the workers, probably in order to secure the most suitable amount of warmth and moisture. I have observed, also, that they are very often assorted according to age. It is sometimes very curious in my nests to see them arranged in groups according to size, so that they remind one of a school divided into five or six classes." In this stage they live for several weeks, and grow rapidly. When full grown they turn into pupæ, sometimes naked, sometimes covered with a silken cocoon, constituting the so called "ant-eggs." After remaining some days in this state, they emerge as perfect insects. In many cases, however, they would perish in the attempt, if they were not assisted; and it is very pretty to see the older ants helping them to extricate themselves, carefully unfolding their legs and smoothing out the wings with truly feminine tenderness and delicacy. The very young ants do not at first take any share in the defence of the nest or other out-of-door work, but help in the care of the larvæ and pupæ, until their skin has hardened. Then they take part in the general labours of the society. How far, however, the "division of labour" system is carried, has not yet been ascertained. But there are good reasons for thinking that it is followed out to some extent, as several of Sir John Lubbock's observations point in this direction. One of these was as follows:

"In summer the ants moved freely about the stand, and each one fed itself, but when the weather became cold and gloomy, and the ants required but little food, they remained indoors, and deputed to certain individuals the duty of procuring supplies for the whole community. During the winter, two nests of different species were kept under constant observation, and the foragers were marked, so that they could be identified. One of the nests was a large community of *F. fusca*, and it was found that the whole supply of food for this nest was carried in by the same four or five ants for a period of several weeks. The other nest was of *Polyergus rufescens*, a slave-holding species. In this case the mistresses never came out for food, leaving the work to three slaves, who carried it into the nest daily for the two months during which the observations continued."

The inmates of a nest are bound together by ties of friendship, and have a strong feeling of attachment to their own community. Hence some species—like the old Highland clans—regard other nests, even of their own species, as enemies, and will not allow a stranger ant to remain among them. Other species, however, are not quite so exclusive. The inhabitants of a nest all recognise one another; a wonderful fact, when we consider the number of individuals in some of their settlements. In the larger societies of *Formica*

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FIG. 21.

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The industry Sir John Lubbo worked, without containing larvæ, to the nest. I ha observations sever I went to bed at out she began to my return I took feet from the nest However, though immediately picke returned for another

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pratensis (in a wild state), there are probably from 400,000 to 500,000 ants, and in other cases even these large numbers are exceeded. Yet they not only recognise each other while living together, but even after living apart for a long period. Thus Sir John Lubbock separated one of his colonies of *F. fusca* into two halves, and kept them entirely apart. At different times he put specimens from the one half into the other. At first they were always amicably received, but after some months' separation, they were



FIG. 21.

occasionally attacked, as if some of the ants, perhaps the young ones, did not know them. The mistake, however, was always rectified in a short time. The last three ants were put back after a separation of a year and nine months, yet they were well received, and evidently recognised as friends. *Formica fulvacea* is shown in Fig. 21.

Further experiments were made by this accomplished observer, with pupæ taken from a nest and brought up by stranger nurses. Even these young ants, when placed in the nest from which they had been taken as pupæ, were acknowledged as friends. But when they were put into the nest from which their nurses had been taken, they were always attacked. A still more extraordinary fact is, that ants will recognise the claims of consanguinity even in young ants taken from their nest in the egg state, and brought up wholly by strangers. How this recognition of their friends is effected, is a mystery. Signs, passwords, the sense of smell, have all been suggested by naturalists as the solution of the problem, but none of these are fully satisfactory.

Besides this power of recognising their friends, there is no doubt but that they have the power of communicating information to one another. Indeed, their acting in concert in large numbers, for some special object—as in their warlike expeditions—is a proof of this, for without this faculty, such combinations would be impossible. Sir John Lubbock tried many experiments with marked specimens, and came to the conclusion that ants can impart information to their fellows, but the *modus operandi* could not be made out. It seems to be connected in some way with signs given by touching with the antennæ, which, (according to Huber and others), they use freely in this manner. That it is imparted by sound, is not probable, unless ants can hear sounds which to us are altogether inaudible. Sir John Lubbock attached an extremely sensitive microphone to one of his nests, for the purpose of testing this point. The ants could be distinctly heard walking about, but no other sounds could be distinguished.

The industry of ants has long been celebrated. They work literally day and night. Sir John Lubbock says, "I once watched an ant from six in the morning, and she worked, without intermission, till a quarter to ten at night. I had put her to a saucer containing larvæ, and in this time she carried off no less than a hundred and eighty-seven to the nest. I had another ant, which I employed in my experiments, under continuous observations several days. When I started for London in the morning, and again when I went to bed at night, I used to put her in a small bottle, but the moment she was let out she began to work again. On one occasion I was away from home for a week. On my return I took her out of the bottle, placing her on a little heap of larvæ about three feet from the nest. Under these circumstances I certainly did not expect her to return. However, though she had thus been six days in confinement, the brave little creature immediately picked up a larvæ, carried it off to the nest, and after half an hour's rest, returned for another."

If they work so hard, why should they not sometimes play? Huber mentions scenes which he had witnessed on the surface of ant hills, which strongly resembled sportive games. The ants raised themselves on their hind legs, caressed one another with their antennæ, engaged in mock combats, and almost seemed to be playing hide and seek. Gould, an old English observer, also mentions having seen similar "amusements." Even the terrible *Eciton*s sometimes relax. Bates observed behaviour, in the case of *Eciton legionis*, which looked like simple indulgence in idle amusement; the conclusion, he says, "that the ants were engaged merely in play was irresistible."

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Ants are very cleanly, and assist one another in this respect. They are often seen licking one another, and those which Sir John Lubbock marked with paint, for the purpose of identification, were gradually cleaned by their friends. Those, too, which die in the nest, are always carried outside, and in the cases observed by Sir John Lubbock, were generally thrown into the moat surrounding his apparatus.

As to their friendly feelings towards each other, it is shown to a different degree by different ants, for, like men, they differ in individual character. Of course, in carrying on their ordinary avocations, they act together with great harmony, but it is in exceptional circumstances that their real character in this respect is revealed. In the case of sick or disabled ants, he has observed, on several occasions, that they were carefully nursed and guarded: while on others, their friends acted more like the Priest and the Levite than the Good Samaritan. Even in the case of ants who had got drunk (not voluntarily, however), their friends picked them up and carried them to the nest to sleep off their potations. But if these intoxicated ants were strangers, they were thrown into the water. Indeed, the experiments proved that though their friendship for each other is strong, their hatred to their enemies is still stronger, for they were willing to leave friends in confinement, if they could only get at stranger ants and maltreat them. No doubt this must be regarded as a blemish in their character.

SENSES—SIGHT, HEARING AND SMELLING.

As regards vision, the species of ants are very differently endowed. Some have upwards of a thousand facets in their eyes, others less, some *Ecitons* only one. Some species are entirely blind. One of these, *Ponera contracta*, is found in England. Besides the compound eyes, many species are furnished with simple eyes (*ocelli*) on the top of the head.

Whether each facet in an insect's eye acts as a separate organ, or only a part of the object is seen by it, is a question not yet decided by entomologists. The latter, however, is the prevailing opinion, in which Sir John Lubbock, who has made many observations on the vision of ants, is disposed to coincide. "If," he says, "the male of *Formica pratensis*, for example, sees 1,000 queens when only one is really present, it would seem to be rather a bewildering privilege." Still, if we do not know *how* they see, we know that they *do* see, and by taking advantage of their dislike to light in their nests, he found that they were susceptible to colour, and prefer some to others. By placing strips of violet, red, green and yellow glass over their nests, he discovered that they preferred the green and yellow, and particularly avoided being under the violet, and after many elaborate experiments with the magnesium light, the spectra of different substances, etc., he concludes that they have an aversion to that colour, and even that they are very sensitive to the ultra-violet rays of the spectrum, which our eyes cannot perceive. This he considers a very interesting discovery, making it probable that these rays appear to ants as a distinct and separate colour (of which we can form no idea), as unlike the rest as red is from yellow; and that, as light appears to them composed of not only the rays which we see, but of those of the ultra-violet, the general aspect of nature must, as regards colour, present to them a very different appearance from what it does to us.

None of the experiments he tried could prove to him that ants had the power of hearing. Tuning forks, penny pipes, shrill whistles, a fiddle, or the most piercing and startling sounds he could produce, had not the slightest effect upon them. Still, he thinks that they may be capable of hearing sounds which we cannot distinguish. In the terminal joint of the antennæ of ants there are several curious structures, which seem to be auditory organs. They are of two kinds, one a cork-shaped organ, opening on the outer surface of the antenna. The other kind is in the form of a stethoscope, (see Fig. 22) with an outer sac (s) a long tube (t), and a posterior chamber (w) to which is given a nerve (n).

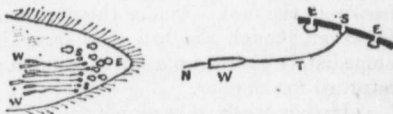


Fig. 22.

Terminal portion of antenna of *Myrmica ruginodis*; E, "cork-shaped" organs. S, opening of "stethoscope" on surface. T, tube. W, inner chamber. N, nerve. (From Lubbock.)



Fig. 23.

Sir John Lubbock's experiment of the trap apparatus. A European native.

Ants possess a segment, which they are provided with of emitting sound, deaf, their perception where ours begins.

Their sense of scents, from as far as it seems to be the being in fact the

The ants of the species catalogued in the United States of Canada.

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Brown

Entirely

First discoid

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Reddish or y

Yellow

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Genus Myrmica

Peduncle of

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F. herculea

This, the largest in decaying trees destructive powers page 38. Found in small insect, only does not mention it.

F. Mellea (Pro under stones.

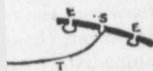
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Sir John Lubbock has also discovered in the front tibiae of *Formica flava* an arrangement of the tracheal tubes in a somewhat similar way, which may also serve as a hearing apparatus. A similar organ is seen in the front tibiae of *Gryllus*, and is thought by some European naturalists of eminence to be for this purpose.

Ants possess a stridulating apparatus on the upper surface of the fourth abdominal segment, which is finely ribbed, and when rubbed, gives out a sound. We see, then, that they are provided with what are presumably organs of hearing, and also with the means of emitting sound, so that although Huber, Forel, and others, state that ants are quite deaf, their perceptions of sound may really be far more delicate than ours, but ending where ours begin.

Their sense of smell is well developed. Their behaviour, when tested with various scents, from assafœtida to lavender water, proved conclusively that this was the case. And it seems to be the principal means of finding their way, more serviceable even than sight, being in fact the keenest and most useful of their senses.

CANADIAN SPECIES.

The ants of Canada have not been much studied. The following list comprises all the species catalogued up to the present, but, no doubt, it could be much enlarged, as the United States possesses about 200 species. Only two genera have so far been found in Canada.

Genus *Formica*, (Linn.)

Peduncle of abdomen with one knot.

Discoidal cellule not closed.

Black, feet and thorax partly red..... *herculeana*.

Entirely black..... *Pennsylvanica*.

Brown or black, feet pale..... *pallitarsis*.

Entirely yellow..... *mellea*.

First discoidal cell closed.

Black, feet red..... *fusca*.

Reddish or yellowish.

Yellow or yellowish red, abdomen black..... *rufa*.

All brownish or reddish yellow..... *flava*.

Genus *Myrmica*, (Latreille).

Peduncle of abdomen with two knots.

Bright red and black..... *incompleta*.

Pale red and black..... *tuberculum*.

Pale yellow, size small..... *molesta*.

F. herculeana, (Linn), *ligniperda*, (Latr).

This, the largest of our ants, is black, with the feet and thorax partly red. It lives in decaying trees or wood, where it forms numerous galleries. An example of its destructive powers is given by Mr. E. Baynes Reed, in the Annual Report for 1883, page 38. Found also in Europe. *F. Pennsylvania*, (DeGeer). A somewhat smaller species than the former, but having similar habits. *F. pallitarsis*, (Provancher). A very small insect, only $\frac{3}{16}$ of an inch long, black, with pale feet. The Abbé Provancher does not mention its habits.

F. Mellea (Provancher). $\frac{1}{16}$ inch long, and of a uniform pale yellow colour. Lives under stones.

F. fusca, (Linn). A well-known species, found also in Europe. It generally makes its nests under stones, in sheltered places. Very common on Montreal Mountain.



Fig. 23.

F. rufa, (Linn). A yellowish red species, common also in Europe. Fig. 23 represents the female of this species. It forms its nests in the earth, covering them with the soil it carries out of its galleries, mixed with bits of wood and other rubbish, so as sometimes to raise considerable mounds. Figure 24 represents one of their nests. In Europe it is called the Wood Ant, its nest being generally found in woods.

Part of 10
Species, known
to occur
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Canada
pp.
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Fig. 24. The Wood Ant, *Formica rufa*.



1. Abdomen of (R) between 2nd and 3rd segments.
2. Tibia of *F. rufa* (S S), returned to its normal position.

M. molestus the ant sometimes etc., in the day. Provancher says that it is not in the habit of biting purposes.

The ants of *M. molestus* and workers, are not biting purposes.

A curious fact is mentioned by Provancher in his work on the bark, which is eaten with avidity. In the autumn they are seen digging and they were picked up by those who should have

The insects are considered by entomologists as true entomophagous, membranous hymenoptera to which it is necessary to mention frequently and mentioned all by the sweet sp

NOTE.—In compiled in the *Encyclopedia, Nature* and particularly in the *Report for 1880*.

An exceedingly interesting report for 1880. In it including full directions for the Bethune, owing to his being compelled to relinquish his result which we feel su

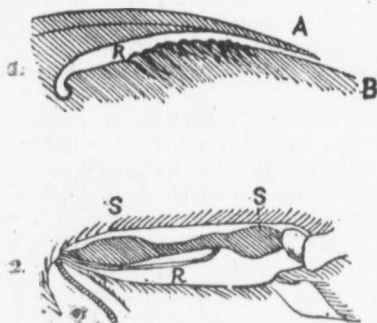


Fig. 25.

1. Abdomen of *F. flava* showing ridges (R) between 2nd and 3rd segments (A and B).
2. Tibia of *F. flava*, showing enlarged trachea (S S), return tube (R) (From Lubbock).

F. flava (Fabr). This species establishes its nest at the sides of roads, in fields, raising a small mound by its labours. It is about $\frac{1}{3}$ of an inch in length, or about the same size as the two species preceding.

Myrmica, the second genus, has two "knots" in the peduncle of the abdomen, while *Formica* has only one. These genera can be easily distinguished by this difference, which is shown in fig. 25. *M. incompleta*, (Provancher). A species about $\frac{1}{4}$ of an inch long, bright red and black. Very common under stones, particularly in sandy localities. Perhaps this is the *dimidiata* of Say. *M. tuberculum*, (Fabr). Light red and dull black in colour, and about $\frac{1}{5}$ of an inch long. A rare species (in the Province of Quebec), found under the bark of trees.

M. molesta, (Say). A very small ant, only $\frac{3}{20}$ of an inch long, and pale yellow. This is the ant sometimes so troublesome in houses. It hides in the crevices of the plastering, etc., in the daytime, and at night swarms in the cupboards or wherever food is left. M. Provancher says he has never met with it, except in houses, which leads him to believe that it is not indigenous, at least in the Province of Quebec.

The ants of the genus *Formica* do not sting, while those of *Myrmica*, both females and workers, are furnished with that weapon. All, however, can use their mandibles for biting purposes.

A curious practice of the *habitans* in the Province of Quebec is mentioned by M. Provancher in the *Naturaliste Canadien*. He states that in felling trees, particularly in winter, the woodcutters often find numbers of the benumbed ants in the cavities of the bark, which they eat as delicacies. "We, ourselves," he says, "have seen ants eaten with avidity. Passing through Somerset in November, 1876, we remarked several children digging among the roots of an old stump. We approached them, and found that they were picking out ants from the bark of the roots and eating them, disputing as to who should have the largest share. It was our black ant, *Formica Pennsylvanica*."

SAW-FLIES.

(*Tenthredinidae*.)

BY W. HAGUE HARRINGTON, OTTAWA.

The insects to be briefly described in this paper belong to the division known to entomologists as the *Hymenoptera*, which order contains all forms having four transparent, membranous wings. To give a clear conception of the appearance of typical hymenoptera to those unfamiliar with the different orders of insects, it will only be necessary to mention the honey-bee. The habits of this familiar insect have been more frequently and more fully investigated than those of any other, and it is endeared to us all by the sweet spoils which it gathers; its remarkable industry in harvesting the dainty

NOTE.—In compiling this paper, I have drawn material from the Encyclopædia Britannica, Chambers' Encyclopædia, Nature, Science Gossip; Huber's "Fourmis Indigenes"; Provancher's "Naturaliste Canadien," and particularly from Lubbock's work. "Ants, Bees and Wasps, 1882."

An exceedingly interesting paper on Ants, by Rev. C. J. S. Bethune, is contained in the Annual Report for 1880. In it will be found much information on the subject, not contained in the present paper, including full directions for getting rid of them when they infest houses. It may be added that Mr. Bethune, owing to his onerous duties as Principal of the Trinity College School, Port Hope, has been compelled to relinquish his intention of continuing his papers, on these interesting insects, in the Reports—a result which we feel sure our readers will hear of with great regret.

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pp. 63.

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secretions of flowers having been so directed and controlled by man as to obtain the best results for himself. The habits of many ants, wasps, ichneumon-flies and other hymenoptera have been also studied, but there remain vast numbers of which little or nothing is known, and which afford scope for the observations of all who seek to add to our knowledge of insect life.

Hymenoptera are divided into two sub-orders, named respectively Aculeata, or stingers, and Terebrantia, or borers. The first contains the bees, wasps, ants and other insects which have the abdomen (in the females) furnished with a sting to which an irritating poison is applied by special glands. The second contains forms in which the abdominal instrument is so constructed as to be used in sawing slits or boring holes in which the insect may deposit its eggs. It may be conveniently divided into three sections, namely: Entomophaga, or insect-eaters, such as the ichneumon-flies; Gallicola, or gallformers, consisting of a single family called Cynipidæ; and Phytophaga, or plant-eaters, containing the saw-flies and horn-tails.

The Phytophaga, being plant-eaters and consequently destructive and obnoxious insects, are of more immediate interest to agriculturists than the other sections. They are divided into two families, Uroceridæ and Tenthredinidæ. The former contains a limited number of species, usually of large size, of which the females are provided with a long augur-like borer for inserting their eggs deeply into the wood of the trees in which the larvæ feed when hatched.

The Tenthredinidæ, or second family, is that of which the remainder of this paper will treat. It includes the insects popularly known as saw-flies, of which certain species are well-known to every one who has attempted agriculture on even the smallest scale.

Saw-flies have none of the interesting social, or architectural habits of bees, wasps and ants, and, although highly organized in many points of structure, rank as the lowest of the hymenoptera. They are most obnoxious insects from the gardener's point of view, because they are all, as larvæ, strictly vegetarians, and what the farmer must perforce admire in his customers is, as regards insects, a most undesirable habit. In size they vary from the formidable cimbeæ, an inch in length, and with a wing expanse of more than two inches, to species no larger than a grain of rice.

The perfect, or winged, insect differs from the honey-bee in form, chiefly through having the abdomen sessile, or joined solidly to the thorax, instead of having the waist constricted so as to almost cut the insect in two. The head is of medium size, generally broad in front so that the large eyes are widely separated. On the top of the head are three ocelli, or single eyes, arranged in a triangle. The mouth is furnished with toothed mandibles, or jaws, which, in the larger species are quite dangerous looking instruments, although in reality they are quite harmless. The thorax is generally wider than the head, and bears, as in all insects, the organs of locomotion. It is formed of a large number of chitinous or horny plates, all of which have special names, and are of value in technical descriptions, but which need not be here enumerated. The legs are of moderate length, and slender in the majority of species. The wings, four in number, are large and membranous, having comparatively few veins, and being generally transparent. The venation, or arrangement, of the ribs or skeleton, which supports the membranes of the wings, especially the front ones, is of importance as being principally used in the division of the species into genera. The anterior margin (of the front wing) is strengthened by a vein, which expands towards the tip into what is known as the stigma. Behind this are from one to three marginal cells, and behind these three or four sub-marginal ones. The abdomen is sub-cylindrical in form, and, as above stated, is not constricted at its junction with the thorax. It is composed of several distinct segments, the last of which in the female carry in a groove beneath them the characteristic ovipositor. This instrument consists of several pieces, but may be briefly described as a pair of horny saw-like plates enclosed in a pair of outer sheaths.

It is from the possession of these minute saws that the insects have received the popular and, as is frequently not the case in popular nomenclature, appropriate name of "Saw-flies." With this complex ovipositor the female saws slits in the stems or leaves of plants, in order that she may deposit therein her eggs. In some species, however, as in the imported currant saw-fly, the apparatus is so feeble, or aborted, that the insect has to

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content herself with merely attaching the eggs to the plants in the same way as insects which are not equipped for carpentering.

From the eggs so carefully and laboriously deposited there hatch elongated, cylindrical larvæ, often resembling very closely those of lepidoptera, and for that reason known as "false-caterpillars." There are, however, structural differences by which they may be readily distinguished from the larvæ of moths and butterflies. The most noticeable of these is the relative number of abdominal or prolegs. No caterpillar has more than five pairs of these, whereas the saw-fly worms have from six to eight pairs, except in the peculiar genus *Lyda*, the larvæ of which are destitute of them.

The habits of saw-fly larvæ also resemble those of the true caterpillars—many species feed openly upon the foliage of plants, in large family groups, or singly, while others seclude themselves in galls, produced either by themselves or by other species of insects. When fully grown, the majority of species spin a silken cocoon, of greater or less compactness, within which to pupate. This cocoon is at times affixed to the food plant or to adjacent objects, but is more commonly found beneath the leaves and rubbish on the ground, or buried at varying depths beneath its surface. Many species do not spin a cocoon, but instead burrow in the ground and construct earthen cells in which to undergo the customary transformations. The duration of the several stages of life naturally varies with different genera and species: some are only single-brooded, while others produce two, three or more broods annually, and thus multiply so rapidly as to become, under favourable conditions, exceedingly abundant and destructive.

Having thus, rapidly and imperfectly, outlined the appearance and habits of the insects belonging to the family Tenthredinidæ, I will proceed to consider the several groups into which, for convenience of study, it is divided, and will give brief descriptions and life-histories of some of the better-known species. Although the family has been but meagrely studied in Canada, the species are so numerous that fully two hundred are recorded. The record is, however, as regards a large proportion of them, unfortunately confined to the mere capture of specimens, and an immense amount of work must yet be done before the complete life-history of each species can be given, while many additional species, doubtless, remain to be discovered.

Sub-families, six in number, have been formed, which are characterized chiefly by the number of articulations, or joints, of the antennæ. These are again divided into groups according to the number of marginal and sub-marginal cells, while minor differences of structure are made use of in distinguishing the genera which compose the respective groups.

Sub-FAMILY I.—CIMBICINÆ.

The species included herein have short club-shaped antennæ consisting of from five to eight segments, and include our largest and most formidable representatives of the Tenthredinidæ. Of these the list is headed by *Cimbex americana*, which varies in length from three-fourths of an inch to one inch, and from one and three-fourth to two and one-fourth inches in the expanse of its wings. The sexes differ greatly in appearance, the male having the abdomen more elongated and flatter beneath. His legs, especially the four posterior ones, are enormously developed, and, with his long, toothed mandibles, make him a ferocious looking insect, as with strong, noisy flight he circles about in search of his mate. There are several distinct varieties of this species, separated by the colour and markings of the abdomen, and the relative clearness of the wings. The clear-winged varieties prevail in Canada; but even in these the margin of the wing is cloudy, as is also a spot beneath the stigma. In the typical form of the species the male is black, the head and thorax having a bluish, and the abdomen a purplish tinge. The female is black with a yellowish spot on the sides of the third, fourth and fifth segments of the abdomen. Both sexes have yellow feet and antennæ, the latter having seven joints, the last three forming a knob. The larva feeds chiefly upon the elm, but frequents also other trees, as willow and linden. It is of a pale yellowish colour, with a black stripe running down the back, and black dots along the sides. It is solitary in its habits, and when at rest upon a leaf, is coiled up like a snail-shell. When disturbed, it discharges a fluid secretion

from pores along the side, which probably serves as a defence against many of its enemies. In the latter part of summer it is full-grown (measuring an inch and a half or more in length) and spins a strong brown oval cocoon, either in the leaves, with which it falls to the ground, or on the surface of the earth under leaves, etc. It does not transform to a pupa until the following spring, and the winged insect appears in June and July. Though the larvæ of this species are large and voracious, they are never so numerous as to become very destructive to foliage.

Trichiosoma triangulum is a northern species, somewhat similar in appearance to the preceding, but smaller, being about three-fifths of an inch long. The head and thorax are black, the latter clothed with long whitish hairs. The thighs are bluish-black (the four posterior ones of the male having a sharp tooth underneath) and the remainder of the legs yellow. The antennæ are eight-jointed, the base and club being dark, and the intervening joints yellow. The wings have a strong yellowish tinge. This insect is rare throughout Ontario, but appears to be more plentiful west and north. Mr. Geo. W. Taylor records it (Canadian Entomologist, vol. xvi, page 91) as tolerably common in British Columbia. The larva is said to have the same habits and to undergo the same changes as that of *Cimbex*.

Abia Kennicotti is a smaller and somewhat bee-shaped insect about one-third of an inch long. Its colour is black varied with blue and green; the legs whitish and wings yellowish. I am not acquainted with its habits. Two closely allied species, not yet recorded from Canada, although probably inhabiting it, are *Abia caprifolia* and *Abia cerasi*, which, as their names indicate, feed upon the honeysuckle and cherry respectively. The larva of the former is described as yellow, with the back greenish, and with rows of black spots. It spins a compact cocoon half an inch long, in which it undergoes its changes in the manner of that of the *Cimbex*.

The last species of this sub-family which I will mention is a diminutive black fly (only about one-eighth of an inch long), which I have frequently found on hickory (*Carya amara*). It is *Acordulecera dorsalis*, and has short six-jointed antennæ, the last joint rounded, but not enlarged so as to form a club or knob. The body is short and stout; black, with minute whitish hairs; the feet are also whitish. I have taken these saw-flies upon the hickory leaves about the first of June, and again about the first of August. Larvæ, which are perhaps those of these flies, do considerable damage to the hickory, especially the smaller trees, as they feed together in a row across the leaf and devour everything but the mid-rib. They are pale green, whitish below, about one-third of an inch long, and when full grown they descend to the ground and form therein white shell-like cocoons about the size of a grain of rice, from which so far I have been unable to obtain the winged insects.

SUB-FAMILY 2.—HYLOTOMINÆ.

The species of this group are not numerous, and are distinguished by the antennæ having only three or four joints, of which the third is very much longer than the others. Two genera are represented in Canada; the first—*Schizocerus*—by a single species which I have not seen, the second—*Hylotoma*—by four. Of these I have collected three species in this vicinity, and have received the fourth from Mr. Fletcher, who captured it at Dalhousie, N.B. They are rather handsome insects, about one-third of an inch long, but are neither sufficiently numerous nor injurious to call for detailed descriptions. They are easily distinguished from our other saw-flies by their three-jointed antennæ, of which the third is very much elongated and in the males furnished with rows of hairs.

SUB-FAMILY 3.—TENTHREDININÆ.

The species herein contained are of small or moderate size, and the number of articulations in the antennæ varies from nine to fifteen. The sub-family contains at least nine-tenths of our saw-flies, and nearly all the well-known destructive species.

At the head of it stands *Cladius isomera*, which is a small shining black fly, with whitish feet and clouded wings; length less than one-quarter inch. The larvæ feed in large numbers upon the willow, and devour the leaves with the exception of the skeleton.

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They are about two-fifths of an inch long, and are of a pale, yellowish colour, with the back greenish. The head and last segment are black, and there is on each side a row of black spots, eleven in number. Upon the back and on each side are two rows of small tubercles, bearing long, white hairs. Specimens which I collected on 26th June, spun (between 1st and 3rd July) transparent yellowish cocoons of light texture, which were attached to leaves in the breeding-jar, and in which the larvæ could be plainly seen. A few days later they transformed to pupæ, and the winged insects appeared on 19th to 24th July, or a month after the larvæ were full grown.

The genus *Pristophora* contains several species, of which *P. grossularie* is known as our native currant saw-fly. It has been figured and described in one of our early reports, as well as by Mr. Saunders in his "Insects Injurious to Fruit," in which useful and beautiful book several other saw-flies are also treated of. It is never so abundant or injurious as the imported currant worm (*Nematus ventricosus*) hereafter to be mentioned,

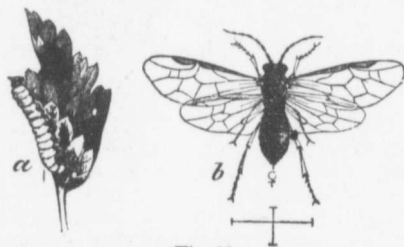


Fig. 26.

nor is it so large an insect. The larvæ, shown at Fig. 26, a, are of a pale green colour, without black spots, and are scattered over the bush when feeding. Although generally few in number and doing comparatively slight injury, they have been found at times so numerous in some places as to entirely strip the plants, gooseberry or currant, on which they fed. The flies (Fig. 26, b,) are black, with yellowish markings. A closely allied species found in the United States, is the Cranberry Saw-fly (*Pristophora identidem*), which sometimes com-

mits serious injuries in the cranberry marshes of Cape Cod. The genus *Euura* contains small species, of which the larvæ form galls on willows, or inhabit galls formed thereon by other insects. *Euura orbitalis*, the only species apparently recorded from Canada, is one of the former. It is a shining black species, one-eighth of an inch long, with pale head and legs. The larvæ, of a greenish-white colour, feed in the lateral buds of the willow twigs, causing them to become much enlarged, and eating the increased growth internally so as to leave but a mere shell, from which they bore out, and descending to the ground spin a thin whitish cocoon.

The genus *Cresus* contains a single species (*C. latitarsus*) of which the larvæ are known to feed upon wild cherry and birch. The perfect insect is one-third of an inch long: the body shining blue-black, legs and antennæ black, wings hyaline.

Nematus is a very extensive genus containing small or medium-sized species, the operations of which are often extremely destructive.

Nematus ventricosus, introduced from Europe, is so familiar to everyone, and has been so frequently mentioned in previous reports that, were it not such an important species, it would not merit further description. My remarks on it will, therefore, be as brief as possible, giving merely the leading facts. The winged insects are from two-tenths to three-tenths of an inch long, the male, as is usually the case, being the smaller, and the ample wings expand about one-half of an inch. The sexes differ in colouring, the female (Fig. 27, b,) having the brightest dress. She is mostly yellow, but her head is black, her antennæ brown-black, and her thorax more or less spotted and striped with black. The male (Fig. 27, a,) has the head, antennæ, thorax, and most of the upper surface of the abdomen black, the lower side being yellow. The females which appear in early spring deposit their eggs in rows upon the under surface of the leaves (Fig. 28), and from these hatch, in about ten days, the worms which so speedily destroy the young foliage. At first a number are found upon

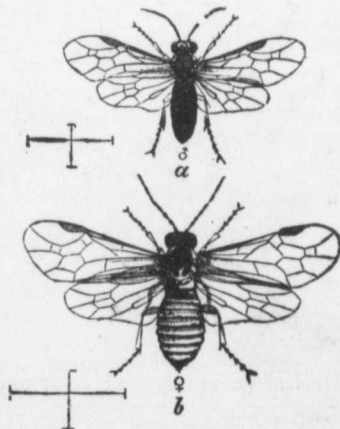


Fig. 27.

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each leaf attacked, eating small holes through its substance, and gradually devouring all but the skeleton. Then forced to seek new feeding grounds they separate more and more as size and appetite increase, until often the whole bush is visited and defoliated. The



Fig. 28.



Fig. 29.

larvæ* (Fig. 29) are whitish when hatched, but soon become green, and then develop numerous black spots, and have the extremities tinged with yellow. When full-grown they descend to the ground and spin oval, smooth, tough, brownish cocoons, either under leaves and rubbish or in the ground; occasionally they are found attached to the stems and leaves of the bushes. The flies emerge generally about the first of July, and the second brood of worms attain their full growth toward the close of summer, and winter in their cocoons. Hellebore has been proved to be the most convenient and efficient

remedy for the removal of the worms. It is applied in the proportion of an ounce to a pail of water, thoroughly mixed, and freely sprinkled over the plants; care being taken to watch for the successive broods.

Nematus Erichsonii is a saw-fly which has recently been found committing immense ravages upon the larch (commonly known as tamarac, hackmatack, juniper, etc.) in the Provinces of Quebec and New Brunswick, as well as in portions of the United States. It is about the size of the preceding species; the head, antennæ, thorax and tip of abdomen are black; the legs, except hind feet, and five segments of abdomen are rufous. The larvæ devour the leaves rapidly, and when numerous a tree is speedily stripped. They spin cocoons very similar to those of the *ventricosus*.*

Nematus Similaris is a smaller species, of which the worms feed upon the leaves of the locust. The fly (Fig. 30, *f*) is about one-fourth of an inch long; yellowish, with a patch on top of head; the sides and front of the thorax and bands on the abdomen, black. The egg (Fig. 30, *a*) is laid in a slit made on the under surface of the leaf (as are those of many other species) and the worm (Fig. 30, *b, c*), when hatched,

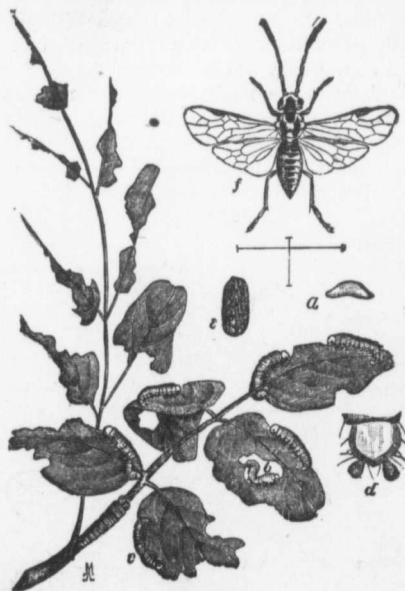


FIG. 30.

of the leaf (as are those of many other species) and the worm (Fig. 30, *b, c*), when hatched,

* A special paper on this species is being prepared by Mr. Fletcher, who has studied its extensive ravages, so that a more complete account of it is unnecessary here.

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FIG. 32.

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commences its ravages by eating the margin of the leaf or a hole therein. It is pale green, with a brownish head, and is about half an inch long when full grown. The cocoon (Fig. 30, *e*) which it spins is oval, and dark brown. There are at least two broods, as I have observed the young larvæ feeding (as represented at 30, *b*) in June and older ones in October, and have captured the imago at the end of August. Last October I found larvæ, nearly full-grown, feeding on my trees as late as 12th or 13th, which were probably killed (if they had not descended to spin up) by the sharp frost which occurred on the night of the 14th, as upon my return from attending the annual meeting of the Entomological Society (held in London on 15th), I found the foliage shrivelled and black, and no signs of the worms. They are not abundant enough here to do much harm; nor am I aware that injuries by them have been recorded in the Province.

Several species of Nematid form galls on willows, such as *N. salix-pomum* and *N. salix-pisum*. The first, about one-fifth of an inch long, is yellow with black markings, and the larva inhabits a globular, smooth, fleshy gall, which develops under its influence on the side of the midrib of the leaf of *Salix cordata*. The second is an insect of the same size, producing on the under surface of the leaves of *Salix discolor* galls which are yellowish, hollow and subspherical.

The genus *Emphytus* contains several species, of which one—*E. maculatus*—is a well-known enemy to the strawberry plant. The eggs (Fig. 31, *9*) are placed early in spring in slits sawed in the stems, and a fortnight afterwards the larvæ (Fig. 31, *4* and *6*) are found commencing to riddle the foliage. They are pale greenish above, and pale yellowish beneath, and when mature are about three-fifths of an inch long. The cocoons (Fig. 31, *7*) are formed under ground of particles of earth, and the flies emerge early in July. In August a second brood of larvæ appears, which pass the winter in their earthen cells. The winged insect (Fig. 31, *3*) is black with whitish bands (interrupted so as to form two rows of spots, whence the specific name) on the upper surface of the abdomen.

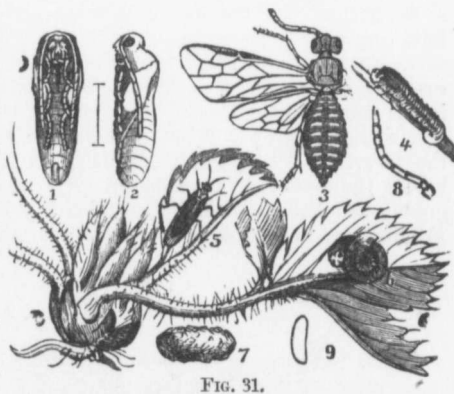


FIG. 31.

We now reach the genus *Selandria*, which is perhaps even more destructive than *Nematid*, and of which nearly twenty species are known to occur in Canada. They are small insects of inconspicuous colouring, much like some species of the preceding genus, but are distinguished from them by the wings having two marginal cells instead of one. I will have space here only to mention a few of the more injurious species, and these but very briefly.

Selandria cerasi, as its name indicates, is found upon the cherry, but feeds also upon the pear and occasionally on other trees. The larvæ are slug-like worms, covered, as are several other species of the genus, with a viscid slimy substance exuded from the skin, probably as a protection. They are tapering in form, being largest just behind the head, are brownish in colour, and are disagreeable in appearance, owing to their slimy coating. After the last moult, they have a clear yellow skin, and are not covered with slime. Descending into the ground from one to four inches, they construct little earthen cells smooth within. Eggs are laid in the leaves about the first of June by the flies produced from the worms of the previous year, and hatch in about two weeks. The larvæ (Fig. 32) attain their growth in about a month, and the flies (Fig. 33) issue about the end of July. A second brood of larvæ are to be found feeding in August, the flies from which emerge the following spring. The winged insects are of a glossy black colour; the legs below the knees are whitish, and the front wings with a large clouded spot in the middle.



FIG. 32.



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Fig. 34.

Selandria rose produces a slug which feeds voraciously at night upon the upper surface of the leaves of roses. It lives about a fortnight and is of a dull yellowish colour, and not slimy. A cell is constructed in the ground and the slug does not pupate until the following spring, there being only one brood. The small blackish flies emerge from the ground when the roses are in leaf, and deposit their eggs in slits sawed in the margin of the leaves.

The grape-grower is sometimes much annoyed by the larvæ of *Selandria vitis*, which is a blackish fly having the thorax red above, and the legs below the knees whitish. The worms, when full-grown, are half an inch long, and are yellowish with transverse rows of black spots. Feeding side by side in rows of from five to twenty, they speedily devour a leaf and seek

Another very injurious and abundant species is *Selandria rubi*, the larvæ of which destroy the foliage of both wild and cultivated raspberries. They are not slimy like those of the foregoing species, but bear whorls of white spines in rows upon the back and sides. (See figure 34.) The leaves are pierced with small holes by the young worms, and as these increase in size the holes become larger and more conspicuous. The period of growth and manner of transformation are as in the preceding species, but there appears to be only one brood, the flies not appearing until the following spring. The larvæ appeared to be unusually abundant last season. The flies, an example of which is shown in figure 35, magnified, have a black head and thorax, and reddish or yellowish abdomen and legs.



Fig. 35.

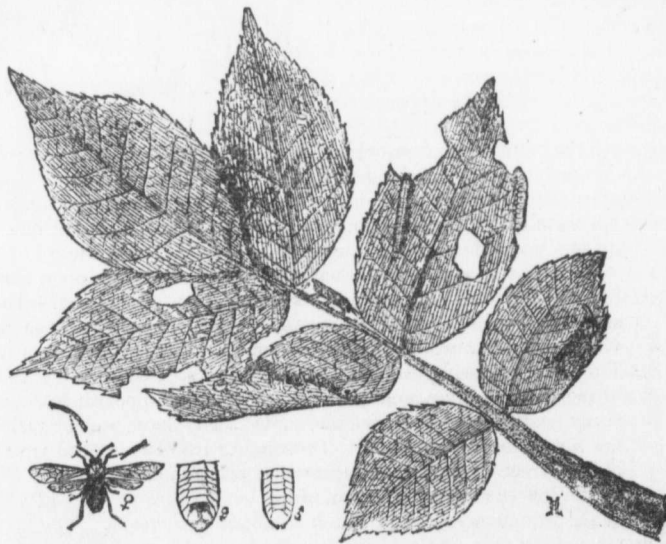


Fig. 36.

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* Mr. Henry Osbo
Ent. Vol. xvi., p. 148.

Selandria barda is a saw-fly differing from the former in being entirely black, with the exception of the red portions of the thorax, and in having the upper wings darker. It has been recently recorded* as infesting ash trees in Iowa, and we may safely expect that its habits will be the same here. (Figure 36 from Mr. Osborn's report illustrates this insect in its several stages.) The eggs are laid in the leaf-stem and produce, in two or three days, whitish worms, having black heads and feet. As the worms grow older they become of a clear green colour, retaining their jet-black heads and thoracic legs. I have only captured one specimen of this saw-fly myself, but it may be more abundant in other parts of the Province.

The larvæ of *Selandria caryæ*, which feed in the United States upon butternut and hickory, are remarkable from the dense covering of a white flocculent substance which they secrete, and which gives them the appearance of little masses of cottony wool.

Macrophya is an extensive genus containing larger and handsomer species than the foregoing, but their habits are apparently less obnoxious, and not so well recorded. *M. niger*, as the name indicates, is black, but the tips of the antennæ are white. *M. flavicoxa* is another black species, having the legs handsomely banded with white.

The genus *Allantus* contains species very similar in general appearance, but having shorter and thicker antennæ. *A. basillaris* is very abundant in July and August on the flowers of *Spiræa* and *Solidago*. It is a handsome fly, half an inch long, and black, with liberal markings of yellow, and has quite a wasp-like look.

The last, and typical genus of the sub-family, is *Tenthredo*, which contains more than thirty Canadian species, some of considerable size and beauty. *T. rufipes* (*Allantus leucostoma* of Kirby's Fauna Bor. Am.) appears to be the commonest species here. It is half an inch long; black with reddish legs, of which the hinder pair are partly black. *T. atroviolacea* is of the same size and colour, but the legs are dark and the wings violaceous or cloudy, instead of transparent. *T. grandis*, *T. tricolor*, and *T. mellina* are also large handsome species. Of the larvæ of these interesting species I am, however, unfortunately ignorant, probably they are not very injurious as the winged insects do not appear to be abundant.

SUB-FAMILY 4.—LYDINÆ.

The members of this family are distinguished by their multi-articulate antennæ, which usually have from fifteen to thirty-six joints, and vary much in shape, being short or long, simple, serrate or pectinate. The larvæ feed upon evergreens. Only two genera, *Lophyrus* and *Lyda* occur in Canada; each contains several species.

Lophyrus abietis is a robust fly about one quarter of an inch long, and with large transparent wings expanding more than half an inch. The antennæ are short; those of the females being stout, serrated, and containing eighteen joints; those of the male are broadly pectinate and cause him to appear very different from his mate. In colour also the sexes differ, the male being black and the female yellowish or ferruginous. The worms, when young, are brownish, but subsequently become of almost the same shade of green as the leaves on which they feed (those of fir and spruce) and upon which it is, therefore, difficult to see them. The head is pale, and there is a white stripe along each side. The flies are said to emerge in May, and produce larvæ which feed in July and August, and there may, perhaps, be two broods. I found both young and mature larvæ feeding together on 23rd August last, and the winged insects were also captured on the same day upon the trees (spruce). The full-grown larvæ spun their cocoons two or three days later, from which the flies will issue next spring.

Lophyrus Abbotii is a slightly larger saw-fly, very similar in appearance, the larvæ of which are often found abundant on the white pine (*Pinus strobus*) greedily devouring the foliage, to the injury and even destruction of the trees. (In Fig. 37 the insect is

*Mr. Henry Osborn in Bulletin of the Iowa Agricultural College, reprinted in Aug. number of Can. Ent. Vol. xvi., p. 148.

shown in all its stages.) The larvæ are, when full grown, from three-fourths of an inch to one inch in length, and are soft whitish worms with rows of squarish black spots along the back. (Fig. 35, 4.) When disturbed they throw back their heads and jerk themselves about as shown in the figure. Like those of the preceding species they may be found upon the trees during July, and spin dark compact cocoons from which the flies do not issue until the following summer. I have recorded (Ott. Field-Nat. Club Trans. No. 4, page 76) the presence in destructive abundance of the larvæ of this or an allied species upon the red-pine (*Pinus resinosa*) in this vicinity in 1881. Unfortunately the observations necessary to identify the species were not made at the time, and I have since been unable to discover the insects upon these trees. There are other species of *Lophyrus*, known to prey upon the pines, but I have not been able to find any mention of their occurrence in Canada.*

The genus *Lyda* contains larger species which are wider and more fattened, and which have long, slender antennæ. The larvæ also differ from those of all other saw-flies in having no abdominal feet, and in having three-jointed antennæ, and a pair of appendages of similar form on the anal (last) segment, which is covered above by a hard horse-shoe shaped plate. I have captured four or five species of these saw-flies on white pine, the most abundant being *L. maculiventris*, which appears in June and July. Larvæ, some of which are probably those of the species just mentioned, may be found late in the season feeding singly, or two or three together, in the clusters of leaves which they bind loosely together with silk which they are able to secrete, freely and rapidly. Last August, I collected specimens belonging evidently to two species, but owing to an accident they all perished, and further study will be needed to determine the question.

SUB-FAMILY 5. CEPHINÆ.

The species, few in number, which belong to this sub-family, have the neck elongated, the antennæ multi-articulate, 21-28 jointed, and the wings with two marginal and four sub-marginal cells. Of their habits but little is known; the larvæ probably feed in the new wood of different trees and shrubs. Three species belonging to the genus *Phyllæus* are recorded from Canada, but they are rare and I have never met with any specimens.

SUB-FAMILY 6, XYELINÆ.

These insects have the ovipositor exerted and nearly as long as the abdomen. The antennæ are about thirteen-jointed, the third joint being greatly elongated. There appears to be but one Canadian species, *Xyela minor*, a small blackish insect about one-tenth of an inch long with twelve-jointed antennæ.

THE LARCH SAW-FLY—*Nematus Erichsonii* (Hartig).

BY JAMES FLETCHER, OTTAWA.

During the last year or two, a new and formidable insect-enemy to our forest trees has appeared in Canada, in the shape of the larch saw-fly, *Nematus Erichsonii*. The first notice of this saw-fly as an American species was, I think, Dr. Hagen's short note pub-

* The genus is omitted from the Check List of the Toronto Natural History Society, and Abbé Provancher, in his admirable work (*Petite Faune Entomologique du Canada*, Vol. II., p. 228), states that he had never met with specimens.

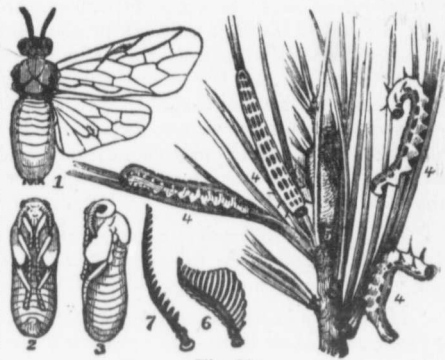


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228), states that he

ished in the *Canadian Entomologist* for 1881 (Vol. XIII, p. 37), on some larvæ collected in 1880, by Prof. Sargent of the United States Census, Forestry Division, from European larch trees growing in the neighbourhood of Brookline, Mass. The first notice of its occurrence in Canada was the announcement made at the annual meeting of the Entomological Society of Ontario for 1883, by the Rev. T. W. Fyles, of South Quebec, to the effect that much injury had been done during 1882 and 1883 to the tamarac trees (*Larix Americana*) in the eastern townships, particularly in the townships of Bury and Fingwick, by a species of saw-fly, which he thought was probably the same as that which had caused so much injury in Maine and the other Eastern States, *Nematus Erichsonii*. Mr. Fyles was at that time living at Quebec, and from the fact that he did not mention having found the species in that locality it may be inferred that it had not reached there then. In the *Quebec Morning Chronicle* of the 16th July last, however, Mr. Fyles publishes a letter in which he states that the tamarac trees at Beauport, near Quebec, had been nearly stripped of their foliage by the larvæ of this insect, and in travelling from Ottawa to the Lower Provinces, in the month of July, I observed almost all along the line of railway that an enormous amount of damage had been done to the tamarac trees. For miles not a tree of this species could be seen that did not bear unmistakable signs of their presence. At first, not knowing the appearance of the trees after they had been defoliated by these larvæ, I supposed that the brown appearance had been caused by forest fires, which are by far too frequent in Canada; but after a time a clump of trees occurred close to the railway and I was able to detect the true cause of the injury. The trees about Quebec seem to have suffered most severely, and from this point, proceeding east and west, the ravages appear to diminish. In the Eastern Townships I found the tamaracs badly injured. Through the kindness of S. A. Fisher Esq., M.P., I was enabled to examine some trees near Brome, P.Q., which were almost defoliated by these worms. The tops of the large trees and all young trees which stood alone, away from the edge of the swamp, were entirely bare, on many of them there was not a green needle to be seen. I think it is hardly probable that these trees will be able to survive, for they did not throw out any later leaves towards the end of the summer. Among the trees destroyed this year were some small dead trees which had presumably been killed the previous season, for the terminal shoots of the branchlets were twisted and distorted in the manner peculiar to the attack of this pest. Some interesting specimens of twigs were sent to me from Quebec, by the Rev. Mr. Fyles, in the month of October, in which the tree had succeeded in pushing out the leaves which had been eaten down by the *Nematus* in July, to the distance of about a quarter of an inch. It is just possible that the trees may survive the attack, unless it is again repeated next season, for these leaves, although insufficient to perform the full functions of the foliage to the plant, may yet have stored up enough food to support the tree until the next season, when the marauding army having passed on to more abundant feeding grounds, will allow the weakened trees to regain their vigor, the very severity of the attack working a partial remedy. The instinct of the parent fly will prevent it laying its eggs where there is an insufficient food supply to carry the progeny to maturity. The most western point so far recorded for this insect is Alexandria, on the Canada Atlantic Railway—miles from Ottawa, this, too, is the nearest point to Ottawa where I have observed the injury to be sufficiently great to attract attention. At Casselman, 30 miles from Ottawa, by searching closely I found a few twigs which had been punctured by the female for the reception of the eggs; and at Ottawa itself, one twig was found distorted in the characteristic manner. From these facts, and the remarkable rapidity with which this destructive insect has spread over the continent during the past four years, I fear that by next year the tender green foliage of the larches in this locality will be destroyed, and the trees rendered as unsightly as they were in Quebec and New Brunswick last year.

Below Quebec, along the Intercolonial Railway, particularly about Chaudière Junction, by the middle of July, there was not a leaf to be seen on the tamarac trees. Soon after leaving Chaudière Junction the country is open and there are no trees to be seen for a long distance. It was not until the Province of New Brunswick was entered that I again had a chance to notice the ravages of this insect. During a short visit to Dalhousie, N.B., I had a good opportunity of observing the work and life-histories of these larvæ closely. The first evidence that I saw of the presence of the insect was a row of

young European larches which had been planted in a garden in the middle of the town, and which were entirely stripped of their leaves. Upon enquiring if there were any larch or tamarac trees in the neighbourhood, I found that these names were not even known, and when I explained that the tree I was in search of was a Conifer which dropped its leaves in winter, I was informed that "Juniper" was what I meant and should have asked for. This tree does not appear to be so plentiful in the Lower Provinces as in Quebec and Ontario; but wherever they were detected I found more or less of the larvæ of the saw-fly also. At the mouth of Eel River, a mile or two from Dalhousie, is an extensive tamarac and cedar swamp, and here I found that although some of the trees were untouched; yet the greater proportion, especially the taller trees, were badly infested.

On the farm of Mr. Duncan Stewart, there was a row of tamaracs which he has transplanted from the swamp mentioned, and these were badly infested, being conveniently near to the McHarran Hotel, where I was staying, I was able to examine the insects frequently, between the 16th and the 28th July. On visiting the trees the first time, I succeeded in capturing two perfect females of the saw-fly, and found a large number of the clusters of the young larvæ. They were evidently much later in hatching out in this locality than at Quebec, as at this time little harm had been done, and although there were larvæ of all sizes, by far the greater part were very lately hatched from the eggs—and were collected in clusters, every needle of each fascicle, near the part of the twig which had held the eggs, bearing its strange-looking dark-green larvæ. Immediately after hatching, the young larvæ attack the leaves nearest the orifices of their cells; they do not consume the whole of the leaves but nibble the edges, leaving them ragged and uneven. They seem always to work backwards, down the branchlet, and leave the terminal shoot untouched. After the first month they are very voracious and consume every needle in the different fascicles as they come to them; beginning at the apex and holding them between their thoracic feet, they eat them right down to the base, and as soon as one bunch of leaves is finished they move back to the next. On being disturbed they curl their bodies over their backs similarly with the larvæ of some other species of saw-flies. They may, too, be seen sometimes resting in the same position, when being in large numbers all together, they have a very peculiar appearance. When the young larva is first hatched the head is disproportionately large and of a darker colour than the body. I regret to say I did not take accurate measurements of the larvæ, nor record the duration of the different moults; but the active larvæ stage seemed, in most instances, to last about one week, although a few individuals I took home with me from the Eastern Townships, fed for the remarkably long period of three weeks before spinning their cocoons. It is probable that some of these will turn out to be parasitised. After the first moult the larva is of a lighter green in colour, and the head and thoracic feet are black instead of dusky green. After the next moult, however, a great change takes place; the worm is quite altered in appearance; it is very much larger and the colour is quite different; instead of dull-green the whole upper surface of the body is of a peculiar bluish-white hue, similar to the glaucous waxy bloom which is seen on some fruits or the leaves of some plants, as for instance the bloom of the ripe plums or the glaucous white colour beneath the leaves of Pines and the Common Juniper (*Juniperus Vulgaris*). The black head is very conspicuous, and on each of the segments, after those which bear the thoracic feet, except the last, are two double rows of small black tubercles; these do not occur on the second, third and fourth segments. After this there is one more moult; but the only important change is in the size of the larva which, when full-grown, is about an inch and a quarter in length, bluish-white above and green beneath, head and thoracic feet black; pro-legs, of which there are seven pairs, green. When mature and just before spinning up, the larvæ assume a brownish or pinkish hue, and drop from the trees to the ground, where they spin an oval cocoon about half an inch in length and of a dark-brown colour. The cocoon is generally found beneath moss or stones or among the roots of grasses, on or just beneath the surface of the ground; but Dr. Fyles writes me that he found the cocoons at least six inches beneath the surface along the bottom of a hot-bed where they were collected together in masses. Although the larvæ spin up about a week after emergence from the egg, they do not at once change to pupæ, but pass the

winter in the larvæ attained. This is in a cocoon.

The perfect size, somewhat res it is slightly large. nine-jointed antennæ two to five and part of a rich waxy or little darker than third pair of legs the same colour as the light-yellow for tw colour is black. The rest of the leg. A dark spot towards the three sub-costal cell wing of the female over half the length insects emerge to according to the tamarac, and some to observe the pro last Annual Report Dr. Packard has coloured plate. It follows:

"The female green shoot, somewhat shape of the hole, is and about 1.5m.m. parallel, one being base of the fresh, seen by June 20th to 30th of the eggs causes in all cases observed, foregoing lines were while engaged in the slit and deposit more than that length as a number of eggs and worked down to while engaged in the twig from the glass ovipositor under a were thrust obliquely most active, sliding saw. After the incision blades of the ovipositor the muscles at the egg has passed into the process the ant drawn, they begin fresh incision. * increases in size the slits enlarge and gaps when the eggs are finished

winter in the larval form, and it is not until the following spring that the pupal stage is attained. This is the case with most, if not all, the Tenthredinidae which pass the winter in a cocoon.

The perfect insect is a handsome Saw-Fly, in general appearance, as to shape and size, somewhat resembling the well-known Gooseberry Saw-Fly (*Nematus venetricosus*); but it is slightly larger and quite different in colour. The head and thorax, as well as the nine-jointed antennæ, are black, together with the base and tip of the abdomen; segments two to five and part of the upper and the whole of the lower surface of segment six, are of a rich waxy orange colour; the first and second pair of legs yellowish, the femora a little darker than the rest of the legs and slightly tipped with black above, and the third pair of legs is much longer than the others; the femora are a little darker, about the same colour as the abdomen, more decidedly tipped with black above; the tibiæ are light-yellow for two-thirds of their length, and from that spot to the ends of the legs the colour is black. In the other two pairs of legs the tarsi and claws are yellow like the rest of the leg. The wings are black-veined, with a tawny fore margin on costa; the dark spot towards the tip of the wing, known as the stigma, is black, and there are only three sub-costal cells in this species. The perfect insect is a handsome Saw-fly, the wing of the female expanding about three quarters of an inch, the antennæ are long, over half the length of the body, which latter measures about half an inch. Perfect insects emerge towards the end of June or in the beginning of July, the date varying according to the locality. The eggs are laid in the terminal young shoots of the tamarac, and sometimes in one of the lateral shoots as well. I was not fortunate enough to observe the process of oviposition, nor indeed to find the unhatched eggs; but in the last Annual Report of the Entomologist to the United States Department of Agriculture, Dr. Packard has published a most interesting report on this insect with a beautiful coloured plate. In this report he describes the manner in which the eggs are laid, as follows:

"The female saw-fly makes about a dozen incisions in the terminal young, fresh, green shoot, sometimes in one of the side shoots next to the terminal one; judging by the shape of the hole, the eggs are of the shape described by Ratzeburgh, *i.e.*, oval cylindrical, and about 1.5 m.m. in length. The eggs are placed in two rows, alternating, not exactly parallel, one being placed a little in advance of the other. The eggs are inserted at the base of the fresh, soft, young, partly-developed leaves of the new shoots, which are usually by June 20th to 30th, only about an inch or an inch and a half in length. The presence of the eggs causes a deformation of the shoot, which curls over, the incisions being in all cases observed, on one (the inner) side of the shoot. * * * * After the foregoing lines were written, we fortunately observed a female in confinement, June 29th, while engaged in the process of ovipositing; we should judge that the operation of sawing the slit and depositing the egg required not less than five minutes, and perhaps not much more than that length of time. The fly had been evidently at work some time previous, as a number of eggs had been laid along the shoot; she had begun at the further end and worked down to the base of the new, fresh, green shoot. She stood head downward while engaged in making the puncture, and was not disturbed by our removing the larch twig from the glass jar and holding it in our hand while watching the movements of the ovipositor under a Tolles triplet. The two sets of serrated blades of the ovipositor were thrust obliquely into the shoot by a sawing movement; the lower set of blades was most active, sliding in and out alternately, the general motion being like that of a hand-saw. After the incision is sufficiently deep, the egg evidently passes through the inner blades of the ovipositor, forced out of the oviduct by an evident expulsive movement of the muscles at the base of the ovipositor. The slit or opening of the incision, after the egg has passed into it, is quite narrow and about $1\frac{2}{3}$ m.m. in length. While engaged in the process the antennæ are motionless; but immediately after the ovipositor is withdrawn, they begin to vibrate actively, the insect being then in search of a site for a fresh incision. * * * * Although the slit is at first closed, as soon as the embryo increases in size the twigs swell where they have been incised by the ovipositor, and the slits enlarge and gape more or less, becoming much larger and more conspicuous than when the eggs are first deposited."

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"The egg is slender, cylindrical, tapering rapidly towards each end. Length, 1.2m.m."

There is apparently some slight uncertainty as to the identity of our American insect with the true *Nematus Erichsonii* of Europe. In the United States Bulletin, No. 3, issued by the Entomological Division of the Department of Agriculture in 1883, I notice that it is mentioned as "*Nematus Erichsonii*." When the insect was first discovered, it was referred to Dr. Hagen, who pronounced it to be *N. Erichsonii*, and published the note above referred to in the *Canadian Entomologist*. The habits of the two forms do not seem to agree in every particular. In Dr. Packard's excellent report, he gives Ratzeburgh's description of the fly, which the latter author called the Large Larch Saw-fly, and further states that "our saw-fly differs slightly from the German, in the eggs being laid at the base of the leaves, on the newly-grown shoots, rather than on, or just under, the epidermis of the last year's shoots, where we have repeatedly, and in vain, searched for them." Ratzeburgh describes the eggs as "laid usually in a single row on the upper end of the young shoots, two or three sometimes being placed together along the shoot." In all instances that I have examined, the eggs were laid in a double row. The European insect is extremely rare, but Ratzeburgh thought that, from a forestry point of view, it might become injurious, since the larvæ had already, in certain seasons, abounded on the larches in sufficient numbers to attract the attention of the forestry officers in Holstein. Dr. Hagen records that twice before 1840 they had been observed to be very obnoxious to the larch in Holstein by Tischbein, and in the Horz by Saxesen.

However, the habits of the American and European forms are very similar, and Dr. Packard thinks it is very probable that the insect is common to both Europe and North-Eastern America. He further adds, "at any rate, our species could not have been introduced with European larches, since its ravages have been committed in the wilder and less frequented portions of Maine, New Hampshire, and New York, as well as on the seaboard in towns long settled." Notwithstanding the above, I cannot help thinking that the appearances are strongly suggestive of the insect being an introduced pest,—its rapid progress over the continent and its occurring in such vast numbers for four years successively, as well as its comparative freedom from parasites. Moreover, the first specimens were found on European larches, and wherever I have seen this tree, planted in the infested districts, it seems to have been preferred by the insect to the native tree, and to have suffered first; and it would even appear that in the notable instance of the discovery of the *nematus*, the native tree was left alone while the introduced species suffered. In Prof. Sargent's letter, printed in Dr. Packard's report, he writes, "I have not heard of any injury to our native hackmatacs. Three or four years ago, however, I noticed that specimens of the European larch in this immediate neighbourhood were suffering from the attacks of a larva, which I gathered and submitted to Dr. Hagen.

It is important to notice, too, that although the insect had been there, it had passed on to some other locality; and from this we may hope that a similar occurrence may take place in Canada; and indeed I am informed by S. A. Fisher, Esq., that on the lawn of the Hon. J. J. C. Abbott, of St. Anne's, P.Q., a specimen European larch was, in the summer of 1883, severely attacked by some larva and almost defoliated; but that during the past season it had been well covered with foliage and was uninjured.

Should the attack of these injurious saw-flies continue unabated for but a very few years more, it will occasion a most serious loss to the Dominion. The Tamarac or Larch, known also as Hackmatac and locally as "Juniper," is one of the most valuable available woods for railway sleepers, and is also used for many other purposes, particularly in ship-building; and not only is the wood valuable intrinsically, but the tree has also a special and peculiar value, from the fact that it will grow in those extensive swampy tracts, so common in Canada, where few timber trees are able to exist.

It is to be hoped that before long some natural enemy will appear, to keep these insects in check, for it would be impossible to apply any artificial remedy with any hope of success, on account of the inaccessible nature of the bogs and swamps in which they breed. Already some parasites have been discovered; Dr. Packard has provisionally named a chalcid parasite *Pteromalus nematicidæ* which was found in some cocoons collected in Maine and at Brome in the Eastern Townships. I found the larvæ being

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destroyed by a small hemipterous bug; I could only secure one specimen, which was in the larval stage; I kept this in a cage and fed it on the larvæ of *Nematus ventricosus*, and after a time it produced *Podisus modestus*. Two other species of insects were noticed by me harrassing them, but I could not secure specimens: a larger Hemipteron, and at Dalhousie a species of Ichneumon fly about half an inch long, black, with red legs. Where single trees are grown as specimens on lawns, or as ornamental trees by the sides of roads and streets, they may be protected by showering them with Hellebore or Paris-green, in liquid mixtures; or, where the clusters of young larvæ are within reach, a blow with a flat instrument as the blade of an oar or a paddle will knock them off the branch, and thus a whole family of larvæ may be despatched at one stroke. Two of the trees in the row I have mentioned, which were planted by Mr. Stewart at Dalhousie, were kept clean by this simple means, the young larvæ, evidently getting lost among the tall grass under the trees, were thus prevented from climbing up again and attacking the foliage.

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