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REPORT  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF ONTARIO,

FOR THE YEAR 1883.

ENTOMOLOGICAL BRANCH  
DEPARTMENT OF AGRICULTURE  
OTTAWA - - CANADA

*Printed by Order of the Legislative Assembly.*

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ENTOMOLOGICAL BRANCH  
DEPARTMENT OF  
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OTTAWA.

Toronto :  
PRINTED BY C. BLACKETT ROBINSON, 5 JORDAN STREET.  
1884.

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*To the Honour*

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ENTOMOLOGICAL BRANCH  
DEPARTMENT OF AGRICULTURE  
OTTAWA - - CANADA

FOURTEENTH ANNUAL REPORT  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
ONTARIO,

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL AND  
OTHER INSECTS OF THE PROVINCE,

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE,  
BY THE OFFICERS AND MEMBERS OF THE SOCIETY.

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1883.

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*To the Honourable the Commissioner of Agriculture:*

SIR,—In accordance with the provisions of our Act of Incorporation, it becomes my duty to present to you herewith the Fourteenth Annual Report of the Entomological Society of Ontario.

The Annual Meeting of the Society was held in the City of London, on October 3rd, 1883, when the officers for the ensuing year were duly elected, and the necessary business of the Society transacted.

The account of the meeting, and the audited Financial Statement, are also submitted herewith.

In pursuance of one of the chief objects for which this Society was established some fifteen years ago, illustrated reports of various noxious and beneficial insects have been prepared by members of the Society for publication (with your approval), for the benefit of those interested in Agriculture and its kindred pursuits.

The publication of the *Canadian Entomologist* is still maintained, the Society having nearly completed the fifteenth volume.

I have the honour, Sir, to remain,

Your obedient servant,

EDMUND BAYNES REED,

*Secretary-Treasurer.*

3. X. 1883

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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 3rd, 1883, at 7.30 o'clock p.m.

The President, Mr. William Saunders, of London, Ont., in the chair.

*Present* :—Rev. C. J. S. Bethune, M.A., Port Hope; Rev. T. W. Fyles, Levis, P.Q.; James Fletcher, Ottawa; R. A. Hanham, Paris; W. H. Harrington, Ottawa; J. M. Denton, London; B. Gott, Arkonà; A. Puddicombe, London; F. C. Lowe, Dunnville; H. P. Bock, London; W. E. Saunders, London; J. Magnus Johnston, London; the Secretary-Treasurer, E. Baynes Reed, and others.

The minutes of the previous meeting were confirmed, the reading being dispensed with, as they had already been printed, and sent to the members.

The President addressed a few words of welcome to the members, expressing the pleasure which the London brethren felt at meeting their fellow-workers from the various parts of the Province.

The Report of the Council and the Financial Statement of the Secretary-Treasurer or the past year were then read, and on motion duly received, discussed, and adopted.

REPORT OF THE COUNCIL FOR 1883.

The Council desire in presenting their Annual Report to congratulate the members on the continued activity and prosperity of the Entomological Society of Ontario. The stimulus given to our scientific and economic work by the meeting last year in Montreal, when we were favoured with the presence and co-operation of so many distinguished entomologists, has done much to promote Entomology in Canada, and we look forward with additional satisfaction to the prospect of meeting some of our European fellow-labourers at the scientific gathering of the British Association which is to be held next year in Montreal.

A large number of the insects in our collection have been forwarded for exhibition at the International Fisheries Exhibition now being held in Great Britain, your Council having gladly acceded to the request of the Minister of Marine and Fisheries to add in this way to the interest of the Dominion exhibit. The collection arrived in England safely, and has attracted much attention, and has added to the reputation already possessed by the Society; every precaution has been taken for the safety of this collection and its due return.

During the year a very complete general Index to our thirteen Annual Reports has been prepared, which has added greatly to their value.

Early in the spring we were honoured with a request from the Royal Society of Canada to send a representative to their meeting, which was to be held in Ottawa in May. The Council appointed Mr. James Fletcher, who duly attended the meeting of that learned body, and read a statement of the objects and condition of the Society.

At the recent meeting of the American Association for the Advancement of Science, held at Minneapolis, Minnesota, our Society was represented by the President, who has prepared a report of the proceedings of the Entomological Club for publication in the Society's Annual Report.

The Council purpose still to continue their efforts to obtain a more liberal interpretation of the existing Customs' regulations, so as to render such supplies as our Society may need for its scientific work free of duty. Efforts have also been made through the Royal Society of Canada to obtain more favourable postal regulations for the transmission of entomological and botanical specimens in order to facilitate exchanges between students in this country and those in Europe and America.

The thanks of the Society are due to Prof. James Bell, of Albert College, Belleville, who has kindly contributed a variety of beautifully prepared microscopical objects for the use of the Society.

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Numerous additions have been made to the Library, among which special mention may be made of six of the beautifully illustrated volumes published by the British Government containing some of the scientific results of the Challenger expedition. The new edition of the Micrographic Dictionary; Insects Injurious to Fruits, by Mr. Saunders; and a complete series, coloured, of the magnificent illustrated works on Entomology, by the late Prof. Townend Glover.

In conclusion, the Council cannot refrain from expressing their gratification that our President, Mr. Wm. Saunders, has completed and published his able work on "The Insects Injurious to Fruits," thus supplying a much needed manual for the guidance of Fruit-growers and Horticulturists.

The audited Report of the finances will be submitted as usual; on behalf of the Council.

E. BAYNES REED,  
*Secretary-Treasurer.*

ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE  
ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE  
YEAR ENDING SEPTEMBER 30TH, 1883.

*Receipts.*

Balance from previous year, 1882 .....	\$55 98
Members' fees, sale of <i>Entomologist</i> , etc.....	336 61
Provincial grant, 1883 .....	1000 00
Dominion grant for Fisheries Exhibition .....	200 00
Collectors' material—pins, cork, etc.....	26 79
Interest on Bank account.....	9 50
Engraving—received for electrotypes of cuts.....	2 42
	<hr/>
	\$1,631 30

*Disbursements.*

<i>Canadian Entomologist</i> : printing, paper, stationery, etc., including reprints of earlier volumes .....	\$618 67
Library account.....	116 52
Expenses of Report for 1882, including engraving, electrotypes and woodcuts, and also of Index to the thirteen Annual Reports ..	303 40
Expenses of preparing cases for Dominion Fisheries Exhibition ...	200 00
Annual vote to Editor and Secretary-Treasurer.....	175 00
Rent .....	80 00
Caretaker .....	12 00
Insurance .....	16 00
Collectors' material: pins, etc .....	58 95
Sundries: Postage, etc. ....	42 29
Balance.....	8 47
	<hr/>
	\$1,631 30

We certify that we have examined the above account with books and vouchers, and found the same to be correct. Balance in bank eight dollars and forty-seven cents.

CHARLES CHAPMAN, }  
H. P. BOCK, } *Auditors.*

Entomological Society's Rooms, London, Ont.  
October 7th, 1883.

The report of the Montreal branch of the Society was next submitted.

#### MONTREAL BRANCH, ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Tenth Annual Meeting of this branch was held at the residence of the President, H. H. Lyman, Esq., M.A., Montreal, on Tuesday, 8th May, 1883, at 8 o'clock, p.m.

President read the following report of the operations of the Society for the year :—

##### REPORT.

Your Council beg to submit the Tenth Annual Report of the Branch.

Five regular meetings have been held during the year, and in addition to these, the members have had the pleasure of attending the Annual Meeting of the parent Society, which was held in the rooms of the Natural History Society, on the 24th August last, during the session of the American Association for the Advancement of Science. The opportunity of meeting with many of the entomologists of the United States, and the President and other officers of our Canadian Society, was highly appreciated by our members.

The following original papers have contributed to the interest of our meetings during the year :—

1. Description of a *Dipterous* parasite on *Phylloxera vastatrix*, by the Rev. T. W. Fyles.
2. Sir John Lubbock on Ants, by G. J. Bowles.
3. Notes on the Genus *Callimorpha*, by H. H. Lyman.
4. Preliminary list of the *Geometridæ* of Quebec and Montreal, by G. J. Bowles.
5. Notes on some diurnal *Lepidoptera* occurring in Canada, by F. B. Caulfield.
6. Causes of rarity in some species of insects, by G. J. Bowles.

The whole respectfully submitted.

H. H. LYMAN,  
*President.*

The Report having been adopted, the election of officers took place, with the following result :—

G. J. Bowles, President; W. Cooper, Vice-President; F. B. Caulfield, Secretary-Treasurer; J. G. Jack, H. H. Lyman, W. Shaw, H. Graves, Council.

A very pleasant hour was then spent in examining the President's collection of *Lepidoptera* and the scarce and valuable illustrated entomological works in his library.

GEO. JOHN BOWLES,  
*Secretary.*

The President then delivered his annual address, for which he was unanimously accorded a vote of thanks and requested to publish it in the *Canadian Entomologist*.

#### ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

GENTLEMEN,—Twenty years ago, on the afternoon of the 16th of April, 1863, there met at the rooms of the Canadian Institute in Toronto nine gentlemen interested in entomology, for the purpose of organizing a society having for its object the advancement of entomology in Canada. These gentlemen had been called by special invitation of the Rev. C. J. S. Bethune and myself, and in addition to the nine who responded by their presence, letters of apology were received from five others expressing regret at their being unable to attend; these fourteen comprised all who at that time took an active interest in entomology in Canada.

A society was formed, and with President Lyman, as President, the first meeting was held on the 16th of April, 1863, at which was read the first paper, which was kindly presented by the Rev. C. J. S. Bethune.

In December, 1863, the first catalogue of the Society was published, and in May, 1864, the first issue of the *Canadian Entomologist* was published. The first committee was appointed in 1864, and the first meeting of the committee was held in 1865.

Previous to the formation of the Society, the *Canadian Entomologist* was published by the Rev. C. J. S. Bethune, and in 1865, it was published by the Rev. C. J. S. Bethune and the Rev. C. J. S. Bethune. The first issue of the *Canadian Entomologist* was published in 1864, and the first issue of the *Canadian Entomologist* was published in 1865.

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The Entomological Society of Ontario was formed in 1863, and the first meeting was held on the 16th of April, 1863, at which was read the first paper, which was kindly presented by the Rev. C. J. S. Bethune. The first issue of the *Canadian Entomologist* was published in 1864, and the first issue of the *Canadian Entomologist* was published in 1865.

In August, 1863, the first issue of the *Canadian Entomologist* was published, and in 1864, the first issue of the *Canadian Entomologist* was published. The first issue of the *Canadian Entomologist* was published in 1863, and the first issue of the *Canadian Entomologist* was published in 1864.

A society was duly organized under the name of the Entomological Society of Canada, with Professor Croft, of Toronto, as its first President. Two scientific papers on insects were presented and read, and a number of interesting insects exhibited. Application was made to the Council of the Canadian Institute for the use of a room in their building, which was kindly granted free of expense, and it was resolved to hold monthly meetings for the discussion of entomological subjects.

In December of the same year a committee was appointed to prepare and publish catalogues of the names of insects in the orders of *Coleoptera* and *Lepidoptera*, and in May the following year the committee reported that the list of *Lepidoptera* had been completed and published, and that considerable progress had been made in determining the species of *Coleoptera*, but not sufficient to warrant the publication of the catalogue. This catalogue was completed and published shortly after. Before the close of this meeting committees were appointed charged with the special duty of paying particular attention to the study of insects injurious to vegetation.

Previous to this nothing had been done in Canada in the important department of Economic Entomology, no information was available to the farmer or fruit grower in reference to most of the insect pests which destroyed his field crops or fruit unless he happened to be the fortunate possessor of a volume published in New England by Dr. Harris under the title of *Insects Injurious to Vegetation in Massachusetts*, and this, although a very useful work, only partially met the wants of the practical farmer. Dr. Fitch, State Entomologist for New York, had published his first nine reports and was almost the only active labourer in this important department of insects injurious to agriculture, but his works were not accessible to many in this country.

In scientific entomology but little had been done in Canada up to this period. Several catalogues of the names of insects captured in this country had appeared in the *Canadian Naturalist* the organ of the Natural History Society of Montreal, and the occurrence of several rare species of butterflies had been noted. Messrs. Wm. Couper and B. Billings, of Montreal, had also communicated some papers to the same journal, urging the importance of the study of entomology, and referring to the habits of some of the pine borers and other prominent insects, but the circulation of the *Naturalist* was so limited that the information given reached but few in the community.

The Entomological Society of Canada at first had no funds to enable them to publish reports of their proceedings beyond the small sum derived from the annual fees of the members; but among these were a number of active workers, who, by careful and systematic observation and study, were rapidly accumulating stores of knowledge which were destined to be of much value in the future to the great community of farmers and horticulturists. At first the proceedings of the infant society were published in the *Canadian Journal*, but soon it was felt to be most desirable, in order to give them the prominence they deserved, that the records of facts observed by the members should be published in a separate form, and early in 1867 an effort was made to obtain some assistance from the Canadian Government to aid the Society in carrying out this object; but at a meeting held the 1st of June, 1867, a communication was presented from the Finance Minister of the united Provinces to the effect that he could not recommend any fresh grants for scientific objects, as the country was on the eve of confederation. The annual report of the secretary presented at this meeting showed that the membership had been increased to forty-eight. The meeting was to have been followed by a field day, but the Fenian raid, which just then occurred, called some of the members away to their duty as volunteers, and others to the defence of their homes.

In August, 1868, the first number of the *Canadian Entomologist* appeared under the editorship of our esteemed coadjutor, Rev. C. J. S. Bethune, of Port Hope. It was a humble looking sheet of eight pages only, and this was not promised to be issued at any regular intervals, but from time to time as material accumulated which was thought to be worthy of publication. To meet the expenses of publication, voluntary contributions were made by many of the members, and the journal was thus sustained and issued monthly for fifteen months, during which time it was found to be so useful that it met with encouragement everywhere. It had also acquired a reputation abroad, and many entomologists in Great Britain and the United States had become regular subscribers. Early in 1870 the

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Council of the Agricultural and Arts Association of Ontario recognizing the important bearing of entomology on agriculture, liberally appropriated the sum of four hundred dollars in aid of the Entomological Society for the year ensuing, on the following conditions:—That the Society continued to publish the *Canadian Entomologist*; that it furnish a report to the Council on insects injurious or beneficial to agriculture; and that a small cabinet of insects illustrating the various orders be made and placed at the disposal of the Council. These conditions were gladly complied with and faithfully carried out, and the report consisting of sixty-four pages, illustrated with sixty-one cuts, was printed in the report of the Commissioner of Agriculture for that year. During the latter part of 1870, an amendment to the Agricultural and Arts Act was introduced by the Hon. John Carling, then Commissioner of Agriculture for Ontario, which provided for the incorporation of the Society under the name of "The Entomological Society of Ontario," with a yearly grant of five hundred dollars from the public funds of the Province, on condition that the Society prepare annually for the Commissioner of Agriculture a report on the subject of insects injurious or beneficial to the farm and garden, with the understanding also that the *Canadian Entomologist* should be continued. During the period which has since elapsed, the Ontario Government have recognized the value of the service rendered by the Society to the agricultural interests of Ontario, by increasing the grant several times, until it now amounts to one thousand dollars a year. The liberality of the Government has greatly stimulated the work of the Society.

The practical or economic aspect of this work has been presented to the public mainly in the series of thirteen annual reports, which have been submitted to the Commissioner of Agriculture by members of the Society, and published in the Commissioner's report. In these publications the insects injurious to the various field crops and fruits have from time to time been discussed, together with the remedies which have been suggested for their destruction. The value of these reports is indicated by the demand which has arisen for them, owing to which it has been found necessary to greatly increase the number of copies issued. Some of those belonging to the earlier years are now quite scarce and difficult to obtain. They have been most favourably noticed by the press in all parts of America and in Great Britain, and thus the good work has been brought prominently into notice. If we contrast the amount of information now available to our farmers and fruit growers on the nature and life history of destructive insects and the best methods of subduing them with our knowledge on this subject fifteen years ago, the vast progress made will at once be recognized, and it is to the unselfish labours of the members of our Society that much of the credit for this is legitimately due. I have no hesitation in asserting that the value of the information thus distributed has returned to the country by the losses which have been lessened or prevented many times the amount which has been granted to the Society during the past twelve years from the public moneys of this Province.

The *Canadian Entomologist* has been regularly issued, and is now in its fifteenth volume. The volumes published have contained a vast amount of useful scientific information, which by its wide dissemination has been one of the chief factors in the progress of entomology in this country. The work of our Society in this department has attracted much attention abroad, and our journal has been sought after by many of the learned societies in Great Britain, the United States, France, Germany, Russia and Sweden, and regular exchanges of our publications with theirs on equal terms effected. Thus from small beginnings the Entomological Society of Ontario has come to be recognized as one of the important aids to scientific progress. It is much to the credit of Ontario that for some years the *Canadian Entomologist* was the only regularly issued periodical specially devoted to the interests of entomology on the American continent, and that it still commands the contributions of many of the most distinguished entomologists in all parts of the country.

During the period of the existence of the Society a large collection of insects has been made, a good library accumulated, and an excellent working microscope and other facilities for the study of insects provided, all of which are readily accessible here to any of our members who may reside in London, or who may visit us from a distance. The collection shown, at the request of the Government, at the Centennial Exposition in Phila-

delphia, in 1876, was a complete exhibit of a gold medal series for the purpose of such insects to be sent with the report now being held by our worthy ward in due

The large rooms in London for collectors from all over the world and appliances for insect forms: by the Society indicating the

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The clove in the Annua and many con The perfect in appearance of minute eggs of red larvæ de

delphia, in 1876, attracted much attention; and was admitted by all to be the most complete exhibit of North American insects ever brought together; the Society was awarded a gold medal on that occasion. Last year a request was made by the Minister of Fisheries for the Dominion of Canada that our Society would prepare and exhibit a collection of such insects as were injurious to fishes as well as those which served as food for fishes, to be sent with the Canadian exhibit to the great International Fisheries Exhibition now being held in London, England. The arrangement of this collection was undertaken by our worthy Secretary, Mr. E. Baynes Reed, who completed the work and sent forward in due season forty cases of Canadian insects.

The large collection of carefully determined specimens in the cabinets in the Society's rooms in London, has also served a valuable purpose, as a collection of reference where collectors from all parts of the Province can name their insects, and where all the books and appliances which can aid this work are ready at hand. As our knowledge of the insect forms found in our country increases, classified lists of their names are published by the Society, for the purpose of aiding students in arranging their collections, and also indicating the work which has been accomplished.

During the past year a most complete and systematic index has been prepared by our Secretary, Mr. E. Baynes Reed, to the full series of our thirteen annual reports, by means of which the information they contain in reference to any insect or subject may be referred to with little trouble or delay. This has greatly enhanced the value of these reports, and opened the eyes of all to the vast fund of information they contain; the results amply repay the attendant labour and outlay of this compilation, and nothing would do more to add to the value of the *Canadian Entomologist* than the publication of a similar general index to the fifteen volumes of our monthly now completed. I trust our esteemed Secretary may be induced to continue the good work in this direction.

We have not been afflicted with any very formidable invasion of insect enemies during the past year. At the opening of the season the apple-tree aphid which is generally common, was in some districts unusually abundant, and attracted some attention. The injury inflicted by them on the apple-buds was not serious, and in a few days the buds expanded, when the lice became scattered over the opening foliage and caused no further apprehension.

Later on the tufted caterpillar of the white-marked tussock moth *Orgyia leucostigma* appeared in force, having hatched in multitudes from the numerous masses of eggs attached to the twigs and limbs of various trees. These eggs are usually partly sheltered by a dead leaf or leaves firmly adherent. The mass contains from 300 to 500 white eggs imbedded in a frothy gelatinous substance, is of a grayish white colour, with a nearly smooth convex surface, while there is usually attached to the mass the empty grey cocoon from which the parent moth escaped. The eggs hatch about the middle of May, when the young larvæ at once begin to devour the leaves of the tree on which they are placed, rapidly increase in size, and when full grown present a handsome appearance. Their bodies are more than an inch long, of a bright yellow colour, with a red head, three or four cream-coloured tufts set in a black stripe along the back, two long black spreading plumes extending forward on the anterior part of the body, and one at the opposite extremity. By gathering the clusters of eggs during the winter when they are easily seen, the depredations of this insect may be prevented; but should this simple measure from any cause be omitted, the larvæ may be destroyed on the trees by syringing the foliage on which they are feeding with Paris green and water in the proportion of a teaspoonful of the poison to a pailful of water. This caterpillar is a very general feeder, and occurred this year on almost every species of deciduous tree, especially on street trees, and in lawns and parks, as well as in orchards.

The clover seed midge to which the attention of farmers of this Province was first called in the Annual Report of our Society for 1881, continues to extend its sphere of operations, and many complaints are being made of the failure of the crop of clover seed from this cause. The perfect insect is a two-winged fly, about the size and having much of the general appearance of the wheat midge. By the aid of a long ovipositor the insect pushes her minute eggs down the flower tubes in the young clover heads, and when hatched the tiny red larvæ devour the seed. In districts where this insect has fairly established itself

there seems to be but one method of subduing it, and that is to starve it out by ceasing to grow clover for a year or two, a large proportion of the larvæ may be destroyed by cutting the clover earlier than usual, just as it is coming into bloom, when being only partially developed most of them would perish. The greater danger arises from the possibility of their being distributed by the use of infested clover seed. The insect passes the winter either in the larval or pupal state, and in both of these conditions is often found amongst clover seed, and if sown with the seed the insect is placed amid conditions most favourable for its development. Seedsmen should carefully examine their seed before offering it for sale, and farmers should exercise similar caution before purchasing. The insects are very small but are much larger than the individual seeds, and if a small quantity of the clover seed is passed through a fine sieve these insects, if present, will be found along with the coarser weed seeds with which clover seed is so often contaminated.

The maple Egerian known also as "the legged maple borer" *Agarica acerni* has prevailed during the past year in the neighbourhood of London to an alarming extent, to the serious injury of some of our shade trees. These insects which pass the winter in the larval state under the bark of the maple trees change to chrysalids early in June, and about the middle of that month they protrude themselves from the bark to the extent of about half an inch, when in a very short time the mature insect escapes, leaving the empty chrysalis behind it. This is a very pretty clear-winged moth, resembling a wasp, which when its wings are spread will measure about three quarters of an inch across. The transparent wings are adorned with bluish-black markings, the head is orange, the thorax yellow, and the abdomen bluish black banded with golden yellow. The female lays her eggs on the bark of the trees, preferring the red maple *Acer rubrum*, although the other varieties of maple are also more or less affected. In a few days small larvæ hatch from the eggs, which penetrate through the bark and feed upon the inner portion and sapwood of the tree, making an irregular cavity which is packed with the castings of the larvæ mixed with minute fragments of wood. When full grown it is about three quarters of an inch long, with a small yellow head, and a white or yellowish white body, which is darker on the hinder segments. Where the larvæ are safely lodged under the bark no remedy but the knife will reach them, but the moths may be prevented from laying their eggs by coating the bark with a mixture of soap and strong solution of washing soda, the mixture being made about the consistence of ordinary paint, and applied to the trees in the middle of June.

Within the past two or three years Paris green mixed with water in the proportion of a teaspoonful to a pailful of water has been recommended as a remedy for the codling moth, the mixture being freely applied to the apple trees with a syringe or force pump soon after the fruit has set. The results of experiments conducted during the past season go far towards establishing the value of this remedy, the number of wormy apples having been materially lessened on the trees so treated. In my own experiments where the mixture was applied to alternate trees, the proportion of wormy fruit in some instances on the trees syringed seemed to be nearly the same as on the adjoining trees which were not treated; the fruit on both being less wormy than usual, while in other instances there was a very unusual freedom from the apple-worm. Other experimenters claim far more decided results. So promising a measure, where so much is at stake, well deserves a most extensive trial. The mixture should be applied while the fruit is quite small and before the stem is bent with its weight, then as the eye or calyx of the fruit on which the codling moth usually deposits her eggs points upwards, it will more readily catch some portion of the spray. A very minute quantity lodged in the little cavity and drying there would leave a trace of Paris green sufficient to destroy the newly-hatched larvæ as it begins to eat its way into the fruit.

The meeting of the American Association for the Advancement of Science was held this year at Minneapolis, where I had the honour to represent our Society. The attendance of entomologists, although good, was scarcely so large as last year. Since the adoption of the new Constitution, whereby the sub-section of Entomology has been merged into the section of Biology, the entomologists have greatly felt the need of opportunities of bringing up for informal discussion many questions suggested by the experience of those present, matters which could not well be brought before the general session. To

meet this most interesting  
*Entomologist*

We have well known to our Journal have passed Professor Clemens the eminent a world-wide years. Dr. and an occasional Townsend Government of Agriculture ever worked excellent enough his notice. any man in several years quiet home regular and him we are in field in which Dr. Clemens Ont., although habits of industry long been a success years ago, and sixth year. always took portion of our Society its prosperity his son, after Who will busy workers continue to a generations.

MR. JAMES

REPORT OF

To the President

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meet this need the Entomological Club of the Association has been reorganized, several interesting meetings were held, the proceedings of which have been reported for the *Entomologist* and Annual Report.

We have had occasion to mourn the loss by death during the past year of several well known entomologists, some of whom were active members and valued contributors to our Journal. The names of Zeller, Glover, and Chambers are familiar to you all; these have passed away. Our list also includes the names of Dr. Bailey, of Albany, N.Y.; Professor Croft, late of Toronto, and Charles Arnold, of Paris, Ont. Prof. P. C. Zeller, the eminent German lepidopterist, whose labours in the micro-lepidoptera have given him a world-wide reputation, died at his home near Stettin at the ripe age of seventy-seven years. Dr. Jas. S. Bailey, of Albany, N.Y., a zealous worker among the lepidoptera, and an occasional contributor to the *Entomologist*, passed away on the 1st of July. Prof. Townsend Glover, who for so many years held the position of Entomologist to the Department of Agriculture in Washington, died on the 8th of September. Probably no man ever worked more persistently and continuously than he. A good draughtsman and an excellent engraver, it was his delight to make figures of every native insect brought under his notice. Our library has been enriched by his beautiful works, and the wonder is how any man in one short life could have done so much. His health having failed, he retired several years ago from his official position and active work, and spent his last days in a quiet home in Baltimore. V. T. Chambers, of Covington, Kentucky, one of our most regular and valued contributors, died on the 7th of August, his fifty-second birthday. To him we are largely indebted for the knowledge we possess of our micro-lepidoptera, a field in which he ardently laboured, and in which he was a worthy successor to the late Dr. Clemens; his loss will be much felt and sincerely deplored. Charles Arnold, of Paris, Ont., although not an active worker in the entomological field, was a close observer of the habits of insects, especially such as are injurious to agriculture or horticulture. He had long been a member of our Society, was with us at our annual meeting held here two years ago, and took part in our discussions. He died on the 15th of April, in his sixty-sixth year. Prof. Croft, long well known throughout Canada as an eminent chemist, always took an active interest in entomology, he took a prominent part in the organization of our Society, was its first president, and always manifested the greatest interest in its prosperity. He died at Hermanitas, Texas, on the 28th of April, at the residence of his son, after a brief illness, aged sixty-four years.

Who will press to the front and fill the vacant places in our ranks? One by one our busy workers pass away, but our favourite branch of natural science still lives, and will continue to assert its increasing importance, and to confer its benefits on all succeeding generations.

I have the honour to be,

Yours very sincerely,

WM. SAUNDERS.

MR. JAMES FLETCHER, of Ottawa, then read the

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

*To the President and Members of the Royal Society of Canada.*

GENTLEMEN,—In response to the invitation received by the Entomological Society of Ontario to send a delegate to the meetings of the Royal Society of Canada, the Council of Management gladly avail themselves of the privilege so accorded them of being represented on this occasion.

As their delegate, I shall endeavour to submit for your information, in as brief a manner as possible, some of the main features relating to the origin, and progress, of the Society, now so well known as the Entomological Society of Ontario. It was organized

in 1863, under the name of the Entomological Society of Canada, by a few naturalists living in different parts of the Provinces, who met together at Toronto for this special purpose. Its membership at first was only sixteen, and this number included all those then known to be interested in the study of insect life in Canada. From this small beginning the Society has steadily increased, until its membership now reaches upwards of five hundred.

The benefits of organization and united effort were soon manifested by the rapid accumulation of valuable facts relating to scientific and economic entomology. Formerly this material was, from time to time, published in the pages of the *Canadian Journal*; but the increased interest in the work of the Society, and its larger membership, rendered it necessary in a few years to establish a periodical of its own, entirely in the interests of Entomology. On August 1st, 1868, appeared the first number of *The Canadian Entomologist*, a monthly periodical which has, from that time forward, been regularly issued, and which was for some years the only publication on the continent of America, devoted solely to this important branch of natural science. It has now reached its fifteenth volume. From the outset its pages have been almost entirely filled with the records of original work; and during its existence it has been the means of disseminating a vast amount of scientific knowledge which has been of benefit, not only to Canada but to the world at large. In this connection it may not be out of place to quote the opinion of one of the leading American entomologists. Prof. Grote, of New York, in his late work on the Noctuidæ, when enumerating the sources of information of value to entomological students, speaks of the organ of our Society in the following complimentary terms:—

"The treatise of Dr. Harris, which has become classical on its subject, did much towards creating a general interest in Entomology. But the publication of the *Canadian Entomologist*, a journal aided pecuniarily by the Ontario Government, and owing its success chiefly to the unselfish labours of Mr. William Saunders, has assisted the progress of Entomology in America probably more than any one other similar undertaking."

The work of our Society has also been favourably commented upon abroad, and a regular system of exchange of publications has been established with many of the important learned societies of Europe. In addition to the good work done by the issue of the *Canadian Entomologist*, collectors have been materially aided in their studies by the classified lists of the different orders of Canadian insects, which have been published as the material for the purpose was gathered together.

The extensive collection exhibited by the Society at the Centennial Exhibition at Philadelphia attracted much notice, and was admitted by all who saw it, to be most creditable to Canada. At the request of the Dominion Government a similar collection has been sent to England as part of Canada's contribution to the International Fisheries Exhibition.

Beyond this purely scientific work, the Society has, in a series of thirteen annual reports on insects injurious and beneficial to agriculture, given to the farming community a large amount of useful information.

The Government of Ontario, recognizing the good work thus accomplished, incorporated the Society as the Entomological Society of Ontario, under the "Agriculture and Arts Act," in 1870; and at the same time gave material aid by allowing a liberal annual grant from the public funds.

In view of the necessity for the constant interchange of specimens between students in every department of Natural History, in order that, by comparison of other forms, their studies may be thorough; the Entomological Society of Ontario respectfully suggest that the Royal Society of Canada should use its influence to secure a more liberal interpretation of the postal regulations, with reference to the exchange of specimens between students in Canada and those in the United States and Europe, particularly in the closely allied sciences of entomology and botany.

And it would also further suggest that a representation be made to the Government to the end that arrangements be made whereby scientific bodies may be permitted to import, free of duty, any engravings, woodcuts, lithographs, electrotypes, or other illustrations which they may require for their publications.

The members of the Entomological Society of Ontario have learned with much

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pleasure that the Royal Society has already taken some steps towards the establishment of a national museum, and believing that such an institution would very appreciably assist the whole cause of science in Canada, they take this opportunity of assuring the Royal Society that they will be pleased to help in every way in their power, towards this end, by collecting specimens or otherwise.

Signed on behalf of the Council,

J. FLETCHER,

*Delegate.*

Ottawa, May, 1883.

On motion duly carried, the report was received and adopted, and Mr. Fletcher was unanimously re-elected the representative from the Entomological Society to the Royal Society.

#### ELECTION OF OFFICERS.

The election of officers then took place, when the following gentlemen were duly elected :—

*President.*—Wm. Saunders, London.

*Vice-President.*—James Fletcher, Ottawa.

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

*Council.*—Rev. C. J. S. Bethune, M.A., Port Hope ; Rev. T. W. Fyles, Levis, P.Q. ; W. H. Harrington, Ottawa ; John M. Denton, London ; J. Alston Moffatt, Hamilton.

*Editor "Canadian Entomologist."*—Wm. Saunders.

*Editing Committee.*—Rev. C. J. S. Bethune, J. M. Denton, E. Baynes Reed.

*Auditors.*—H. P. Bock and W. E. Saunders, London.

#### REVISION OF THE SOCIETY'S PRINTED LISTS OF INSECTS, ETC.

On the motion of Rev. C. J. S. Bethune, duly carried, it was resolved that the Society should, as soon as possible, publish a revised list of the Canadian Diurnals ; adopting as a basis the list and classification of Mr. W. H. Edwards, of West Virginia. And that the Society should also publish additional lists of such moths as have been found to be Canadian, and are not contained in the Society's existing lists.

In view of the desirability of the publication of the description of hitherto undescribed larvæ, and with a view to aid therein, the President and Vice-President, Rev. C. J. S. Bethune and W. H. Harrington, were appointed a committee to prepare blank forms for the use of members in describing larvæ ; the Society being of the opinion that following the practice of Westwood and Stainton, the body should be considered as consisting of thirteen segments, the head being the first.

The Rev. T. W. Fyles then read an interesting paper on "Observations on Form and Colour as Exhibited in Insect Life."

#### A. A. A. S.

The President submitted a report of the proceedings of the American Association for the Advancement of Science, held at Minneapolis in August last, which he attended as the representative of the Entomological Society of Ontario.

#### DISCUSSION ON MISCELLANEOUS ENTOMOLOGICAL SUBJECTS.

Mr. Fletcher exhibited a borer found by him injuring maple, the insect being a small moth belonging to *Hepialus* or some closely allied genus. This insect was new to the members.

Rev. Mr. Bethune stated that he had found in a large burrow in an oak tree, the empty pupa case of a species of *Cossus*.

Mr. Harrington had also found this insect quite common on the oak, and had frequently seen the empty pupa cases protruding from the bark.

Mr. Fletcher reported that he had found <sup>Leut.</sup> *Cossus centerensis* common about Ottawa on the Balm of Gilead tree *Populus balsamifera*; the pupa is usually extruded from the bark about four o'clock in the afternoon; he had frequently seen them at this time of day working gradually out; the imago usually escapes within an hour after the appearance of the pupa. He also reported finding *Buprestis fasciata* common on poplars, and had found a larva in poplar wood which he thought, from its appearance, might belong to that species.

Mr. Harrington said that he had lately found the larvæ of a very small fly <sup>Leut.</sup> *Cecidomyia robiniae* on locust trees about Ottawa; these larvæ turn down the margins of the leaves and live within the enclosure thus formed.

Mr. Fletcher had found the stems of sunflowers much bored into by some insect, and exhibited a larva which he had taken boring into the stem of a lily, *Lilium Canadense*.

Mr. Reed exhibited a larva which he had taken recently feeding on oak; it evidently was a species of *Smerinthus*, but did not seem to correspond to any hitherto described larva of this genus to which he had been able to refer.

Mr. Saunders made some reference to the manner in which the eggs of the Round-headed Apple tree borer, *Saperda candida* are placed. He had until lately held the opinion, in common with other entomologists, that the eggs are laid on the surface of the bark of apple trees near their base, but he had recently received from a correspondent, Mr. C. G. Atkins, of Manchester, Maine, specimens of the eggs deposited in young apple trees, from which it was quite evident that the beetle bores into the bark and deposits her eggs under the surface.

Mr. Fletcher said he had raised a brood of the larvæ of *Smerinthus excrucatus*, and found it to feed readily on *Populus balsamifera*, and also on *Populus alba*, the latter known as the silver beble tree; the larvæ varied very much in colouration; hitherto this insect has been supposed to feed only on apple, plum and wild cherry.

Mr. Saunders stated that he found the larvæ of *Papilio turnus* this season on a new food plant *Magnolia acuminata*; as many as forty or fifty specimens were found on a single tree, varying in size from the newly-hatched to the full-grown larva, all feeding together; eggs were also found at the same time and place.

Mr. Fletcher reported finding the larva of *Darapsa versicolor* feeding on swamp loose-strife *Nesaea verticillata*; he had bred a single specimen two years in succession; it is curious to note that this plant grows in the water, and being herbaceous, decays and becomes submerged during the autumn and winter months; in these instances there was no favourable pupating place nearer than the shore, so that the larva would have to swim ashore, unless it formed its cocoon among the leaves and these drifted to land.

Mr. Reed exhibited and reported the larvæ of *Photontha albifrons* Sm. and Abb. as common in London on the maple, he had also observed them recently on the elms in Toronto and Montreal; other members had found them generally common this season on the oak.

Mr. Saunders had found the larvæ of *Papilio cresphontes* on the wafer ash *Ptelea trifoliata*, also on the prickly ash *Zanthoxylum Americanum*; at this late period of the year (September) the larvæ may be found quite small. Query, Do these perish from early frost? If not, how do they pass the winter?

The meeting then adjourned to meet next morning at 9.30 a.m.

Thursday Morning, October 4.

The meeting opened at the Society's rooms at 9.30.

The question of the use of Paris green for the codling worm of the apple *Carpocapsa pomonella* was discussed, and while the members concurred in the desirability of testing

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interesting rec rutulus, P. zo melissa, Parnu bred rutulus a turnus, at leas machaon. He opinion that it

this remedy very fully, they recommended that due caution should be used in preparing the mixture not to make it too strong, one teaspoonful of the poison to a pailful of water being sufficient; if used much stronger than this it is apt to injure the foliage.

An interesting communication was read from Mr. J. Alston Moffatt, of Hamilton, on the pupa of *Calopteron reticulatum*; he had found specimens under the bark of an elm stump, curiously arranged in regular rows. Mr. Harrington had also observed the same species, and remarked that Drs. Leconte and Horn, in their new classification of coleoptera, referred to these curious groups of pupae.

Mr. Fletcher had found *Melanota picta* very abundant at Ottawa on cabbage, carrots, and many wild plants.

Mr. Harrington remarked that *Lycomorpha pholus* <sup>Drum.</sup> had been very common in the vicinity of Ottawa this season, he had seen hundreds of them; had also found *Adipoda corallina* Harris quite common in oat fields. *Pteronidea ribes* (Scopoli)

Rev. Mr. Fyles reported the Currant Worm *Nematus ventricosus* as being very abundant at Levis, P.Q., where the bushes had been almost destroyed by them. He also stated that much injury had been caused to the tamarack trees *Larix Americana* in Bury and the neighbouring townships, by a species of saw fly, the same, probably, as that which

has caused so much injury in Maine and the other eastern States, *Nematus Erichsonii* <sup>Hartig</sup>. Mr. Harrington informed the members he had found *Xyphidria albicornis* boring into maples, chiefly young trees where the bark was thin; he had observed them ovipositing from the middle of June to end of July. The ovipositor is short; he found in one instance a tree thoroughly riddled by these borers, they having penetrated directly into the wood.

The members having spent some time in examining interesting insects in the Society's collection, as well as those brought to the meeting, and also having availed themselves of the opportunity of reference to many of the valuable books in the Society's Library, brought to a close a most interesting and profitable session.

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

A meeting of entomologists was held, according to announcement, on the 15th of August, 1883, at Minneapolis, Minn., in the University Buildings. There were present during the meeting the following: Prof. S. A. Forbes, Normal, Illinois; Prof. C. V. Riley, Washington; D. S. Kellicott, Buffalo; Herbert Osborn, Ames, Iowa; O. S. Westcott, Chicago; Wm. Saunders, London, Ontario; Dr. and Jenny Hoy, Racine, Wisconsin; C. L. Herrick, E. W. Claypole, Prof. E. S. Morse, C. E. Bessey, E. H. Canfield; Miss Mary E. Murtfeldt, Kirkwood, Mo.; Mrs. M. B. Moody, Buffalo, N.Y.; Thomas S. Roberts, Minneapolis, Minn., and others.

S. A. Forbes read a letter from J. A. Lintner, regretting his inability to be present, and after some remarks by Mr. C. V. Riley as to the prevailing sentiment at the meeting of entomologists last year of Montreal, it was decided to reorganize the Entomological Club of the A. A. A. S., under the rules as hereinbefore recorded.

On motion, the following officers for the ensuing year were then elected:—

*President*.—D. S. Kellicott.

*Vice-President*.—Herbert Osborn.

*Secretary*.—O. S. Westcott.

A communication was read from Mr. W. H. Edwards, of Coalburg, W. Va., giving interesting recent experience in the rearing of butterflies of the following species: *Papilio rutulus*, *P. zolicaon*, *Colias barbara*, *C. amorphæ*, *Melitæa chalcodon*, *M. phaeton*, *Lycena melissa*, *Parnassius smintheus*? and *Argynnis coronis*? The author stated that he had bred *rutulus* and *zolicaon* from the egg, that *rutulus* is constantly distinguishable from *turnus*, at least after the first larval stage; and that *zolicaon* is closer to *asterias* than to *machaon*. He had also reared from the egg *Colias amorphæ*, and was inclined to the opinion that it was distinct from *C. eurydice*. Opportunities had been afforded of study-

ing all stages of *M. chalcon*, with *M. phaeton* colonizing on the same plant, so that the habits of the two species could be compared.

Mr. Edwards has also raised *Lycaena melissa* from egg to chrysalis, and finds that the larva in the last stages has similar organs to those of *Pseudargiolus* on the tenth and eleventh segments, and that ants are attracted in the same way by the sweet fluid they exude. Over 100 eggs of *Parnassius*, either *smintheus* or something close to it, have been obtained from West Montana. As to butterflies, the author stated that he had never seen them scarcer than during the past year. An interesting discussion followed this paper, in which several members took part.

Prof. Riley offered some "Notes on *Pædisca Scudderiana*," and exhibited plants of *Solidago* containing the larvæ of this species, and made some remarks on its habits which went to reconcile the published conclusions and differences between himself and Dr. Kellicott, and to show that while the insect is commonly a gall maker, it was also, exceptionally, an inquiline. The specimens showed that the habits of the insect were variable, and the larva was either a leaf-crumpler, living in a bunch of curled terminal leaves held together by a silken gallery, a stem-borer, without causing any swelling, or the maker of a more or less perfect gall. He had also found it as an inquiline in the gall of *Gelechia gallsolidaginis*, the gall of which was always distinguishable from that of the *Pædisca*; among other things by the burrow of the larva always being traceable from the blighted tip of the plant, whereas the *Pædisca* larva lived at first in the tip, and bored in at the side. Mr. Kellicott's observations were accurate so far as they went, but did not take into account the variation in habit. Mr. Riley had watched these larval habits during the present year from the time of hatching, and had concluded that the insect combined, in varying degree, the four characteristics of gall-maker, leaf-crumpler, stem-borer, and inquiline. The larvæ living in the crumpled leaves later in the season had not been reared to the imago, but he had made comparisons of the young larvæ and found that they were exactly alike, but they showed considerable modification as they developed, especially after the last moult. Several other micro-lepidopterous larvæ bored in the stems and lived among the leaves of *Solidago*; while another species, yet unbred, made a gall similar to that of *Pædisca*; but all the other larvæ known to him were easily distinguished from *Pædisca*.

Mr. D. S. Kellicott said he felt sure his observations as reported in the paper referred to were correct, and he was glad to know that both his own conclusions and those of Mr. Riley could be thus harmonized. It would seem he had not carried his observations far enough to discover that all the larvæ of *Scudderiana* fed at first in the terminal leaves. Late in the fall he had often taken from the terminal leaves the mature larvæ referred to by Mr. Riley, but had so far failed to obtain the imago from them. He had some doubt still of its being identical with *P. Scudderiana*.

Prof. Riley also called attention to the life habits of *Helia americanis*, which he finds in the larval state to feed in the nests of *Formica rufa*. So far as he knows, this is the first lepidopterous insect known to develop in ants' nests. He also gave his experience in rearing *Arsame obliquata* during the past two years, and exhibited specimens in different stages of development. The eggs are laid in curious broadly conical or plano-convex masses enveloped in hair, and a cream coloured mucous secretion, which combined look much like spun silk on the inside, and on the outside like the glazed exudation of *Orgyia leucostigma*. The larva, which is pale at first, but dark in its later stages, bores into the stems of *Sagittaria* and *Nelumbium*, and is semi-aquatic, the last pair of spiracles being exceptionally large and dorsal. There are two annual broods, the second hibernating as larvæ in moss and decaying stumps near the water. The moth shows great variation, and the summer brood is on the average not much more than half as large as the spring or hibernated generation, and generally much paler.

Mr. D. S. Kellicott said that he had bred this moth at Buffalo, N. Y., where it was very abundant, and he had found it associated with another species, an account of which he promised to give at some future session.

The meeting then adjourned to meet at 2 p.m., the following day.

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Wednesday, August 15th, 1883.

The members of the Club met at 2 p.m., the President in the chair.

A paper was presented by Prof. S. A. Forbes entitled "Memoranda with regard to the contagious diseases of caterpillars and the possibility of using the virus of the same for economic purposes." The writer had adopted the results of Pasteur's discoveries in relation to the disease affecting silk-worms as the foundation for his researches. M. Pasteur some time since demonstrated the constant presence of a parasite in the intestines of silk-worms affected by this disease, which has at times threatened the silk industry in Europe. This parasite was not only the indispensable accompaniment of the disease, but is its originating cause and the means by which it can be and is conveyed to other individuals of the species.

By placing healthy silk-worms in contact with those suffering from the disease, by sprinkling them with the dust of excreta derived from the latter, or by moistening their food with an infusion of the fermented mulberry leaves upon which these had fed, he proved the possibility of conveying the disease from one subject to another.

In pursuance of this Prof. Forbes has witnessed instances of epidemic disease in different species of insects, as for instance in the Chinch Bug and the Yellow-necked Caterpillar, which disease was invariably dependent upon some form of bacteria or micrococcus, possible of cultivation and reproduction, and by means of which the disease can be indefinitely conveyed. These facts give rise to the suggestion that the specific micrococcus or bacteria causative of these fatal diseases may be used for the infection and destruction of insect pests.

Prof. Osborn called attention to the fact that he had noticed *Bombus Pennsylvanicus* inhabiting a deserted wren's nest, situated under the roof of a porch, and at least twelve feet from the ground, it being the first instance he was aware of where they nested away from the surface of the ground.

Mr. D. S. Kellicott had noticed the same or some allied species of *Bombus* inhabiting a mouse's nest in the brace of a barn.

Miss Murtfeldt had also seen them domiciled in a martin's nest.

Dr. Hoy presented for inspection the larvæ, pupæ and imagines of *Plusiodonta compressipalpis*. He had watched the insect through its transformations and had noted that through its early larval stages its prevailing colour was a pea green varied with uniformly placed black spots, which increased in number with each successive moult. Only during the last stage of its larval life was the insect usually noticeable by other than professional eyes; since then its colour was reddish brown ornamented with creamy white. *Menispermum Canadense* was its usual food plant. The cocoon was formed by first building two nearly parallel walls and then uniting them at the top. Some larvæ which had been displaced after beginning to pupate, had apparently become exhausted, or their teeth had become loosened in anticipation of their approaching new condition, and they were willing to accept bits of paper held to them on a pin, with which they finished the cocoons already begun. The species in Racine cannot be more than two-brooded. The larvæ are not distinguishable from those of Geometrid moths, as they are true loopers. Their transformations in some particulars were exceedingly prompt.

Prof. Riley stated that he had known certain moths, notably *Leucania unipuncta*, to go through their entire transformations in fourteen days, and in some instances in only ten days.

Prof. Herrick made enquiry as to what are sometimes known as frost-flies.

Mr. Kellicott called attention to a monograph by T. Rymer Jones, and one by E. Ray Lankester, to be found in the Quarterly Journal of Microscopical Science, and stated that the species common at Buffalo was *Corethra plumicornis*.

Prof. Forbes had noticed the larvæ of *Corethra* abundant in the stomachs of fishes.

Adjourned to meet at the call of the President.

Friday, August 17th, 1883.

The Club met at the call of the President at 2 p.m., in the room in the University assigned to the use of Section F.

Prof. Osborn presented a paper on the Phytoptera, a group of insects formerly regarded as the larvæ of mites, the individuals of which are so small as to be invisible to the unaided eye. Reference was made to one form found on the soft maple, which occurs as a small swelling on the upper surface of the leaves, containing sometimes a number of these insects, at other times only two or three. One species affects the ash, occurring on both the upper and lower sides of the leaves, one occurs on elm and one on box elder, that on the last named tree having a woolly structure beneath the surface. This paper was illustrated by a very interesting series of carefully mounted microscopic specimens.

Prof. Riley remarked that the species which occur in Europe had been well worked up there, and that in studying our species the work already done on this group should be carefully examined, so as to avoid the making of synonyms. He considered that the hibernating habits of these mites was one of the most interesting discoveries which had been made in reference to them, and he hoped that the attention of investigators would be especially turned to this point. He referred also to additional species which occur on the plum, cherry and linden.

Mr. Osborn said that the Phytopsis on plum was not common in the neighbourhood of Ames, although he had found it occasionally; that on the maple is particularly abundant.

Mr. Saunders referred to the unusual amount of black knot seen in Ontario this year, especially on the common red cherry trees, and stated that he had scarcely seen a specimen of this fungus on the cherry which had not one or more specimens of the plum curculio feeding on the interior.

Mr. Riley remarked that the black knot had been very common of late all through the northern portions of New England.

Mr. Kellicott had observed it as very common in western New York, and had also noticed that a large proportion contained larvæ.

Mr. Osborn stated that he had observed the larvæ of *Gortyna nitela* boring in young twigs of ash, and had noticed many dead twigs from this cause. He had failed to rear the imago from them on account of parasites; he had also observed the same species feeding externally upon the leaves of the common plantain.

Miss Murtfeldt had found the same insect in twigs of the maple, *Acer dasycarpum*.

Prof. Riley stated that it had occurred also in peach twigs and in the stalks of wheat; also in *Ambrosia artemisiifolia*, where it enters from the sides.

Prof. D. S. Kellicott offered the following notes on three lepidopterous stem-borers.

First, *Arzame obliquata*.—Prof. Riley has referred to the habits of this species at a previous session of the Club, and I shall refer only to a few points. As I said yesterday, I feel sure that in Buffalo, N. Y., it is single-brooded. The eggs I have not found, but the recently hatched larvæ I have found feeding upon the flowers about the 12th of June. It occurs in *Typha latifolia*, rarely in *Sparganium*. I have not found it in *Sagittaria* or *Nuphar*. Mr. Riley has referred to the large posterior pair of spiracles placed dorsally. On account of this structure it may remain a long time swimming at the surface. I have had these larvæ confined in a pail of water for five or six hours without apparent injury. When removed from their galleries and dropped into the water, they sink to the bottom and remain there for a considerable time; then rising to the surface, they swim about with a snake-line motion. In the autumn they leave their food plants and bury themselves in the earth, or crawl into old wood, etc. They pupate in May.

Second.—The second larva is that of a *Nonagria*, which I have called *Nonagria subcarnea*. This species is also single-brooded; the larvæ are found boring the stems of *Typha* early in the summer, forming galleries in the stems; it may be readily distinguished from those of *A. obliquata* by the lighter colour, often carneau, and by the fact that the last pair of spiracles is not sub-dorsal. I have found it rarely in *Scirpus*. It appears not to be so nearly aquatic, and probably does not pass from one plant to another through the water, or mud. When the time comes for pupation it prepares a

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pupa-cell above the water line and changes in the bottom of the same, with the head upwards. It leaves the epidermis, closing the place of exit, and the freed moth breaks through this with its clypeal spine when it escapes, leaving the pupa skin in the cell. The elongate pupa has a very stout, blunt clypeal spine. The moth appears in August. It is known to abound throughout western New York, central Michigan, and eastern Wisconsin.

Third.—The larva of a *Chilo* (?) bores the stems of *Scirpus*. Its habits are similar to those of a *Nonagrian*. It passes the winter in the old stems, and after the new ones appear it bores into them, passes below the water line, and lives low down in the stem. It is mature late in June, when it forms a pupa cell with its place of exit above the water. The pupa breaks up the epidermis left by the larva, covering the place of escape, but does not force its way out before disclosing the moth, in a manner similar to that of the *Aegerians* and others. It is enabled to do this by means of clasps on the abdominal rings, and the sharp or pointed clypeus.

Mr. Riley, in commenting on Dr. Kellicott's communication, said that he had been greatly interested in the facts presented, and especially as to the pupation of the *Nonagria*. As to the difference in the clypeal projection in the two pupæ exhibited, he thought it might be sexual, as in all cases where the clypeus was produced sexual difference occurred, the greatest development being, so far as he had observed, not in the male but in the female. He had recently called attention in the *Naturalist* to the correlation between the produced clypeus and the horny, exsertile ovipositor, and the fact that they indicated *endophytous* larval habit. The various methods of imaginal exit in stem-boring lepidoptera, and the structural modifications that resulted, were most interesting to the philosophical entomologist. In some species, as in the *Nonagrian* here mentioned, the clypeal point on the pupa seemed merely a consequence of the necessary point in the imago, the pupa remaining in its burrow and the imago boring out. In others, as in *Prodoxus decipiens*, the similar clypeal point on the pupa permitted it to partly bore out of the stem and thus release the imago, which had no homologous point, but an unarmed head. In some borers the larva prepared a little door which the imago easily pushed open, the pupa remaining inactive within its prison; while in others, closely related, the pupa did the work by forcing itself partly out. There could be no question of the digoneutic nature of *Arsame obliquata* at Washington, and none as to its variability as illustrated by his specimens, *vulnificata* and *melanopyga*, being doubtless but forms of it.

Some specimens of *Cantharis Nuttali* were exhibited by Prof. Riley, it being stated that in Dakota they were accused of devouring the growing wheat.

The meeting then adjourned, when the members spent some time in informal conversation, and in examining the microscopic specimens illustrating Prof. Osborn's paper.

## POPULAR PAPERS ON ENTOMOLOGY.

ENTOMOLOGY FOR BEGINNERS.

BY WM. SAUNDERS, LONDON, ONT.

THE APPLE-LEAF CRUMPLER (*Phycita nebulo*).

During the winter there will often be found on apple trees clusters of curious little cases, partly and sometimes wholly hidden by portions of crumpled and withered leaves, as shown in fig. 1. The withered leaves are firmly fastened to the cases by silken threads, and the cases to the bark of the twig on which they are placed. Each case resembles a long miniature horn, wide at one end, tapering almost to a point at the other, and twisted in a very odd manner, as shown at *a* and *b*, fig. 2. It is curiously constructed of silk interwoven with the castings of the artificer, is lined internally with smooth, whitish silk, externally it is rougher and of a yellowish brown colour.

Within this curious structure there dwells a small caterpillar, which during the winter months remains torpid, awakening to activity with the warmth of spring. As the leaves of the apple tree begin to expand, the larva

draws those that are nearest to it towards the case, and feeds on them, retreating quickly within its case when danger threatens. When full grown it is about six-tenths of an inch long, its body tapering slightly towards the hinder extremity. The head is dark reddish brown, and the body dull greenish brown; the next segment to the head has a dark horny plate above and a flattened blackish prominence on each side. The head and anterior segments are shown at *c* in the figure. On each of the other segments there are several small black dots, from each of which arises a single pale brown hair. When mature, which is usually during the early part of June, it closes the end of its case, and changes to a chrysalis within, about four-tenths of an inch long and of a reddish brown colour, and in about a fortnight the moth appears.

When its wings are spread, the moth (*d*, fig. 2) measures about seven-tenths of an inch across. Its fore wings are pale brown, with streaks and patches of silvery white, the hind wings plain brownish white; the under side of both wings paler. There is only one brood in a year. The moths deposit

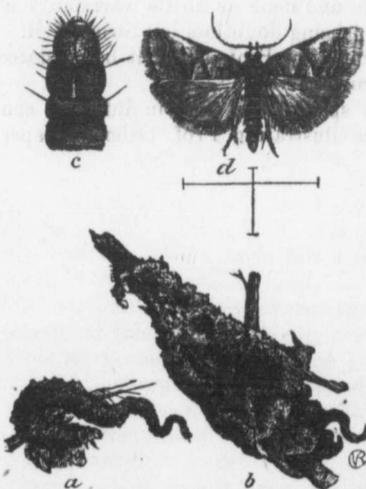


FIG. 2.

their eggs in the summer, and the larvæ construct their cases and attain about one-third of their growth before winter sets in.

Where the insects are abundant they become very injurious, consuming the young growth as it expands and materially affecting the vigour of the tree. To subdue them, pick the crumpled leaves with the cases from the trees and destroy them.

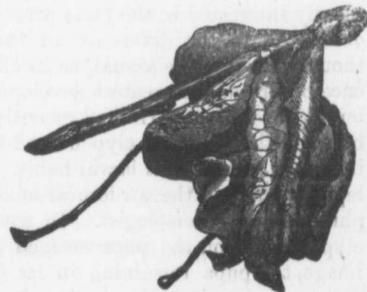


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THE APPLE-LEAF APHIS (*Aphis mali*?) Fabr.

This species of *Aphis* is very common throughout the northern United States and Canada, and has, during the past season, appeared in such numbers in some localities as to excite much alarm among fruit growers. The eggs are deposited by the parent lice in the autumn, about the base of the buds of the apple tree, and in crevices of the bark on the twigs. When first laid they are light yellow or green, but gradually become darker in colour and finally black. During the winter these tiny, oval, shining black eggs may be found with the aid of a magnifying glass on almost every apple tree.

As soon as the buds begin to expand in the spring, small lice are hatched from these eggs, which locate themselves on the swelling buds and young tender leaves, and inserting their sharp beaks into the tissues, feed on the sap they contain. The lice vary in colour from green to dark greenish-brown, the darker colour prevailing at first, the lighter colour in a few days afterwards. When they are abundant, the buds—especially the blossom buds—are sometimes thickly covered with them, yet it is seldom that any serious injury results from their attack. The growth at this period of the year is so rapid, and the sap circulates through the branches in such abundance, that the comparatively small quantity consumed by these plant lice seems scarcely to be missed. In a few days the young leaves expand, when the insects are distributed over the foliage, and usually attract no further notice.

All the lice hatched in the spring are females, and they reach maturity in ten or twelve days, when they commence to give birth to living young, producing about two every day for two or three weeks, after which the older ones die. The young locate about their parents and mature in ten or twelve days, when they also become mothers as prolific as their predecessors. As the season advances some of the females acquire wings, by means of which they fly to other trees where they found new colonies. In fig. 3 both winged and wingless specimens are shown much magnified. Late in the autumn males, as well as females, are produced, and the work of the year closes with the deposit of eggs as already described. Were it not for the

activity of Lady-birds and other useful predaceous insects, which appear early upon the scene and devour multitudes of these lice, they would soon swarm on every leaf of our apple trees and become a source of serious trouble.

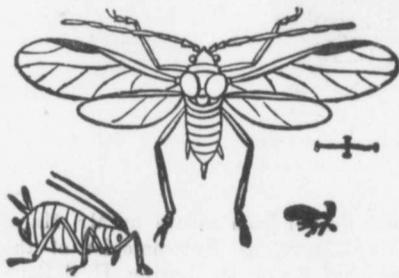


FIG. 3.

*Diaphania*  
THE MELON MOTH (*Ecdiopsis hyalinata*), Linn. .

A specimen of this beautiful little moth, known also under the name of *Phakellura hyalinatalis*, has been taken by Mr. J. Alston Moffat, in the neighbourhood of Hamilton, the first capture, as far as we know, of this insect in Canada. It is shown in fig. 4. The wings are of a pearly white colour with a peculiar iridescence, bordered with black, and they measure, when expanded, nearly an inch across. The body and legs are of the same glistening white, and the abdomen terminates in a movable brush-like tuft of a pretty buff colour, tipped with white and black. It is very widely disseminated, being found throughout the greater part of North and South America; and is very common in some sections in the Southern States.

The larva, shown also in the figure, is, when mature, about an inch and a quarter long, translucent and of a yellowish green colour, with a few hairs scattered over its body. They are frequently found feeding on melon and cucumber vines, and do not confine their attacks to the leaves, but eat also into the fruit, either excavating shallow cavities on the surface, or penetrating directly into its substance. They spin their cocoons on a fold of

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the leaf, as seen in the figure, within which they change to slender brown chrysalids about three quarters of an inch long, from which, in a short time, the perfect insect emerges.



FIG. 4.

The beautiful figure illustrating this subject was drawn from nature by Mr. Marx, of Washington, and published in Prof. Comstock's Report, as Entomologist of the Department of Agriculture, for 1879. Through the kindness of Dr. Loring, U. S. Commissioner of Agriculture, we have been supplied with an electrotype of it.

THE POPLAR DAGGER-MOTH (*Acronycta lepusculina*). Guencé.

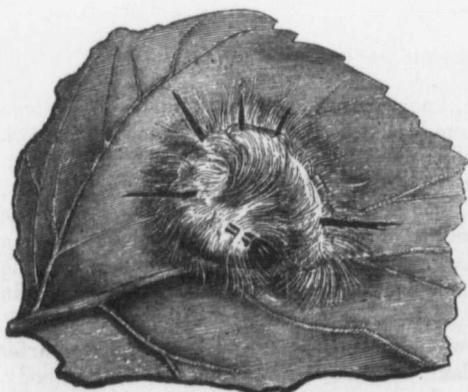


FIG 5, after Riley.

The caterpillar of this moth is often very destructive to poplar trees, and more especially to the foliage of the cottonwood tree in the west. It is, when full grown, an inch and a-half or more in length, with a black head, and its body clothed with long, soft yellow hairs, from amongst which arise along the back five long pencils of black hairs. When at rest it curls itself up on the leaf as shown in fig. 5.

When full grown the caterpillar spins a pale yellow cocoon of silk interwoven with its own hairs, hidden in some sheltered spot, and there changes to a dark brown chrysalis, from which in due time the moth appears.

The perfect insect measures, when its wings are expanded, about an inch and three-quarters across (see fig. 6). Its wings are

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gray, varied with dark brown dots and spots and shadings. Near the hinder angle of the front wings is a rather conspicuous spot not very distinctly shown in the figure, resembling the Greek letter *psi* placed sidewise. There are two broods of this insect during the year; the moths of the first appear in June, deposit eggs which produce larvæ that reach their full growth, pass through the chrysalis stage, and from which moths emerge about the end of July. The second brood of larvæ are found about the last of August and throughout September; they become chrysalids late in the season, and pass the winter in the chrysalis state.



FIG. 6, after Riley.

#### THE LIME-TREE MEASURING WORM (*Hybernia tiliaria*), Har.

The larva of this insect is a yellowish looper or measuring worm, with a reddish head and ten wavy black lines along the back. It is shown in fig. 7 in different positions.

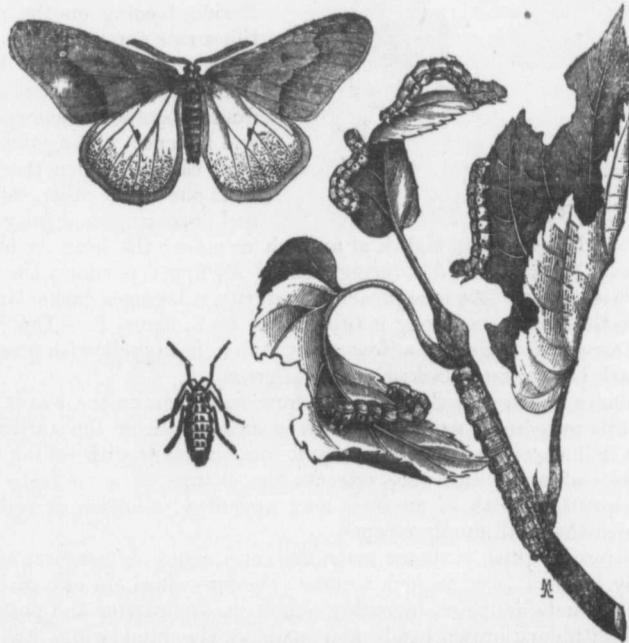


FIG. 7, after Comstock.

It is hatched early in the spring, and completes its growth about the middle of June, about which time it is often very destructive to basswood, elm, hickory and apple trees. When ready for its next change the larva lets itself down from the tree by a silken thread and buries itself five or six inches below the surface of the ground, and there changes to a chrysalis from which the moth usually escapes the following spring. Occasionally some of the moths appear in October or November, but this rarely occurs with us.

The male moths have large and delicate wings and feathered antennæ, as seen in the figure. The fore wings, which measure when spread about an inch and a-half across, are of a rusty buff colour, sprinkled with brownish dots, with two transverse wavy brown lines and a central brown dot. The hind wings are pale with a brown dot about their middle.

The female, also shown in the figure, is a wingless, spider-like creature, with slender, thread-like antennæ, yellowish white body, sprinkled on the sides with black dots, and

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with two black spots on the top of each segment excepting the last which has only one. The eggs are oval, of a pale colour, and covered with a net-work of raised lines.

THE GRAPE BERRY MOTH—(*Eudemis botrana*.) *Polychrosis vitiana Clem'*

This insect is an imported species and has long been injurious to grape culture in the south of Europe. The exact period of its introduction to America is not known, and it is only within the past few years that attention has been called to its ravages. When abundant it is very destructive, in some instances it is said to have destroyed nearly fifty per cent. of the crop.

During the past season it has been very abundant in the neighbourhood of London, there being very few vines the fruit of which has not been more or less injured. The young larvæ have usually been first observed early in July, when the infested grapes show a discoloured spot where the worm has entered. [See fig. 8, c.]

When the grape is opened and the contents carefully examined there will usually be found in the pulp a small larva rather long and thin, and of a whitish green colour. Besides feeding on the pulp it sometimes eats portions of the seeds, and if the contents of a single berry are not sufficient, two, three, or more are drawn together as shown in the figure and fastened with a patch of silk mixed with castings, when the larva travels from one to the other, eating into them and devouring their juicy contents. At

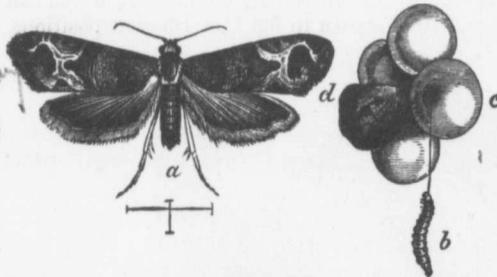


Fig. 8.

this period its length is about an eighth of an inch or more; the head is black and the next segment has a blackish shield covering most of its upper portion; the body is dull whitish or yellowish green. As it approaches maturity it becomes darker in colour, and when about one-third of an inch long is full grown, see *b*, figure 8. The body is then dull green with a reddish tinge and a few short hairs, head yellowish green, shield on next segment dark brown, feet blackish, pro-legs green.

When the larva is full grown it is said to form its cocoon on the leaves of the vine, cutting out for this purpose an oval flap, which is turned back on the leaf forming a snug enclosure which it lines with silk; frequently it contents itself with rolling over a piece of the edge of the leaf, and within such retreats the change to a chrysalis takes place. The chrysalis is about one-fifth of an inch long and of a yellowish or yellowish brown colour, from which the moth finally escapes.

The perfect insect, which is shown magnified, at *a*, figure 8, measures when its wings are spread nearly four-tenths of an inch across. The fore-wings are of a pale, dull, bluish shade with a slight metallic lustre, becoming lighter on the interior and posterior portion, and ornamented with dark brown bands and spots. The hind wings are dull brown, deeper in colour towards the margin, body greenish brown.

There are two broods of this insect during the year. The spring brood has been found by Miss Mary E. Murtfeldt, of Kirkwood, Missouri, feeding on the tender shoots of the common ironweed, *Vernonia noveboracensis*, which they web together for their better protection. When mature the larvæ cut small flaps from the larger leaves, fold them over and fasten them at the edges, within these enclosures the larva changes to a pupa. Professor Fernald, of Orono, Maine, has found the spring brood of this larva similarly affecting the Tulip tree, *Liriodendron tulipifera*.

REMEDIES.

As it is probable that most of the late brood pass the winter in the chrysalis state attached to leaves, if these were gathered and burned a large number of the insects would perish. The infested grapes might also be gathered and destroyed. This insect is attacked by a small parasite which doubtless does its part towards keeping the enemy in subjection.

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Several individuals may be seen on the grape vine. Dec. 1894. Cont'd.

## ON THE MOUTH OF THE LARVA OF CHRYSOPA.

(Read before the A. A. A. S., at Montreal.)

BY WILLIAM SAUNDERS, LONDON, ONT.

Recently I had the opportunity of watching in a live box, under a low power of the microscope, the seizing and devouring of some plant-lice by a larva of an undetermined species of *Chrysopa*, and was interested in the manner in which it emptied the body of its victims. The jaws are large, hooked, pointed, and tubular; with a small opening at or near the points. Approaching its prey the body of the *Aphis* is grasped by the hooked mandibles which at the same time pierce it. The *Chrysopa* larva remains stationary, and proceeds to pump its victim dry. At the base of each of the mandibles the integuments are dilated into a sac-like form, capable of expansion and compression at will, a portion of the thorax is similarly constructed, and it is by the repeated dilating and compressing of these sacs that the fluid contents of the body of the *Aphis* are transferred through the tubular mandibles to the stomach of the *Chrysopa* larva.

When the abdomen of the *Aphis* has been emptied, the points of the mandibles of the *Chrysopa* larva are thrust into the thorax, and forward into the head in every direction, and in a few moments nothing remains of the once plump plant louse but a shrivelled skin. In the authors accessible to me, I can find no reference to these elastic bulb-like sacs at the base of the mandibles, nor to the peculiar structure of the thorax, which admits of its expansion and contraction as referred to.

## "MOSS-HUNTING."

BY PROFESSOR J. T. BELL, BELLEVILLE, ONT.

Having had several enquires addressed to me as to how I captured the *Pselaphidæ*, etc., a list of which appeared in the *Entomologist* of March, 1881, it has occurred to me that it might be acceptable to some of my entomological brethren to have a detailed account of my method of moss-hunting published in our organ.

First, then, as to gathering the moss. For pedestrian excursions, a gamebag or haversack to sling over the shoulder, will be most convenient; where a vehicle is employed, a pillow case or grainbag may be used, and in either case a small hand rake about a foot long will be found very useful. As soon as the snow leaves the ground, the collector may seek some open swampy woods, where the ground is varied with little mounds by the decay of fallen trees or the upturned roots of windfalls, which are overgrown with mixed mosses,—or the banks of a pond or creek strewn with rotting logs and branches. The moss should be taken up in large flakes, with as little disturbance as possible, and packed tightly in the bag. It is of little use taking the moss which grows in thin sheets on the stumps and trunks of trees, as few insects will be found in it; and there is one sort which grows in compact oval bunches of a bright green, which I uniformly reject as barren. The most productive is that which grows on the ground, and is not less than an inch in length of stem. So long as the ground is clean of snow, a little frost is not objectionable, but rather the reverse, as some of my most successful collecting was done when the moss was pretty well frozen, and the pools were covered with ice strong enough to walk over; but, whatever may be the weather, the moss must be damp,—insects will not live in dry moss.

Having brought a cargo home, the next step is to get out its living treasures, for which the following implements will be needed: 1. A sieve, which can be easily and cheaply made as follows: A light wooden box about nine inches by seven inches may be had at any drug store; the bottom is knocked off and replaced with a piece of wire-web of four meshes to the linear inch; the sides must be cut down with a fine saw to a depth of three inches, and strips about half-an-inch wide nailed along the sides beneath the wire to keep it from touching the table. 2. A sable or camel hair pencil of the size known as

duck quill, on a wooden handle. 3. A pair of flexible tweezers with fine points. 4. A small palette knife, the use of which is when a small insect is covered up among the dust and debris of the moss, to take up a portion and scatter it on a bare place on the paper, when the beetle will become accessible. 5. A hand or pocket magnifier. 6. Two cyanide bottles, without sawdust. 7. A basket or box to receive the spent moss.

The operator will place the sieve upon a sheet of strong white paper,—cartridge paper is best—and taking up a moderate handful of moss, tease and shake it well over the wire; he will then lift the sieve, giving a couple of smart taps on the end to dislodge any clinging insect—and look out for the “bugs.” The Carabidæ and Staphylinidæ will first run at racing pace over the paper; the Pselaphidæ and Scydmaenidæ will progress more deliberately, though still pretty rapidly, in a steady, straightforward march, with their prominent antennæ stretched out before them, while the Trichopterygidæ will circle about, like the Gyrini upon the surface of a still pool, at an astonishing pace for such molecules of beetles. The larger insects may be captured with the fingers or forceps; the smaller ones by moistening the brush between the lips and touching them with the point, to which they will adhere; the brush with the insect attached is introduced through the neck of the bottle, when a slight fillip with the fingers will dislodge the captive. In the meantime the Curculios, Chrysomelas, Tenebrios, etc., will recover from the shock, and betray their presence in their own slow, deliberate manner, when they too can be secured. Along with the beetles there will be seen numerous spiders, ants, mites, poduras, etc., and now and then a few small Diptera and Hymenoptera.

To display the smaller captured beetles to the best advantage, they should be suffered to remain for twenty-four hours in the bottle, when the cyanogen vapour will have caused their limbs to be limber and relaxed. They may then be attached to a strip of cardboard by a small portion of mucilage, previously thickened by evaporation till it will not spread out or sink into the card. A sufficient number of spots of this are placed about a quarter of an inch apart, and on each spot is laid a beetle, back down, care being taken that the head, legs, and antennæ are kept from contact with the cement. When the latter has hardened sufficiently to hold the insect in its place, its antennæ, palpi, legs, etc., may be adjusted with a very small, short-haired, red sable pencil, just moistened enough to make the hairs adhere together and form a single point. For the larger and more refractory ones, a fine sewing needle, set in a wooden handle, and bent at an obtuse angle at the point, may be used.

When the limbs have been properly adjusted, the insects may be laid away to dry, which will require three or four days for the smaller, and twice that time for the larger ones. When dry they may be removed from the card by inserting the point of a fine needle under the shoulder; if this is carefully done the insect will generally come clear off without damage to the most delicate pubescence or the longest bristles. Any portions of the mucilage which may adhere to the elytra, may be removed with the needle point or sable pencil moistened as before. Each specimen may then be mounted on a strip of cardboard, or fastened to the cell of a microscope slide with a minute touch of Canada balsam, and a thin glass cover cemented over it, when it will form an interesting object for examination either by direct or transmitted light.

### ALYPIA OCTOMACULATA.

BY H. H. LYMAN, MONTREAL, P. Q.

Last June I was in Boston, from the 14th to the 30th, and during this time *Alypia octomaculata* was in season and very abundant. Had I chosen to carry a net in the public gardens and uptown streets, I suppose I could have taken a couple of hundred specimens, always provided that I wasn't “run in” as a lunatic. As it was, I contented myself with carrying a supply of pill boxes, and succeeded in taking about thirty-five specimens. During two days I was visiting a friend about seven miles from the city, but did not see a single specimen of this species; but in those streets in which there were

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small plots of grass in front of the houses, they were very common. The spot where I took most of those I captured was a plot of grass about ten feet by seven, in which there was a *Syringa* between two *Deutzias*, both species of shrubs being in blossom. The *Alypias* constantly frequented the latter, and were there easily taken with a pill box, but though they occasionally alighted on the leaves of the *Syringa*, I never saw them visit the flowers.

## INSECTS INJURIOUS TO DRUGS.

BY WILLIAM EDWIN SAUNDERS, PH. G., LONDON, ONT.

In this paper is given simply what has been noted by the writer during a study of these insects extending over more than a year.

*Sivodrepa panicea*.—This is the elliptical, reddish brown beetle, about one-eighth of an inch long, which is found in almost every edible drug, and in some, such as aconite root and capsicum, that would be pronounced far from edible. In addition to these two drugs, I have found it in bitter almonds, sweet almonds, angelica, boneset, calumba, chamomile, chocolate, coriander, dandelion, elm bark, ergot, extract of licorice, German chamomile, orris root, prince's pine, rhubarb, squill, and sweet flag.

The larva is white, with a brown head, is about twice as long as the beetle when full grown, although it is seldom or never seen stretched out at full length, always remaining curled up in a ball. It will in time fairly honeycomb a piece of root with small holes about one-twenty-fifth of an inch in diameter, at the end of which it is generally to be seen at home. Under the influence of camphor, these larvæ become uneasy, but being apparently unable to crawl away, resign themselves to their fate, and seem to thrive just as well with camphor as without it.

*Calendra remotopunctata*.—This is a small, black beetle, about the size of the last, with what is popularly termed a "snout," projecting from the front of the head downwards. Under the microscope the back, thorax, and head are seen to be finely pitted, giving the insect a rough appearance. It was found in large numbers, the larva feeding on pearl barley, inside of which it lives, the egg being probably laid in the grain by the parent, and on hatching, the little insect makes its home there, eating all but the shell, and sometimes attacking the grain from the outside.

*Tenebrioides mauritanica*.—This species of "meal-worm," was found in pearl barley, and one specimen in calumba. It is a dark brown beetle, five-sixteenths of an inch long, the head and thorax forming nearly half the total length, and the mouth being fringed with hair. The back, which at first sight appears perfectly smooth, proves to be, when examined under the microscope, longitudinally corrugated. The larva is nearly half an inch long, white, with a brown head, and between the jaws is a row of hair as in the perfect insect. The posterior end is furnished with a pair of claspers.

*Tribolium ferrugineum* is a flat, reddish brown beetle, about one-eighth of an inch long, appearing smooth to the naked eye, though the microscope shows the back numerous pitted. These insects affect patent foods and similar substances, and the beetles are possessed of remarkable longevity, as proved by the fact that I have kept a few alive for two months in a small box with a little *ceralina*, which seems to be their favourite food. Whether the beetles themselves eat it or not I do not know, but they certainly have a liking for the dead bodies of other beetles.

*Sitona purinamensis* is a narrow, brown beetle, almost one-eighth of an inch long, with a pitted and longitudinally corrugated back. One specimen only was found, on *anthesis*.

*Anthrenus varius*.—This insect has been found only in cantharides, but I believe, also attacks other animal drugs, such as castoreum. During the month of July there emerges from the egg a very active larva, densely covered on the tops of the segments with stiff brown hairs, which, at the posterior end, point towards the centre of the back forming a ridge, and when the insect is annoyed, it has the power of dividing the ridge in the centre and throwing it down on each side in a fan-like position, the object of which

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movement could not be determined. When the insect has been feeding on the whole cantharides, all these hairs on the back become rubbed off, those forming the ridge being generally last to go, because, being on the downward slope of the body, they are not exposed to the same amount of friction. Underneath, however, the hairs are shorter, and do not become rubbed off as on the back.

The larva consists of eleven segments, those at the ends being of a much deeper brown than those towards the middle, and the six legs being inserted on the three anterior segments, each furnished with a short, straight claw. The skins are shed quite often during the larval state, and are discarded by a slit nearly the length of the back, terminating indifferently at either end, and through which the insect emerges. The shed skins present a beautiful iridescent appearance under the microscope when viewed by reflected light.

These larvæ feed on the cantharides all winter, and if in quantity, commit great havoc, leaving only the hard exterior portions untouched, such as the upper portion of the thorax, the green wing cases, and transparent wings. When their legitimate food gives out they have no compunction about first eating their dead parents, and then each other, but on this diet they do not seem to thrive so well. *Cantharidæ*

The beetle emerges in May or June, and is about one-eighth of an inch long, oval and black, the upper parts being marbled and streaked with whitish and rufous, which are rubbed off after death if the insect is subjected to any rough usage.

Camphor does not kill these larvæ, and after keeping some for a day in a small box about a quarter full of camphor, the only thing worthy of remark in their actions was that they did not seem quite so lively as those kept without it. Camphor is not a remedy but merely a preventive measure. The vapor of chloroform rapidly kills them, so that by putting a small quantity of chloroform in a gallipot on the top of the infested cantharides, the heavy vapor will sink through it and destroy them.

#### INSECTS AFFECTING DRUGS.

By E. A. SCHWARZ, WASHINGTON, D. C.

To the list of drug insects observed in this country, as given by Mr. Wm. Edwin Saunders, I have two additions to make. One is the Tobacco-beetle, *Lasioderma serricornis* Fabr., a well-known pest in many cigar factories in the United States. I found this in a drug store at Detroit, Mich., where the larvæ had completely honeycombed a lot of rhubarb. The same habit of the species has been recorded by European writers. The second addition is *Cryphalus jalappæ* Letzner, a small, inconspicuous Scolytid beetle, probably originating from Mexico, which has been carried by commerce all over the world. It was first found by Mr. H. G. Hubbard and myself in 1874, in the Medical Laboratory of the United States Navy Yard at Brooklyn, N. Y., and later observed by myself in drug stores at Detroit, Mich., and Washington, D. C. It occurs only in *Radic jalappæ*. The species has to my knowledge never before been recorded from North America, but will no doubt be found wherever the drug mentioned above is kept.

#### DESCRIPTION OF A DIPTEROUS PARASITE OF PHYLLOXERA VASTATRIX.

DIPLOSI? GRASSATOR, N. S.

By REV. T. W. FYLES, COWANSVILLE, P. Q.

Larva, one-tenth of an inch in length—pointed at the head—rounded and blunt at the hinder extremity. First three segments the colour of amber, and semi-transparent: the rest of the body salmon coloured. Nine sets of hooks, or tentacles, in place of feet, the

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two first in pairs, the remainder in threes. The larva has the habit of holding itself erect, by means of peculiar anal protuberances which seem to cling by suction. The body has minute hairs thinly scattered over it. On the sides of the head, which is small and black, there are bristle-like palpi, pointing forwards. The larva is full fed by the end of August.

In the accompanying figure, drawn by myself from nature, the larva is shown at *a*, the pupa at *b*, and the imago at *c*, all highly magnified. The natural size of the perfect insect is given at *d*.

*Pupa*, dark brown, about 9-100 of an inch long. The antennæ cases form a striking feature, projecting on either side about one-sixth the length of the pupa, and giving a flattened appearance to the head. A pair of setæ mark the position of each spiracle, and there is a rounded protuberance at the hinder extremity.

*Imago*.—Wings, semi-transparent—beautifully opaline—three-ribbed—having the form of the blades of a propeller—fringed with long hairs. Balancers conspicuous. Antennæ, setaceous, 24-jointed, having a circlet of hairs around each joint. Eyes, large and black. Thorax, reddish brown, with a peculiar hump on the back, behind the wings. Legs, long and hairy.

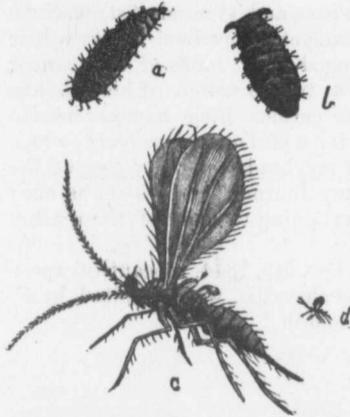


FIG. 9.

Abdomen, salmon coloured—has two lines of hairs extending lengthwise on the under side. The perfect insect appears early in September.

[This insect was reared by us about the same time as those by Mr. Fyles. It was very common in the neighbourhood of London this year, infesting the gall-inhabiting type of the *Phylloxera*. The following notes in reference to it may be of interest, omitting the description already so well given by Mr. Fyles: "About the middle of August my attention was directed to the foliage of some grape-vines, Clinton and other varieties, which were suffering from an attack of the gall-inhabiting type of *Phylloxera*. On opening some of the older galls they were found to be free from living lice and occupied by one, or in some instances two, small, brown chrysalids, and a number of the empty skins of the young lice. On further examination many of the galls were found to contain the larvæ of this same insect. The egg is deposited by the parent fly in the gall, or at its entrance. Each gall is usually occupied by several full grown lice, and from 50 to 500 minute yellow eggs, which are gradually deposited and as gradually hatched. The young larva of our new found friend is very active, and groping about within the hollow of the gall, seizes on the young lice as hatched and sucks them dry. We could find no evidence of its attacking the parent lice, as long as the newly-born and tender progeny were in sufficient abundance to furnish it with a constant supply of fresh food. In some instances one larva, in others two were found in a single gall; but in no instance have we found living lice with the chrysalids, an evidence that this insect does its work thoroughly. A sufficient number of galls have not yet been examined to determine with any accuracy the proportion occupied, but they appear to be sufficiently numerous to materially check the increase of this destructive pest."—ED. C. E.]

## COLLECTING IN EARLY WINTER.

By JAMES FLETCHER, OTTAWA, ONT.

Nov. 13, 1882.

The unusually mild and balmy weather that we have been enjoying for the last week has made it an easy task for the entomologist to neglect his cabinet and correspondence, even now, in the very heart of the exchanging season, and go out into the woods in

search of treasures. Thus many a luckless *Vanessa* or *Grapta*, beguiled by the warm, seductive sun from her winter quarters, to have a last aerial promenade before her long cold nap, has found her way into our collections. The morning of Thanksgiving Day here (9th Nov.) seemed to outdo all its fellows in its efforts to charm grumbling mankind, and seemed to insist on everyone being thankful and happy. To the lover of flowers the woods provided several autumn blossoms of such flowers as *Viola blanda* and *V. Canadensis*, late blooms of *Solidagos*, *Achillea millefolium*, and stunted Asters whose heads had been broken or eaten off by cattle, but who were yet determined to have their look at the world. Among the damp trees the gauzy-winged male moth of the canker worm could frequently be seen hurriedly flying from tree to tree in search of his wingless wife. On the walls of a house several specimens of the curious little hammer-headed Fly, *Sphyracephala brevicornis*, were taken. A fine specimen of *Vanessa milberti*, which came to peer at me by settling within a couple of feet of my head, reminded me of the following, which formerly appeared in the "Dublin Penny Journal," and which, as such literature is not at all common, I thought might be entertaining to some of the readers of the *Entomologist*:

"At the last meeting of the Entomological Society, Feb. 5th, 1844, a beautiful specimen of *Pontia rapae*, evidently just disclosed from the chrysalis, was exhibited by F. Bond, Esq., which he had captured during the preceding month."

Child of the Summer, what doest thou here,  
In the sorrow and gloom of the weeping year?  
When the roses have withered that bloomed on thy birth,  
And the sunbeam that nursed thee has passed from the earth;  
The flowers that fed thee are frozen and ' gone—  
Thy kindred are perished, and thou art alone—  
No one to welcome—no one to cheer—  
Child of the Summer, what doest thou here?  
Yet 'tis sweet thy gossamer wing to view,  
Revelling wild in the troubled blue—  
Heeding nor rain, nor snow, nor storm—  
Buffeting all with thy tiny form.  
Even thus the hope of our summer days,  
In the heart's lone winter gaily plays—  
Thou art the type of that hope so dear—  
Child of the Summer! thou 'rt welcome here!

Welcome 'mid sorrow, and gloom, and showers,  
Emblem of gladness that once was ours—  
Emblem of gladness that yet will come,  
When the sun-bright ether will be thy home;  
And myriads of others as bright as thou,  
Will revel around us—all absent now:  
Emblem of hope to the mourner dear,  
Child of Summer! thou 'rt welcome here!"

### HYBERNATING BUTTERFLIES.

BY A. R. GROTE, NEW BRIGHTON, N. Y.

I am sure your readers were pleased at your printing the pretty lines on a winter butterfly, which Mr. Fletcher took the trouble to send. I remember very many years ago, in January, finding a hibernating *Vanessa Antiopa* in the garret of our Staten Island farm house. It hung from a rafter and seemed almost dead. I placed it on a brick flue, which was hardly warm, but it did not revive at the time. Some few days after, the

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weather having become milder, I searched for it and found it where I had laid it, still on its side with the legs drawn in. But on touching it, the wings suddenly unclosed, the insect took to flight, and, the window being open, it escaped into the winter sunshine. Some years after I found three or four specimens of *Pyrameis Atalanta* under the same circumstances, all close together, hanging to a rough rafter and perfectly torpid. On being placed in a warm room they revived in a short time and I allowed them to escape. As early as warm February days I have met the Camberwell Beauty and Admiral, in solitary state, on the wing. The south side of Staten Island soon gets warmed by the spring sun, and is a good collecting field for the entomologist.

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THE WHITE MARKED TUSSOCK MOTH, (*Orgyia Leucostigma*). Smith.

BY FREDERICK CLARKSON, NEW YORK CITY.

The foliage of the trees in this city is undergoing spoliation by the larvæ of this moth. Many of the trees are entirely denuded of their leaves, particularly the silver-leaf poplar, the ailanthus alone escaping attack. The writer suggested to the authorities last spring that hand-picking of such cocoons as contained the deposit of ova was the only sure way of exterminating these insects. Had such service been rendered the trees at that time, this damaging visitation would have been prevented. There is good reason to believe, however, that what the authorities have failed to do, a young army of parasites, "Pimpla," which have put in an appearance during the last fortnight, are now actively attempting, and we shall probably be rid of this moth another year. The ova commenced to hatch out about the 25th of May, and the larvæ began to assume the pupa form about the 21st of June; ten days thereafter the imago was discovered depositing ova. Out of twelve cocoons gathered on the 15th of July, four yielded the parasite already referred to. I would note here in connection with this parasite a circumstance very commonly observed among the lepidoptera. I discovered two ♂ parasites upon a cocoon containing the pupa of this moth. I drove them away several times, but they as frequently returned. I finally captured them, and placed them together with the cocoon in my collecting bottle. Before I had returned to my residence a ♀ Pimpla had emerged from the cocoon and was busily employed in expanding her wings. I also noticed that this parasite deposits its ova through the cocoon on to the pupa, and that in every case that came under my observation the pupa selected was the ♀, doubtless from the fact that its plump condition provides the necessary food for the development of the parasite, which the ♂ pupa of the moth could not furnish.

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ENTOMOLOGICAL NOTES FOR 1882.

BY PROF. E. W. CLAYPOLE, NEW BLOOMFIELD, PA.

My removal from Yellow Springs, Ohio, to New Bloomfield, Pennsylvania, has had the effect of breaking off the line of my entomological work, or at least throwing it into a rather different channel. Among the first results is a notice of the striking difference between the two places in regard to insect depredations. In my experience last year a great part of the time was occupied with fighting insects. The cherry weevil, the potato worm and beetle, and the apple worm were the ringleaders; but after them came the blister beetles, the turnip flea, the corn worm, the squash bug, *et multa alea*. Here, at least during the present, or rather past season, the ravages of all these have been quite insignificant. Foremost stands the potato beetle. As soon as the young plants came up I followed my usual plan of picking them off and dropping them into a tin having a few spoonfuls of coal oil at the bottom. By this means they cause no trouble in crawling out again. Though the season was rainy, and therefore the opposite of the last, yet I

found two applications of the poison dust (one part of London purple and sixty parts of wood ashes) quite sufficient to keep the plants free from the young grubs. I am inclined, however, to recommend the use of plaster instead of ashes in a wet season. It seems to adhere better to the leaves when rain falls on them.

To my surprise there was here no second brood of the beetles this year. A few belated individuals appeared, but nothing that deserved the name of a brood. Of course the earliest potatoes were ripe before the usual second emergence, but the late ones grew and were green almost till frost came, but were perfectly uninjured after the beginning of July. I cannot learn if this is usual, for I can find no one who has been sufficiently observant, or who is sufficiently acquainted with the habits of insects in general, and with those of *Doryphora 10-lineata* in particular, to tell me. They come, they are here, they go, but when, why and how they come and go is a matter which no one here seems to have considered. Another year I shall try and make more general observations on this point.

Not only is the potato beetle less mischievous here than it was in Ohio, but all the others named follow suit. The apples are much less infested with worms; blister beetles I have scarcely noticed; corn worms are quite innocuous, and as for the cherry weevil, though the crop this year was not heavy for all kinds of cherries, and the fruit should, therefore, be at its worst, I have not seen a score of them all through the summer. I noticed one or two on my own trees showing the crescent cut, but no more. It was almost as safe to eat the fruit unexamined, as it is, in England.

By the way, I never hear any apprehension expressed concerning the migration of *Conotrachelus nenuphar* across the Atlantic. Though fruit is less abundant there than here, yet the introduction of the pest would be a very serious drawback to the enjoyment of plums, peaches, and cherries, not to mention the loss caused by its attacks on the apple.

On the other hand, if these insects are less injurious in Pennsylvania than in Ohio, the imported currant worm is more so, and the growth of currants is greatly limited by its ravages. Very few persons seem to know what can be done by the use of poison to rescue the bushes and the currants. Great, but totally unfounded prejudice also exists against the use of poison, even on potatoes; many people seeming to fear lest the potato should absorb sufficient arsenic as to render its use as a table vegetable dangerous. It is needless to say that all such ground of alarm has long been set at rest in the minds of those who have followed the progress of economic entomology. But prejudice is blind to reason and slow to die away.

In addition to this the various web-worms on the forest trees are vastly more numerous here than they were at Yellow Springs. In earliest spring and before the leaves are generally out, the American Lackey Moth (*C. Americana*) takes possession of the cherry trees and covers the young foliage with its net. Soon afterwards the Forest Lackey (*C. sylvatica*) follows on the same tree, but more frequently on the apple, and later still the walnuts are attacked by the fall web worm (*H. texor*), whose nests remaining on the trees after the fall of the leaf, disfigure them through the winter.

This year, also, the oak caterpillar (*D. Senatoria*) has wrought great ravages in the forest. I have seen hillsides that looked as if fire had passed over them in consequence of the destruction of the foliage by millions of this species. In the woods they could be found crawling over almost every square foot of ground, and lying dead by dozens in every pool of water. The sound of their falling frass, too, was like a slight shower of rain. Farmers tell me they have never known them so abundant before within their recollection. Harris says this species live on the white and red oaks (*Q. alba* and *rubra*) in Massachusetts. Here the white oaks were untouched, and the red oak is not abundant. The food of the caterpillars was almost exclusively the foliage of the black oak (*Q. tinctoria*), the scarlet oak (*Q. coccinea*), and the bear or scrub oak (*Q. ilicifolia*).

#### EXPERIENCE WITH INSECT POWDERS.

I have used the Pyrethrum powder, "Buhach" mixed with ten parts of flour, as the easiest and most effectual remedy for the cabbage worm. It was mixed in 1881 and

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remained mixed in the "insufflator" till the past summer without apparently losing any of its virtue. Its effect was in nowise diminished. I gave some of the mixture to a friend here whose sheep were infested with ticks, requesting him to try it and report to me. He did so, saying that the ticks seemed to enjoy it and he rolled them about in it without inconvenience or injury so far as he could see.

I have both kinds *Pyrethrum roseum* and *P. cinerariifolium* growing from seed sent me by Prof. Riley.

There are marked distinctions between the plants from the very first. The seed leaves of *P. roseum* are spatulate, those of *P. cinerariifolium* are oval. The former throws out a single leaf from between them; the latter throws out two together. The foliage of the former has a tendency to lie flat on the ground, and looks comparatively feeble; that of the latter is ranker and stands much more upright. The plants now (January 1st) look healthy and strong. *P. roseum* lived out of doors in Ohio through last winter, without the slightest care or protection, in a box above ground. Some of the plants began to grow in February, but a heavy rain, followed immediately by a hard frost, unfortunately killed their roots late in the spring. Had they been in the ground this accident would hardly have happened. So far as I can see *P. cinerariifolium* is the more hardy of the two. I will report later on my success, if I have any during the coming season of 1883.

#### INSECTS COLLECTED IN 1882.

BY W. HAGUE HARRINGTON, OTTAWA, ONT.

30th March, 1883.

Although the snow still heavily shrouds the earth, and the air is frosty, the stern, cold sway of winter must soon be ended, and naturalists will again go forth into the fields and forests. Before entering, however, on the coming campaign, I would like to record for my fellow collectors a few facts culled from my copious notes of the past year. The spring of 1882 was very backward, so that insects were unusually scarce during April and May. On the other hand, the autumn was prolonged and fine, and many species could be collected up to the end of October. On April 25th, I carefully searched the pines for Buprestidæ (which at the same date in 1881 were abundant), but could not find a single specimen. On May 11th, a second investigation resulted in the finding of only two specimens of *Chalcophora liberta*, Germ. On June 6th, this species was abundant, and several specimens of *C. virginiensis*, Dr., and *Chrysobothris Harrisii*, Hentz, were also taken. *C. virginiensis*, Dr., *C. liberta*, Germ., and *C. fortis*, Lec., were taken again on several days between September 24th and October 16th. On April 30th, Tiger Beetles were making their appearance, and some specimens of *C. vulgaris*, Say, were taken just emerging from their winter quarters in the sand, under stones and chips. *C. sex-guttata*, Fab., as is well known, frequents paths and clearings in woods. On wet or dull days it may often be found sheltered under the loose bark of fallen trees, or in the deserted burrows of borers, down which it retreats when disturbed. While stripping the bark from a large prostrate maple on May 22nd, to obtain larvae, I captured three of these beautiful beetles, which had thus been driven to shelter by a shower. The tree yielded numerous specimens of *Eupsalis minuta*, Drury, and some pupæ of *Saperda tridentata*, Oliv., from which imagos emerged on June 15th. On June 16th, while beating the branches of a butternut, I found upon my net a Curculio (blackish with an oblique white dash on each elytron), which was new to me, but could find no more upon the tree. As I was leaving the field in which it stood to enter an adjoining wood, I saw upon the gatepost a similar weevil, and a glance around showed me a large butternut growing but a short distance away and having a large dead limb resting on the fence. I at once concluded that the weevils had come from this, and, on examining the decaying limb, hundreds of the beetles were found upon it. On

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 a length of only five or six feet I took fifty, nearly all of which were paired. The beetle proves to be *Pseudomus truncatus*, Lec. On the 21st I took two specimens of *Cephaloon leptauroides*, Newm., as well as several of *Dendroides concolor*, Newm., and other fine species. Among the beetles mentioned by Dr. Le Conte as bred from hickory twigs, is *Chariessa pilosa*, Forst. During the latter part of June and the following month numerous specimens of this handsome beetle were observed upon felled and old hickories. They were very active—coursing about in search of prey, and doubtless destroying many insect enemies of this tree. One was seen devouring an *Agrilus egenus*, Gory, and a second feasting on *Magdalis barbata*, Say, both injurious and abundant species. The delicate and rare *Buprestis, Pectonota cyanipes*, (Say) was captured on June 22nd, upon a dead willow, which I hope may yield me more during the coming season. On the same day a very fine female *Bellamira scalaris*, (Say) was taken ovipositing on an old maple stump. Beating low bushes on the margins of a small lake yielded numerous species, including *Cupes concolor*, Westw., the only specimen of this family I have yet taken. During September the Locust-borer, *Cyrtene robiniae*, (Forst.) was very abundant in all parts of the city. Although I had never previously captured the beetle, I knew from the decayed condition of our locust trees (which are not numerous), that it must infest them. In the latter part of the month, *Ecanthus niveus*, was, as is usual, in large numbers on raspberries, and in full song, if we can so designate its musical performance. An interesting feature of its concerts is one of which I have not been able to find any mention in books accessible. While the male is energetically shuffling together its wings, raised almost vertically, the female may be seen standing just behind it, and with her head applied to the base of the wings, evidently eager to get the full benefit of every note produced. On October 7th, I discovered in the seeds of the basswood some lepidopterous larvæ of which I would be glad to hear from members studying lepidoptera, as I can find no mention of any moth attacking the fruit of this tree. Do the larvæ leave the seeds, and, as they have the power to do, lower themselves to the ground, or do they remain until the seeds fall from the tree? The seeds are completely eaten out, and I noticed in a double-seeded fruit that after finishing one seed, the larva proceeded to the other.

#### AN UNUSUAL MODE OF COLLECTING INSECTS.

An office-mate made a capture last summer in a novel manner, but such as would not meet with the favour of entomologists as a method of collecting. He had occasion one hot midsummer day (29th June) to go out for a short time, and on returning complained that a fly had flown into his ear, and, having crawled in as far as possible, was causing great annoyance by a disagreeable buzzing and scratching. I advise him to pour a few drops of oil into the infested organ, or, better still, perhaps, to seek a doctor and have the occupant extracted by skilled labour. On reaching the doctor's office he found that he was absent at a medical convention, but after telephoning all over the city he found a stay-at-home doctor to whom he went and stated the case. An examination of the ear was made, but the doctor could discover nothing in it, and as the huzzing and scraping had then ceased, it was decided that the insect had taken his departure. However, he said it would do no harm to pour a little oil into the ear to allay the irritation which the fly had caused. My friend had not gone far from the office when the insect, which had only been taking a rest of "playing possum," commenced a more violent commotion than ever, causing his unwilling host to hurry home and try the anointing process. Hastily pouring in a few drops of oil, he lay down with his ear on a pillow, and almost immediately felt the intruder withdrawing from its hiding-place and beating a retreat. Lifting his head he was astonished to see, not a fly, as he expected, but a long-legged, active beetle, scampering away. This he imprisoned and bore back triumphantly to me to identify. It proved to be a full-sized and lively specimen of *Acmæops pratensis*. The doctor, on being afterward confronted with the prisoner, was greatly surprised that it had so well secreted itself from him, and assured my friend that it might easily have caused serious trouble. Small insects cause frequent annoyance and occasional slight pain by flying into

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eyes and ears, but it is fortunate that such formidable hard-shelled beetles as the species just mentioned do not make a habit of exploring our ears. Had the case been that of some "blockhead," one might have supposed that the beetle had visited him under the guidance of instinct, but in the present instance the intrusion must have been merely the result of accident.

Much as beetles injure man's property, they seldom attack his body, but there is one Canadian species which most decidedly indulges in that unpleasant habit, and to an extent that is perhaps unknown to many entomologists. I refer to *Melanophila longipes*, which occur from 12th May to 12th Oct., and is usually abundant during the hot season, basking upon stone walls, etc. It has a fashion of lighting on one's collar and inflicting a sharp nip on the nape of the neck, and then disappearing with great swiftness. I have often been thus bitten, and have sometimes, by making a sudden grab, taken the beetle in the act and proved his identity. Last summer several instances of persons being bitten fell under my observation. While at dinner one day in a hotel, three or four sitting at the same table complained that some "confounded fly" had nipped them viciously. The gentleman sitting next to me was one of the victims and caught the offender, but it escaped almost immediately, only allowing him to see that it was black and harder than a fly. I was just going to say that it was probably a specimen of *M. longipes*, when I got a nip that settled the question and the insect.

A few weeks ago I was trying to convince two ladies that beetles might be handled fearlessly, as they had no biting propensities, when one of them at once exclaimed, "don't tell us that, for there is a nasty, little, flat, black beetle that bites me on the neck in the summer."

#### RARE BUTTERFLIES IN QUEBEC.

By JOHN G. JACK, CHATEAUGUAY BASIN, P. Q.

On the 16th of August last I captured in our orchard a beautiful female specimen of *Papilio cresphontes*, Cram., in perfect condition and evidently not long emerged from a chrysalis. Some days later (August 22) a specimen was seen and pursued without success, and on the 29th another very large female was taken. As one of the food plants of the larva, Prickly Ash (*Zanthoxylum americanum*, Will.) is abundant here, I think they must have bred in this locality, which is about fifteen miles south of Montreal. I think this is the first record of this butterfly being taken in the Province of Quebec. *Euptoieta claudia*, Cram., another butterfly rare in this latitude, was taken by me August 15th, 1874, near a hopfield, and is now in the collection of the Montreal Natural Historical Society. I mention this as Mr. Edwards gives Canada no credit for this species in his useful catalogue.

#### OBSERVATIONS ON *LIMENITIS ARTHEMIS*. *Dunlop*

By MRS. C. E. HEUSTIS, PARRSBORO', N. S.

I was much interested in an article in Vol. xiii., of the *Canadian Entomologist*, by Mr. W. H. Edwards, entitled, "Is *Limenitis arthemis* double-brooded?" My own observations previous to the time of reading the article were confirmatory of Mr. Edwards' theory; but I wished to learn more of this interesting species before hazarding any remarks concerning its habits.

I have never reared or attempted to rear *arthemis* from the egg, but have one specimen obtained from a full-fed larva found on the 2nd July, 1877. It went into chrysalis on the 3rd, and the imago appeared on the 16th. I have seen fresh looking specimens on 1st July, when enjoying, with other citizens, Dominion Day in the country. Later than this I have not seen a fresh specimen, excepting the example before recorded.

I find in an old note book the following entry: "Parrsboro', N. S., July 25, 1877, captured to-day a worn and battered specimen of *Limenitis arthemis*, the only example

seen, although the species is usually abundant in this wood." A few days later I saw another specimen less worn, but did not succeed in capturing it.

The bustle consequent upon a change of residence prevented me in the early part of last summer (1882) from doing much collecting, so that I had no opportunity to observe at how early a date *arthemis* appears here; but later in the season I spent a few days with some friends in a collecting tour along the south shore of Cumberland Co., N. S., a distance of forty-five miles. We were in search of plants and minerals, as well as insects. We started on the 15th of August; on that day I observed two examples of *arthemis*, one of which I took. It was sitting on a low shrub, and seemed to be perfectly stupid, making no attempt to escape when I put my hand on it. It was a good deal worn and damaged. On the three following days I observed quite a number, all in the same condition. At several points they were quite abundant, especially where our road lay through damp woods. Thus, so far as my observation extends, both in New Brunswick and Nova Scotia, *arthemis* may be taken occasionally, in good condition, as late as the middle of July, after which date I think few, if any, fresh specimens will be met with.

I have no doubt that worn and faded specimens might have been found in this county throughout August, or even in September last year. The extreme backwardness of the spring probably retarded the development of the larvæ, and thus caused the imago to be seen later than usual.

#### DAMAGE CAUSED BY ANTS.

BY E. BAYNES REED, LONDON, ONT.

Early in the month of June I discovered that certain portions of the flooring and supports of my verandah were giving way, and I accordingly sent for a carpenter to do the necessary repairs. On taking up the flooring I found two nests of large black ants, and examination showed that nearly the whole damage was caused by these insects. Large joists were very much excavated, and in some cases eaten completely through; two pillars or posts eight inches square were eaten out to a distance of some two feet from the floor, and unless prompt measures had been taken the corner of the verandah would in all probability have given way. I had noticed these ants for a couple of years back, but never dreamt that they were so numerous or were doing so much injury. I sent specimens to my friend, Dr. Hagen, and asked his opinion as to remedy. He writes me that the ant is *Formica ligniperda*, Latr. (*Camponotus ligniperdus*, Mayr). He recommends an application of boiling water in which soft soap has been largely dissolved.

#### LAST YEAR'S COLLECTING.

BY J. ALSTON MOFFAT, HAMILTON, ONT.

The connection between the weather and insect life is an interesting subject, but one that requires a vast amount of observation before any conclusions of much value can be reached. We are all familiar with the relation of the weather to the crops, but insects seem more dependent on favourable weather than vegetation is. The first part of a season may be very injurious to vegetation, whilst later on a favourable change may occur and it will recover all it lost and even exceed an average; but with insects, if they have been seriously interfered with in the early part of their career the result is generally fatal to the bulk of them for that season. This is undoubtedly one of nature's methods for preventing excess. Ontario has a varied range of climate, and what thus is said of one section will not apply to others. Vennor considers Hamilton and neighbourhood endowed with a climate peculiarly its own, and the verdict of concurrent opinion is favourable. But whether it was the open winter or the long continued cold of spring, certain it is the summer of 1882 was rendered remarkable by the absence of butterflies; even those least observant remarked it. *Pieris rapæ* appeared early, and then disappeared almost entirely

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until quite late in the season. I did not see half-a-dozen *Archippus* the whole summer. The milk weeds stood in unbroken leaf until late in the fall, when they were taken possession of by extensive broods of *Euchates egle* larvæ. Even Skippers were scarce, and it was quite a treat to see a *Philodice*. On the 23rd of June I took for the first time here a *Terias lisa*, and there was not another yellow butterfly to be seen in the field. If *Philodice* had been plentiful I might not have noticed it. The Noctuids generally were scarce, and there was a noticeable absence of cut worms in both field and garden. There were but few species of *Catocala* abroad, and these not plentiful, except *Habilis*, which was so abundant as to be offensive. To our delight the highly attractive *Relicta* appeared in goodly numbers, which it was never known to do here before, and three dozen of them were secured. In fall moths a few good things were taken, but not in any quantity. In beetles, *Carabidæ* were scarce; wood-borers were moderately plenty, but they were very late and straggling in appearing. Taking the season all through, it was not one of much success for collectors.

#### A NEW STATE ENTOMOLOGIST FOR ILLINOIS.

Prof. Cyrus Thomas, to whom we are indebted for six out of the eleven valuable reports which have been issued by the State of Illinois on noxious and beneficial insects, has removed to Washington, and Prof. S. A. Forbes, of Normal, Illinois, has been appointed State Entomologist in his place. We heartily congratulate Prof. Forbes on his well-deserved promotion, and also congratulate the authorities of the State in that they have secured the services of one so competent, thorough and painstaking as Prof. Forbes has shown himself to be in his published papers on natural science.

#### CIRCULAR OF INQUIRY CONCERNING CANKER-WORMS.

The U. S. Dept. of Agr. in November last issued the following circular :

In preparing a bulletin upon the subject of canker-worms, to be issued from this Department, I find that much of our present information is of little service, for the reason that until the year 1873 two entirely distinct species of Canker-worms were confounded in description, seasons, habits, and geographical distribution. In many of the publications, of late date even, the distinction is made either not at all or insufficiently.

The most widespread and best known species is the Spring Canker-worm (*Paleacrita vernata*, Peck). The female rises from the ground chiefly in spring, and secretes her ovoid and delicate eggs. The second species is *Anisopteryx pometaria*, Harris, and the female rises chiefly in the fall, and lays her eggs in serried and exposed masses.

Will you please give such information as you possess, especially upon the following points in regard to the occurrence of Canker-worms in your own locality :

1. Which species, if either, is now found in your own locality, or has ever been found?
2. When was it first observed there?
3. During what years has it been especially injurious?
4. During what years has it been entirely unnoticed?
5. Has the appearance of the perfect or parent insect been confined to either season, the fall or the spring, or has it covered both?

Wherever any doubt can or does arise in regard to the species observed, it is particularly requested that specimens may be sent to the Department. All expenses for packing and postage will be reimbursed to the contributor, if a request to that effect is made; or boxes and stamps for the return of specimens will be sent to any who will notify the Department of intention to contribute information and specimens.

Observations may be made during all mild weather from the present month (November) until the middle of June. The more frequent and detailed the observations the greater will be their value. If you have not the time or inclination to make these observations personally, you will confer a favour by handing this circular to some person who will be interested.

Should this circular come to the hands of any entomologist familiar with the two species, I would respectfully ask of such any information they may possess that will throw light on the range and preferred food-plants of either.

Respectfully,

C. V. RILEY,  
*Entomologist.*

### A NEW FOE TO THE MAPLE.

BY W. HAGUE HARRINGTON, OTTAWA.

On 25th June, 1882, I captured upon a maple shade tree near my house two insects belonging to the Hymenoptera, or insects with four membranous wings, such as bees and wasps. These I found upon examination to be female specimens of *Xiphydria albicornis*, described by Dr. Harris in his "Insects Injurious to Vegetation," as occurring "on the trunks of soft wood in August." The first, or generic, name is formed from a Greek word for a "small sword," to which the ovipositor of the female may be compared. The second, or specific, name, composed of two Latin words meaning "white horns," is bestowed upon it because the antennæ are chiefly white. Dr. Harris describes them as white "with the two lowest joints black." The specimens in my collection have the two lower joints and the base of the third black, and the tip is also invariably black. In some instances this black tip is so small as to be scarcely visible without a magnifying glass, but it is usually easily discernable. A few specimens have the antennæ entirely black, and answer to the description of *X. Provancheri* Cresson.\* They are, however, in my opinion, only varieties of *albicornis*, as they were taken in company with those having the normal antennæ. This view is further strengthened by the fact that I have found no males with the usual white antennæ. Of four captured during the past summer, three have black antennæ and the fourth has them variegated irregularly; black predominating over the white. *X. Canadensis* (Prov.) may be merely another variety of the same insect, as it seems to differ chiefly in the colouration of the legs, which members vary considerably in my specimens in that respect; some being much darker than others.

The insect under consideration has a general resemblance, as regards shape, to the larger and well-known maple horntail (*Tremex columba*), to which it is closely related. It is black, with white markings, and legs of a varying shade of yellow. The females vary in size from five-tenths to eight-tenths of an inch, and are easily distinguished by the projecting ovipositor. The head is, roughly speaking, almost hemispherical, and is distinctly separated from the thorax. The front, or face, is roughened; the granulation extending above and surrounding the three ocelli borne on the forehead. The true eyes are moderate in size and not prominent. The antennæ are white, with the exception of the extreme tip, and of the first and second joints with part of the next. Occasionally they are entirely, or nearly, black. The jaws are black, and are well adapted for cutting wood, having teeth (four in number) like a little saw. The markings of the head vary somewhat in different specimens, as do also the white markings on other parts of the body. In the larger and more clearly marked ones a white oval ring, interrupted at the apex and by the roughened ridge across the front, surrounds each cheek, enclosing the

\* This species is given in the Lists published by the Natural History Society of Toronto, as well as its synonym *Xiphidion Canadense* (Prov.).

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eye, above which (and within the ring) is a small oblique white line. There is also a minute white dot at the base of each antenna, with a large almost square one above it.

The thorax is strongly roughened, with a triangular white patch enclosing a black dot on the shoulder, and two small spots on the back between the hinder pair of wings. The wings, four in number, are almost transparent, but have a very faint smoky tinge. The abdomen is jet black, with the exception of spots on each side, varying in number from four to six, and in size from spots to semi-bands; that on the posterior segment being the longest. The ovipositor is contained in a flattened scabbard projecting only slightly beyond the tip of the body, as about two-thirds of it are concealed within the last segment which is grooved to receive it. The full length of the ovipositor is one-fifth to one-fourth of an inch.

The male is slightly smaller than the female and more variable in colour, having the antennæ generally black, but differs essentially only in the abdomen, which is more flattened and rounded at the tip—lacking of course the ovipositor. It is very much more rare than the female; ten of the latter being observed for one of the former.

Having now sufficiently described the insects to ensure their recognition, there remains the consideration of their habits. The specimens mentioned at the beginning of this paper were taken on a tree which had recently died, and although one was in the act of ovipositing in the bark, no particular attention was given to the fact, as dead trees naturally become the prey of various species of insects, many of which may not attack them when living. A few days later, however, I found a third female upon a living tree, and having an interest in the Urocerae (to which group these insects belong), I determined to make further investigations concerning them this summer.

The result shows that the insect is far from being so rare as I then considered it, and that it must do no little damage to our maples, to which trees it seems to entirely confine its operations. Occasionally I have found it upon dead trees, but have usually observed it upon living ones; not only on those that are old and hastening to decay, but upon those that are young and presumably vigorous. Specimens were observed almost daily from the middle of June to the end of July, on shade trees in the city, or on trees in the neighbouring woods.

In the city the trees attacked were usually of small or medium size, and the preference thus shown by *Xiphydria* for young trees seems only natural when we consider its structure. Our other maple horntail (*Tremex columba*, figure 10) is a large powerful insect, armed with an ovipositor long and strong enough to deposit its eggs through the bark even of old and rough trees, and it is upon such trees, usually when they commence to decay, that it is found. *Xiphydria*, on the other hand, is a comparatively small and feeble insect, with a short weapon fitted only to pierce the thin and softer bark of the younger trees. It may be occasionally found upon old trees, but it is then nearly always rambling about, as if unable to find a suitable spot for depositing its eggs.

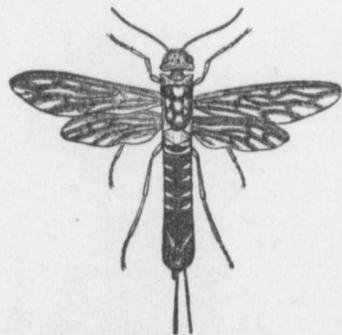


Fig. 10.

On a tree not more than two or three inches in diameter I have seen as many as eight ovipositing at the same time, and have frequently observed two or three at once upon small shade trees. *Tremex* in its endeavours to oviposit through the tough, thick bark of the old trees, frequently fails in withdrawing its ovipositor, and scores of such self-immolated martyrs to the propagation of their race may be seen in the autumn dead and dry. This is a fate that rarely befalls *Xiphydria*; indeed I have only met with one instance of a dead specimen thus anchored. Hence this insect will in many instances deposit successfully a much larger proportion of its eggs than can its larger relative, and thus stands a better chance of rapidly increasing the species.

Not having been able to cut into any of the infested trees and examine the larvæ, I am unfortunately unable to describe them. The grubs of this genus are, however, said

t o closely resemble those of Tremex, which are slender cylindrical worms with a pointed horny tail. I have obtained from maple logs small larvæ of this description and probably of Xiphydria, but have not yet succeeded in breeding them. In Vol. XI. page 15 of *The Canadian Entomologist*, Mr. W. H. Patton mentions finding the pupa and larvæ of *X. attenuata* (Norton), in a stick of black birch, but he does not describe the larva, or the nature of its workings. In July last I found in a neighbouring wood a dead tree on which the bark had become shrivelled and loosened. On removing a large patch of the bark, the surface of the wood was found to be thoroughly riddled with the holes of *X. albicornis*, either empty or still containing dead insects. These had evidently been prevented from leaving their burrows by the death of the tree and consequent drying and hardening of the bark. Many others had partly penetrated the bark, and then perished from the same cause. The holes were slightly larger than would be made by an ordinary knitting-needle, and penetrated the solid wood perpendicularly to some depth.

The use of an alkaline solution, as proposed by Mr. Saunders for borers in fruit-trees, would probably be a sufficient preventive of the attacks of these insects. Such a preparation is made by diluting soft-soap with a saturated solution of washing soda, and must not be made too thin. It is liberally applied with a brush, so as to fill all crevices in the bark and give it a good coating. As the female of Xiphydria, like those of the apple-borers, seems always to deposit her eggs in the trunk below the branches, it would be quite feasible to protect in this manner shade trees in towns or districts where the insect was observed; especially recently transplanted trees, which the insect seems to single out as offering special advantages for her future offspring; perhaps because she can perceive in them a weaker vitality, even when they are apparently flourishing. The coating would have to be applied in the early part of June and again a month later, as the insects occur during the greater part of June and July.

## INJURIOUS INSECTS INFESTING THE HICKORY.

COLEOPTERA.

By W. HAGUE HARRINGTON, OTTAWA.

The vital importance of a systematic preservation and renewal of our forests and groves is now widely acknowledged, and has become of late years a subject of deepest interest to those having at heart the welfare of their country, and movements in this direction have been initiated which will, if vigorously prosecuted, be productive of incalculable good. The Ontario Government, with its usual prompt desire to advance the agricultural and allied industries of the Province, has issued large editions of very valuable reports bearing upon the question in its different aspects. One of the aims of the Entomological Society is to further this good work by collecting, through the original investigations, or the studies, of its members, reliable information in regard to the injurious insects preying upon our forest and shade trees. This information plainly presented, (with a minimum of scientific terms to perplex the non-entomological reader,) will gradually give to the tree-planter that knowledge of insect-foes to be looked for that has been hitherto so liberally offered to the farmer and the fruit-grower.

So long as the forests are left in a state of nature (or recklessly destroyed), such knowledge is both difficult to acquire and to apply; but when timber trees are planted and cared for as fruit-trees are now, it will become necessary to pay close attention to insect enemies if the best results are to be looked for. Forestry reports will lack completeness until they contain trustworthy information regarding the appearance and life-history of all the insects which infest each tree. This in the present state of entomological knowledge is to a great extent impossible, and it is really surprising, when we consider the number of entomologists throughout the country, to find how little information is accessible in regard to the great majority of species. The model

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reports of Fitch have been but meagrely supplemented as regards many of our trees, and, with the exception of a few well-known practical and economic entomologists, the tendency has been apparently simply to collect and describe species. Dr. Packard has recently compiled a very valuable "Bulletin on the Insects injurious to Forest and Shade Trees," which has been issued by the U. S. Entomological Commission; but, although of great assistance to a knowledge of the subject, it is necessarily incomplete, and is intended to be preliminary to a more exhaustive treatise.

In previous reports presented by our Society, descriptions have been frequently given of insects injurious to various trees, but no paper entirely devoted to those infesting a particular species, or genus, of forest tree has yet appeared. Now, however, when our forests bid fair to receive more of that attention which they so richly merit in view of their incalculable benefits to the Province, it is appropriate that our reports should contain a series of articles treating of the more important at least of our timber-trees. The present paper, as its heading shows, does not pretend to enumerate all the insects infesting the hickory, but this genus has been chosen, partly because it yields one of our most valuable woods, and partly because the writer has himself collected from these trees a large proportion of the insects to be considered.

It will require much more labour on the part of our members before a comparatively complete list can be compiled of all the injurious species. The U. S. Bulletin, already mentioned, enumerates eighty-seven species infesting the varieties of hickory, but of these only about one-half are recorded in our Canadian lists, although a majority of the remainder must doubtless occur in Canada, as well as in the United States. There are also many additional species infesting these trees which have not yet been noted. In the present paper I will confine my remarks to the coleoptera, leaving for a future paper, or to some member more competent, the consideration of the numerous species belonging to the remaining orders. The list which I now present of our injurious coleoptera infesting the different varieties of hickory contains no fewer than forty-eight species, of which only twenty-six are mentioned in the U. S. Bulletin. Thirty-three of the species have been collected by myself from these trees, and of these twenty-two are in addition to the list of Dr. Packard.

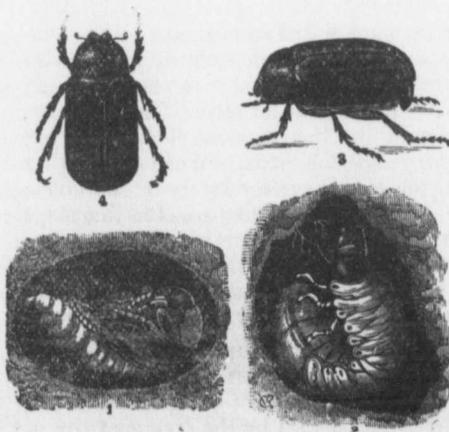


Fig. 11.

long and slender, ending in two claws which are forked at the tip, a characteristic which gives to the genus its name of "Forked claws" (*Dichelonycha*). This species is distinguished from several very similar ones found in Canada, by its blackish hind legs. I have found it in June feeding upon the bitter-hickory (*Carya amara*), and it also occurs commonly on hazel, elm, beech, oak, etc.

The first two beetles to be described belong to the Scarabæidæ, a family containing some of our species which are most destructive both in the larval and perfect forms, and of which very familiar examples are the May-bugs (Figure 11), *Lachnosterna fusca*, in its different stages, which represents our common species.

No. 1. *Dichelonycha elongata* Fab. is a beetle about one-third of an inch long; slender and cylindrical in shape, and of a dark colour, with the exception of the wing-covers, which are testaceous and more or less uniformly tinged with green. It is densely clothed beneath with short white hairs, and is more sparsely hairy above. The female has the thorax more densely covered with this pubescence than has the male, and is also distinguished by the shape of the abdomen. The legs are



Fig. 12.

No. 2. *Osmoderma eremicola* (Knock) is a large, broad beetle, an inch in length, of a very dark mahogany brown colour. The thorax is nearly square, but is slightly rounded on the sides and narrowed in front; that of the male has a deep pit just before the middle. The thorax beneath and also the abdomen above are covered with fine, silky brownish hairs. The elytra (wing-covers) are not large enough to fully cover the abdomen, and a ring of the pubescence is exposed around them. The beetle is very smooth and shining, differing greatly in this respect from *O. scabra* (Beauv.) (Figure 12) which is frequently found on old apple and beech trees. These beetles when alive have a very strong and not unpleasant odour, which has been compared to that of Russian leather, and from which the name of the genus is derived—*Osmoderma* meaning "scented-skin." The name of the present species, *eremicola*, signifies a "wilderness-inhabitant." Its larvæ are large, white, fleshy grubs, very similar in shape to those of the May-bug, and are found in decaying portions of living trees. The beetles obtained by me from hickory were found in the pupa state (at which time they are inclosed in oval cocoons made from particles of the wood), in a small hollow where decay had commenced from the breaking off of a limb. They had fed upon the sappy, partly-decayed wood, enlarging the wound and causing further decay, and thus injuriously affecting the tree.

The next seven species belong to the Buprestidæ, a family containing species clad in armour often of metallic lustre, and almost metallic hardness, or varied with most brilliant colours. Their larvæ are flattened footless grubs, having the second segment behind the head very much enlarged and widened, while the following ones being very much narrower, give to them in some species a regular tadpole appearance, as in Figure 13. They bore chiefly in the stems and branches of trees and shrubs, but a few species are leaf-miners. Among well-known species of this family are the red-necked raspberry-borer, *Agrilus ruficollis* (Fab.), and flat apple-tree-borer, *Chrysobothris femorata* Lec.

No. 3. *Dicerca lurida* (Fab.) is very similar in shape to the species next to be mentioned, but the tips of the wing-covers do not diverge, and each ends in two minute spines. The colour is also a darker and more lurid bronze, whence its name. It varies in length from one-half of an inch to three-quarters of an inch. The larvæ are yellowish white, with a small head nearly buried in the first segment of the body, but armed with powerful jaws adapted for cutting through the wood. When young they bore along under the bark, forming shallow burrows in the surface layers of the wood; going deeper as they gain in size and strength. The length of time passed in this stage has not been ascertained, but is variously stated as two, three or more years. The beetles are found in summer sunning themselves on the trunks of the trees, or crawling up and down in search for their mates. They prefer trees in a weak and diseased condition to those in vigorous health, nor do they appear to attack any other kind of tree.



Fig. 14.

No. 4. *Dicerca divaricata* (Say), is the common Buprestid found during the summer and autumn on so many garden and forest trees. Its appearance and habits are so well known that they need not be again described. It is easily distinguished from the preceding species by the divergent tips of the elytra, (Figure 14) and is a somewhat larger and broader species, measuring from six-tenths to eight-tenths of an inch in length. It infests more especially beech and maple, but I have taken specimens on hickory as well as on various other trees.

No. 5. *Chrysobothris femorata* Lec. the obnoxious apple-tree-borer, has also been found by me very abundantly on dead hickories from June to September, and the fact that the larvæ live upon this tree was established by finding a beetle in its burrow under the bark. The beetle, Figure 15 d, (slightly enlarged)—varies in length from one-third to one-half of an inch, and is nearly half as wide. The colour is greenish-



Fig. 13.



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Fig. 15.

black above and bright coppery below; some specimens (males) having the front of the head and antennæ bright green, and the legs tinged with green and crimson. Each elytron has three raised lines running lengthways, between which are irregular crosslines and punctures, and has two impressed spots. The larva, Figure 15 *a*, mines shallow, irregular, burrows under the bark in the same manner as when boring in the apple-tree.

No. 6. *Anthaxia viridifrons* Gory. This handsome little beetle was bred from hickory twigs by Dr. LeConté, and has very frequently been found by me upon the trees in summer. It is about two-tenths of an inch in length and one-tenth in width. The colour is brown with a bronze lustre, and the males have the front of the head of a vivid green, from which the name of the species is derived.

No. 7. *Anthaxia viridicornis*, (Say) I have also found abundant on hickory. It is a slightly larger species than the preceding, but closely resembles it, except that the elytra are of a bluish-black colour. Found also very commonly on elm.

No. 8. *Agrilus egenus* Gory was also bred by Dr. LeConte from hickory twigs, and is abundant on that tree. It is a little smaller than the red-necked agrilus which bores in the raspberry stems, and is of a uniform dull bronze colour.

No. 9. *Agrilus otiosus* (Say), is very frequently found with the foregoing, and, being almost of the same size and colour, is very difficult to distinguish from it.

We next have a small beetle belonging to the Ptinidæ, the members of which vary greatly in shape, but are usually small. The larvæ of many species are very destructive, boring deeply into the wood of the trees infested.

No. 10. *Lycetus striatus* (Mels.) is a slender reddish beetle about one-fifth of an inch long. The head is prominent, not covered, as in many species, by the thorax, and the antennæ end in a round two-jointed club. The thorax is longer than wide, and the elytra are striated. It is one of the species bred by Dr. LeConte, from hickory twigs.

The extensive family of the Cerambycidæ contains, however, the great majority of our destructive borers, and to it belong no fewer than twenty-seven of the species mentioned in this paper. Its

members are generally beetles of cylindrical form; lively and active in their movements, and having long slender antennæ, whence they are usually called Longicorns. The larvæ are elongated, fleshy grubs of a whitish or yellowish colour, usually with the segments distinct, and footless.—See Fig. 16, *a*, which represents the larva of *Saperda Candida*

Fab., a well-known species infesting the apple-tree; *b* and *c* represent the pupa and perfect stages of the same insect.



(FIG. 16.)

No. 11. *Chion cinctus* (Drury), is a beetle about an inch in length and one-third of an inch in width. The thorax is rounded, with a projecting spine on each side. The general colour is brownish, but a greyish look is given to it by a covering of short hairs, and it has an oblique yellowish band across each wing-cover before the middle. The elytra are bispinose at the tip. The antennæ are very long and slender; those of the male being twice as long as the body. The yellowish, elongated larva burrows when young beneath the bark, and when larger sinks deeper and forms long galleries "in the direction of the fibres of the wood." (Harris.)

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No. 12. *Eburia quadrigeminata* Say, is mentioned in Dr. Packard's Bulletin as "issuing from hickory trees in July, common. (McBride.)"

It is one of the longicorn beetles, and is about nine-tenths of an inch long, with a pale yellowish brown body. On the thorax are two black tubercles above, placed transversely, and a short spine on each side. On each wing case, there are two double short lines of a yellow colour, and slightly elevated. The tip is two spined, the exterior spine being longest.

No. 13. *Heteracthes quadrimaculatus* Newm., was bred from branches of hickory by Dr. LeConte. This species belongs to the same family of beetles as that last referred to, but I am unable to describe it, as I have neither beetle nor description. It is, however, of very elongated form, the thorax being long and cylindrical. Antennæ long and slender; eyes large and coarsely granulated. The name signifies "four-spotted."

No. 14. *Obrium rubrum* ~~Newm.~~ <sup>Y. Gahan</sup>, is a delicate little beetle, about one-fourth of an inch in length, and of a reddish colour, as its name implies. The thorax is cylindrical, with a small prominence on each side. The legs and antennæ are slender, the latter being as long as the body. I have only taken one specimen, which was captured on hickory foliage on 12th July.

No. 15. *Molorchus bimaculatus* Say, is very frequently found on flowering shrubs during June and July, and differs from nearly all our Cerambycidae in having the wing covers only half as long as the abdomen. It is a very slender beetle, one-third of an inch in length; black, with the head and thorax strongly punctured; the abbreviated elytra having each a yellowish dash almost parallel with the inner margin. The antennæ and legs are brownish; the former being much longer in the males. One of the species bred by Dr. LeConte from hickory twigs and branches.

No. 16. *Stenosphenus notatus* (Oliv.), is recorded by Riley as having been cut from hickory wood in March. It is closely allied to the beetle next to be described, but differs from it structurally in some particulars, as, for instance, in having the elytra truncated at the tip, and terminating in two spines. The thorax is rounded, without spines or tubercles; the antennæ of the females are about as long as the body; those of the males longer; legs rather short.

No. 17. *Cyllene picta* (Drury), is a very handsome beetle, so closely resembling in appearance the species *C. robinia* (Forst.), which works such havoc with our locusts that the beetles have been very frequently considered as the same species. There are, however, structural points by which the entomologist can separate them, while for others it is sufficient to know that the hickory-borer appears early in spring, and that the locust-borer is found in autumn, being most abundant in September. The beetle averages about three-fourths of an inch in length, and about one-fourth of an inch in width. The body is black, with yellow markings, and the legs are rust-red. The rounded thorax has four golden bands, formed of yellow hairs, across it, and the wing-covers several waved ones of the same colour, one of which forms a very distinct W. The cream-coloured larvæ of this beautiful beetle bore in every direction under the bark, making extensive excavations, which are packed with the coarse saw-dust-like chips made during the progress of this destructive work.

No. 18. *Xylotrechus colonus* (Fab.). This beetle is of a more cylindrical and narrower shape than the preceding, and is much smaller, measuring only from four to six-tenths of an inch in length. It is of a blackish-brown colour, the wing-covers having two irregular whitish bands near the base, and the tips also whitish; with a large black spot on each, the black spots sometimes forming a band. I have found it running on dead hickory in July. It is recorded as having been "bred from oak" by Riley, and as having been found under the bark of an old sugar maple by Mr. G. Hunt.

No. 19. *Neoclytus erythrocephalus* (Fab.) is a much more slender and pretty beetle of similar shape, found on felled or dead hickories during July, and has been bred from this wood both by Dr. Horn and Dr. Le Conte. It is about one-third of an inch long and hardly one-tenth of an inch wide, the thorax being very cylindrical and as wide as the wing covers. The colour is a rusty-red, the head being of a brighter red, whence the name *erythrocephalus*, from two Greek words signifying "red-head." The antennæ are about one-half as long as the body; the elytra have four narrow yellow bands across them,

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and the legs are long and slender, especially the hinder pair, which are almost twice as long as the body. This beetle is exceedingly quick in its movements, and difficult to capture, as it runs swiftly, and takes to flight instantly if disturbed.

No. 20. *Euderces picipes* (Fab.). This pretty little ant-like beetle has been found by me on hickory in July, and also on the flowers of sumachs growing among these trees. Having found it only in this one locality, it seems very probable that it bores in this tree, although (as in the case of several other species in this list) there is no direct evidence of the fact. The beetle is only one-fourth to one-third of an inch in length, and has the thorax constricted behind, so as to give it much resemblance to an ant, which it further resembles in its movements upon the flowers on which it delights to spend the sunny days. It is of a glossy black colour; the thorax is very finely wrinkled longitudinally, and the elytra are coarsely punctured, and have an ivory-like raised line running obliquely across each near the middle.

No. 21. *Typocerus velutina* (Oliv.) is a very common longicorn which appears upon flowering plants and shrubs, such as spiræa and viburnum, in July and August, but I have not been able to find any record of the trees attacked by it. Having taken it on hickory and found it numerous in the neighbourhood of these trees, I place it in the present list with the conviction that future investigations will sustain me in so doing. The thorax, head and antennæ are black; the thorax being margined and sparsely clad with golden hairs, and increasing in size from the head to the base of the wing-covers. The abdomen, legs and elytra are of a rusty-red, the latter having four golden bands. Length averages about six-tenths of an inch.

No. 22. *Leptura proxima* Say occurs with the preceding species and is also common. It is about the same size, but has the thorax constricted behind and is entirely black, with the exception of the elytra, which are ochre yellow with black tips. As an example of the scanty knowledge regarding the habits of longicorns, I may say that out of some seventy-five species belonging to this genus in the United States and Canada, only one is mentioned among the "Insects Injurious to Forest and Shade Trees."

No. 23. *Dorchaschema nigrum* (Say) is of a velvety black colour and from four-tenths to five-tenths of an inch in length. The thorax is cylindrical; not constricted at the head, and but slightly behind. The wing-covers widen slightly toward the tips, which are rounded, and they are coarsely punctured. The lower surface of the body and the legs are clothed with short white hairs. The antennæ are very long and slender. I have found the beetles issuing from dead trees in June, and they are abundant during that and the following month, both on dead and felled wood, and on the trunks and foliage of living trees.

No. 24. *Goes tigrinus* (DeG.) is, according to Fitch, probably the most destructive of all the beetles boring in hickory; attacking not only dead wood but infesting trees apparently sound, and greatly injuring them. The average length is about an inch, some of the males being less and some of the females more. The general colour is a reddish-brown, but the beetle has a tawny appearance owing to the short hairs which cover all the under surface and much of the upper. The antennæ are not quite so long as the body; the two lower joints are swollen and brown, the remaining ones slender and pale. The thorax has on each side a blunt conical spine. The elytra appear to have a brown band at the base and a similar one behind the middle, due to the absence from these portions of the short hairs that clothe the rest of the body. The beetle appears in summer and the female deposits her eggs in holes which she gnaws in the bark. The larva when hatched feeds beneath the bark on the sappy layers of the surface wood, but as it becomes larger and stronger it sinks gradually deeper and bores a burrow, increasing in size with its own growth, upward toward the centre of the tree. It is a soft, gradually tapering grub of a yellowish colour; about an inch long and one-fourth of an inch wide across the broadest segment—the second from the head. When it feels that its life in this form is about to end, it turns and bores outward to the bark, through which, after the usual metamorphoses, the beetle makes its exit.

No. 25. *Goes pulcher* (Hald.). The "Beautiful Goes" infests the shag-bark and pig-nut hickories. It is a rarer and somewhat larger species than the former, but closely resembles it, and its habits in the larval form are probably the same.

*microgaster*  
No. 26. *Goes oculatus* Lec. is a much smaller species, of the habits of which I have not been able to find any mention. The beetle is rare, and I have only taken two specimens. These were a pair captured on hickory in the end of June, and which were copulating when taken. They are hardly half an inch long, and are black, densely covered beneath with short white hairs. The pubescence above is more sparse and scattered, and the coarse puncturing of the elytra gives them a mottled appearance. There is a black spot on each elytron just behind the middle, and the presence of these spots gives to the beetle its distinctive name of *oculatus* or "eyed."

No. 27. *Goes pulverulentus* (Hald.) is a fourth species of the same genus and resembles very closely Nos. twenty-four and twenty-five. It is recorded by Dr. Horn as very destructive in the United States to living beech-trees, of which it attacks the larger branches, and bores in them large burrows several inches long. This is the only notice I find of its habits, but it is probable that it bores also in hickory, as I have taken several specimens on bitter hickory in July and August. The chief points of distinction between this species and *tigrinus* appear to be in the vesture of the elytra and the length of the antennæ. Their size and general colour are about the same, but the elytra of *pulverulentus* are uniformly clad with short hairs, and have no appearance of dark bands. The antennæ (at least in some specimens) are slightly longer than the body.

*sphaeroderus*  
No. 28. *Acanthoderus quadrigibbus* (Say) is reported by Schwarz as boring in the dead twigs of oak, beech and hackberry, and it has been bred by Dr. LeConte from small branches and twigs of hickory. It differs considerably in shape from the beetles of the preceding genus, being broader and flatter. It is about one-half of an inch long, and one-fifth of an inch across the base of the wing-covers. The thorax, in addition to two lateral spines, has two more above, whence the name *quadrigibba* or "Four-horned." The legs are nearly of a uniform length, and the thighs are much enlarged. The general colour is a mottled grey, due to pubescence, and there is a "moderately broad transverse band of white in front of the middle."

*astylus*  
No. 29. *Leptostylus macula* (Say) is a very pretty little species about one-third of an inch in length. The antennæ are longer than the body; brown, with the joints black. The thorax is cylindrical, without spines, and with the sides white, bordered above by a black line. The general colour is brown, spotted with black, and there is a large white spot on each wing-cover beyond the middle. In some specimens these spots together form a broad white band across the back. The elytra are not twice as long as wide, and are rounded and deflected at the tips. The legs are as in the preceding species. Fitch in his reports states that the larvæ of these beetles may at times be found very abundantly under the bark of old butternut trees. I have taken specimens upon butternut, but not so frequently as upon the bitter hickory. A slightly larger and broader species *L. aculifer* (Say) is found upon the apple-tree occasionally.

No. 30. *Liopus alpha* (Say) is one of a groupe of small long-horned beetles which bear a close resemblance to one another in shape and size, as well as in their habits of boring the small branches and twigs of various trees. Their larvæ are rather slender, and are covered with fine hairs; they feed under bark, and are said to be fully grown in the autumn of the first year. The only record I can find of the habits of *L. alpha* is one by Riley, of their boring in dead apple-twigs and issuing in May. The date of appearance varies of course with range of habitat. My specimens have been chiefly taken in July. The beetle is about one-fifth of an inch in length; of an ashy-grey colour, with the exception of an angulated black band across the tips, and a black line along the anterior margin of the elytra. The antennæ are very slender, and half as long again as the body. Fig. 17, which represents the apple liopus, *Liopus facetus* Say, will give the reader a general idea of the appearance of the insects belonging to this genus.

No. 31. *Liopus cinereus* (Lec.) is almost identical in appearance with the preceding, and is distinguished mainly by the coarser puncturing of the surface of the elytra. It was bred by Dr. LeConte from twigs of hickory.

No. 32. *Lepturges querci* (Fitch) is of the same shape and size, but is more variegated

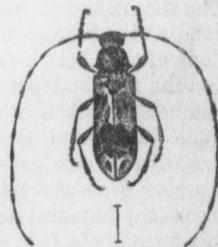


Fig. 17.

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Fig. 18.

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Fig. 17.

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in colour. The head and thorax are black; the antennæ twice as long as the body, and pale, with the tip of each joint black. The yellowish elytra have a black transverse spot behind the scutel, and a broad, angulated, black band behind the middle. In front of this band are several short black lines, and between it and the tips are black dots. This species received its name from Fitch, because it was captured upon oak trees by him, and believed to live upon them. This appears to be all that can be learnt of their history. All of my specimens have been captured upon hickory, either on the bark of felled trees, or among the foliage of living ones.

No. 33. *Hyperplatys aspersus* (Say) is nearly one-fourth of an inch in length, and of an ashy-grey colour, with the upper surface sprinkled with small black dots, and with an interrupted black band behind the middle of the elytra. It is reported by Schwarz as boring in dry twigs of *Populus monilifera* at Columbus, Texas; the perfect insects being found throughout the spring and summer. It is not uncommon here upon the bitter-hickory in company with Nos. 30, 31, and 32.

No. 34. *Ecyrus dasycerus* (Say) is of nearly the same size and resembles somewhat in shape the Spotted Leptostylus (No. 27). The thorax has feebly rounded sides, without any tubercle, or angulated spine, as in the preceding four species. The pubescence is close and short, and the beetle is of a brownish or greyish-brown colour, with a somewhat mottled appearance. The antennæ are as long, or a little longer, than the body. It is one of the species bred from hickory by Dr. LeConte.

No. 35. *Eupoqonius vestitus* (Say) has been bred from hickory by Riley. It is about one-third of an inch in length, of a chestnut-red colour, mottled with short yellowish pubescence, and clothed (as its name indicates) above with longer dark hairs arising from punctures in the surface. The head and thorax are darker and more closely punctured than the elytra. The legs and antennæ are also hairy, the latter being as long as the body. The only specimens which I have taken were found upon wild raspberry bushes.



Fig. 18.

No. 36. *Oncideres cingulatus* (Say) is a species of very curious and interesting habits. When the female desires to deposit her eggs she does so in punctures made in the bark of small branches or twigs, usually from one-fourth to one-half of an inch in diameter. After this operation, or before it (according to different authorities), she gnaws a ring just below where the eggs are deposited; so girdling the twig that it usually breaks off during the winter storms and falls to the ground. Fig. 18 shows the beetle in the act of thus girdling a slender branch. Where the twig fails to break off, it is nevertheless killed, and the larvæ feed in the dead wood. The beetle is about six-tenths of an inch long, with cylindrical unarmed thorax, and antennæ longer than the body. Its colour is a greyish-brown, and it has a broad grey band across the elytra covering their middle third. It is widely known as the "Twig-girdler," and infests a variety of trees, including the apple and pear.

No. 37. *Saperda discoidea* Fab. belongs to the same genus as the Striped-borer of the apple, and is of similar shape, but smaller. The colour varies from brown to black, the males being the darker. The pubescence with which the head, thorax and under surface is clothed also varies from yellowish to grey. It appears to be very rare in this vicinity, but is, I believe, more common in western Ontario. Reported by Fitch and Riley as boring in hickory, and also bred therefrom by Dr. LeConte.

The next beetle belongs to the Chrysomelidæ, a family containing many species, feeding upon the foliage of plants and doing serious damage. Among them may be mentioned the potato-beetle, cucumber-beetle and grapevine flea-beetle. A number of species must undoubtedly feed more or less upon the hickory; but none are enumerated in Packard's Bulletin, and I have not been able to find notices of any elsewhere. Unfortunately my own notes in this direction are so scanty that I can only find a record of one species.

No. 38. *Systema marginalis* (Ill.) is a small, elongated beetle of a lemon-yellow

colour, and having the thorax and elytra margined with black. It belongs to the flea-beetles and is very active. It is abundant upon elm, oak, etc., in the summer and autumn; and in the early part of September (1882) I found it in great numbers feeding on the foliage of the sweet hickory.

The remaining species to be mentioned belong to the division of coleoptera known as Rhyncophora or snout-beetles, because the head is prolonged more or less into a beak. This division contains a great number of small, or moderate-sized, species, of very obnoxious habits, as the larvæ live generally in seeds, under bark, or in the roots, etc., of plants. The first five species belong to the family Curculionidæ.

No. 39. *Magdalis barbata* Say is a black species about one-fourth of an inch long. The thorax is closely punctured, and the rounded sides project in front in a short, acute tubercle. The head is prolonged into a slightly curved beak, not deflexed, and as long as the thorax. The elytra have deep punctured striæ, and are as long as the head and thorax together. The scutellum (a small plate at the base of the elytra) is covered with white hairs. The beetles are found during the summer months puncturing the bark of felled and dead hickories, and the larvæ live in great numbers in the bark or between it and the wood. I have found the beetles most abundant from 15th to 30th June. A species almost identical with this, viz., *M. olyra* (Herbst.), is stated in the U. S. Bulletin to bore under the bark of the oak, and a smaller and smoother species with a bluish tinge, *M. inconspicua* Horn is very abundant on our pines.

No. 39 A. *Magdalis olyra* Herbst. Since the preceding paragraph was written, and in type, I have received the January number of the "Quarterly Journal of the Boston Zoölogical Society," in which Mr. F. C. Bowditch describes this species as always found by him to infest various species of *Carya*. The larvæ "tunnel the bark in every direction, leaving only just enough tissue to prevent the bark warping away from the tree." "As far as my observations extend, the species appears to prefer small trees, from four to six inches in diameter." "If the tree is small and very badly infested it dies very quickly; and shortly after the beetles have escaped the bark is apt to flake off, or curl up in quite large pieces." As this beetle is also found in Canada, it will add one more to the present list, thus making the total number forty-nine.

No. 40. *Anthonomus suturalis* Lec. is a pretty little weevil also found very abundantly on the bitter hickory. It is black and punctured, but shining, and the elytra have each a large red spot (varying in size) extending from the tips almost to the middle. The beak is longer than the thorax, and bent down, instead of projecting forward as in the preceding species. In regard to the actions of this beetle upon the hickory, I am unfortunately in ignorance; but it is known to attack cranberry-vines in the United States, by laying an egg in the fruit-bud and then cutting it off; the larva feeding in it upon the ground.

No. 41. *Conotrachelus posticatus* Boh. very much resembles in shape and colour *C. nemuphar* (Herbst.), the well-known plum curculio, but is smaller and without tubercles on the elytra. There are, however, upon the elytra slightly elevated ridges between which are rows of punctures. Across the elytra, near the tips, is a yellowish band. It occurs upon the foliage of the bitter-hickory during the summer months. An allied species, *C. elegans* (Say) is described by Packard as "laying its eggs in the partly rolled up leaves of the pig-hickory (*Carya porcina*) and during the process cutting off the leaves, which hang down, wither, and turn black."

No. 42. *Acoptus suturalis* Lec. is a small black beetle, densely clothed beneath and more sparsely above with short yellowish hairs. The elytra are striated and in unrubbed specimens have a wide band of yellowish pubescence across the base, and a narrow one near the tips, which are black, as is also the space between the bands; a white line along the suture interrupts the basal band. Found in abundance on dead hickories, in the bark of which it bores in company with No. 39.

No. 43. *Balaninus nasicus* Say is named the "Hickory-nut weevil" in Packard's Bulletin, and according to Riley breeds entirely on hickory-nuts. Harris, however, considered it probable that it bred in the nuts of the hazel, because found paired on hazel-bushes in summer. In this neighbourhood it is never found on hickory so far as I am aware, and frequents the hazel almost entirely. Some years it is very numerous

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on these bushes, and the nuts correspondingly worm-eaten. It is nearly one-third of an inch long (exclusive of the beak) and of an oval shape; being widest across the base of the wing-covers. It is densely clad with very short yellowish hairs and has a somewhat variegated or mottled appearance, especially on the elytra, due to patches of darker hairs. The beak is very long, slender, curved, and almost black.

No. 44. *Balaninus rectus* Say is generally known as the acorn-weevil, and is also believed by Riley to infest hazel-nuts. It is of the same size as the preceding species, but much lighter in colour and distinguished by its more slender and less curved beak, which in the female is longer than the whole body. This species is much more rare (around Ottawa) than the preceding, but I have taken several specimens on hickory, so that as regards this locality at least I am disposed to regard it as usurping the claim of *B. nasicus* to be considered the hickory-nut weevil. A few specimens also occur on oak.

The following three species belong to the Scolytidæ, which are small, and often minute, cylindrical beetles boring in the bark and surface wood of various trees, and at times destroying immense quantities of valuable timber.

No. 45. *Xyleborus celsus* Eich. is a small species bred from hickory twigs by Dr. LeConte, and is recorded as found in Canada, but is not known to me.

No. 46. *Scolytus quadrispinosus* Say is from one-sixth to one-fifth of an inch long; entirely black, or black with brown elytra. The elytra have rows of deep punctures forming striæ, between which are rows of hardly perceptible punctures. This beetle attacks the different varieties of hickory and is very destructive. The female bores a little tunnel under the bark and deposits eggs along it. The larvæ when hatched make other tunnels out from this and thus loosen the bark; they are short, stout, footless grubs.

No. 47. *Chramesus hickoricæ* Lec. is a small species also bred by Dr. LeConte from the twigs and branches of hickory.

The remaining beetles on my list of injurious species belongs to the family Anthribidæ.

No. 48. *Hormiscus saltator* Lec. is a minute cylindrical black species not more than one line in length, with a short broad beak and antennæ ending in a small club or knob. The thorax is closely punctured, and the elytra punctured in rows. It is found on the hickory in June, and probably bores in the bark.

Further observations by our members will probably largely increase the foregoing list, as I know that other species have been taken by me on hickory, of which I have kept no notes. There are also three injurious species which I have captured on these trees, but which I have not yet determined.

There are also many beetles infesting these trees, of the habits of which but little is known, so that I am unable to say whether they do any injury or not. Among such are species of Cistelidæ, which are found abundantly on the foliage or under the bark.

As regards the measures to be taken against the ravages of these destructive beetles, there can be offered at present merely suggestions. For those boring in the bark and larger branches of the trees, it is probable that the soapy alkaline washes used as preventives against the borers in fruit trees will be equally effective. The species which infest the smaller branches may be checked by careful pruning and burning in the autumn of all diseased and dead twigs. As, also, a large number of species breed in dead and felled timber, it is evident that the presence of such wood will attract the beetles and help to increase their numbers. Timber when felled should be immediately hauled away to a place of safety, and all the refuse burnt. All badly diseased trees and standing dead timber should be felled and disposed of in the same manner. Those beetles which are so numerous attracted to flowering shrubs, in the vicinity of the trees in which they live, might be profitably collected and killed by children armed with sweeping or beating nets. The gathering of all nuts which fall to the ground and feeding them to pigs, or burning them, would soon diminish the ravages of the nut weevils.

Although it was not my intention in the present paper to make any mention of the various species of beneficial insects which I have observed on the hickory, I cannot refrain from making a few remarks regarding two beetles bred by Dr. LeConte from hickory twigs, viz.: *Chariessa pilosa* and *Phyllobenus dislocatus*. To those unacquainted

with the habits of the family Cleridæ, to which they belong, it might be supposed from finding these beetles mentioned, without comment, in the "Bulletin of Insects Injurious to Forest and Shade Trees," that they were injurious species. The larvæ of the Cleridæ, however, whose habits are known, are carnivorous, and it is therefore probable that the species in question merely lived upon the larvæ of some of the injurious beetles. I have already recorded (Can. Ent., Vol. XV., p. 80) the fact that *Chariessa pilosa* was found by me in the act of devouring specimens of Nos. 8 and 39 of the present list; thus proving itself in the perfect form at least to be a decidedly beneficial species. Several other species of this family are commonly found upon the hickory, and are all probably the opposite of injurious to them.

### INSECTS INJURIOUS TO THE WHITE PINE—*Pinus strobus*.

BY WM. SAUNDERS, LONDON, ONTARIO.

More than one hundred species of insects have been enumerated as destructive to the white pine, some attacking the wood, others the bark, twigs or leaves, and while some of them do comparatively little harm, others are very injurious. In the present paper reference will be made mainly to those which do the greatest injury to this our most valuable timber tree, briefly sketching their life history, and habits as far as they are known. The losses occasioned by the destructive work of borers are unfortunately too well known to those engaged in the lumber trade, although the sufferers in most instances know but little of the curious transformations which these insects undergo. These specially destructive species inflict their greatest injuries during the larval period of their existence, in which condition some of them continue their work for several years before reaching maturity. Most of these pests belong to one of two families of beetles, the longicorn, or long-horned beetles (*Cerambycidae*), or the serricorn, or saw-horn beetles (*Buprestidae*). The cylindrical bark-beetles are also injurious, but as they operate chiefly near the surface, immediately under the bark, they do not injure the timber to any material extent.

#### MONOCHAMMUS CONFUSOR.

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Among the most formidable enemies in the family of long-horned beetles are two species belonging to the genus *Monochammus*, and known as *Monochammus confusor* and

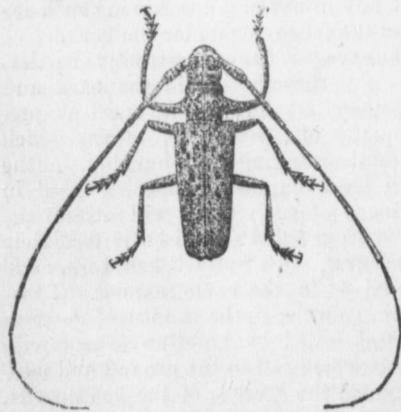


Fig. 19.

*M. scutellatus*. *M. confusor* is a large grey beetle, remarkable for the extraordinary length of its antennæ or horns. This insect is shown in fig. 19. The body varies in length from an inch to an inch and a-half, the average size being over an inch. Its general colour is ashen grey, mottled with darker spots and dots; there are also patches of a whitish colour on the head, thorax and abdomen, which are sometimes indistinct or almost wanting, the colours being chiefly due to a covering of very fine, short hairs, which, as they are easily rubbed off, occasion these variations in the appearance of the insect. The antennæ of the males vary in length from two to upwards of three inches; those of the female are much shorter, and seldom exceed the length of the body. During the summer the female lays her eggs in the crevices of the bark of the white pine trees, frequently selecting those which have been scorched by fire or felled by the wind or the lumberman's axe.

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The larva when hatched soon eats its way into the wood, where it forms channels or galleries through and through the solid interior. When full grown it is a large, soft, white grub, nearly cylindrical in form and destitute of feet. The head is large, of a reddish-brown colour, and is armed with a pair of powerful jaws; the next joint behind the head is flat and horny, and larger than the others, the body tapering a little from this point backwards. The chrysalis state is passed within the burrow, and the beetle appears late in June or during the month of July. As this insect lives a long time in the larval state, the beetle is often developed after the timber has been built into a house, when, suddenly emerging from its concealment, it becomes a source of wonder to the inhabitants of the dwelling. When burrowing into the wood, the larva makes a noise not unlike the boring of an augur, which on a still night may be heard in the woods for a considerable distance, and such noises occurring in a house where the cause has not been suspected has often given rise to superstitious notions and excited in the timid much alarm. This beetle is very generally distributed throughout the Northern United States and Canada, and in the lumbering districts is sometimes excessively abundant. One instance is on record where nearly three hundred of the beetles were seen at one time on a single pine tree. As these insects are partial to cut timber, they often greatly injure logs which are allowed to remain a season over in the mill-yard.

Shot Can. & C. M. M.

MONOHAMMUS SCUTELLATUS.

This beetle derives its specific name from its white scutellum situated at the junction of the wing-covers with the thorax. It varies in length from three-quarters of an inch to an inch, and usually occurs most abundantly in June. In fig. 20 we have a very good representation of this insect. The body is black above and below, and thickly pitted with irregular impressions. On the wing-cases there are a number of scattered whitish spots of various shapes and sizes, which, when examined with a magnifying lens, are found to be formed of dense clumps of short, whitish hairs, which often disappear by being rubbed off. On each side of the thorax is a thick, triangular spine; the antennæ are many-jointed, and in the female are about the same length as the



Fig. 20.

body, while in the male they are nearly twice that length.

The larva of this insect is also a thick, white grub, without feet. The body is divided into a number of well-marked segments, the head as in the species last described being furnished with a strong pair of jaws. This larva infests the white pine chiefly after the lumber has been cut or newly fallen, and injures it by boring large, oval-shaped cavities, which extend for long distances through the interior of the log. In some localities these insects are very plentiful, literally swarming on pine trees. They are common in the lumbering regions of Canada and the Northern States.

CRIOCEPHALUS AGRESTIS.

Another injurious beetle belonging to the same family, but having much shorter horns, is known under the name of *Criocephalus agrestis*. This beetle is of a blackish-brown colour, with three large irregular indentations on the top of the thorax and two ridges on each of the wing-covers. The antennæ are about half the length of the body. The eggs of this insect are laid on the pine trees, and the larva when hatched bores into the wood, perforating the trunk in all directions, making a flattened cylindrical hole. When full-grown it is about an inch long, is white, footless, with a brown head. The anterior portion of the body is somewhat thicker than the hinder segments. The larva changes to a chrysalis within its burrow, and produces the beetle late in May or early in June.

THE LESSER ORTHOSOMA—*Orthosoma brunneum*.

This is a long-horned beetle of a rather flattened form, about an inch and a-quarter long and about one-third of an inch broad—see fig. 21. It is of a deep red colour, darker anteriorly; on each side of the thorax there are three sharp teeth and several slightly elevated lines on the wing-covers. The larva is about an inch and a-quarter long, cylindrical in form, and of a whitish colour. The beetles are very common during the months of June and July, and the larvæ are frequently met with in decaying pine stumps. Since they feed chiefly on decaying wood they do but little harm.

There are several other smaller species of longicorn beetles which injure pine trees, but as their habits are very similar to those of the larger species to which reference has been made, it will perhaps be unnecessary to speak further of them now.

THE VIRGINIAN BUPRESTIS—*Chalcophora virginiensis*.

Among the Buprestidæ, or saw-horn beetles, the Virginian buprestis (*Chalcophora virginiensis*) will first claim attention. This is a large and handsome beetle, which measures from eight-tenths of an inch to an inch or more in length. It is of an oblong form, and brassy or copper-coloured, sometimes almost black. The upper side of the body is roughly punctated, the top of the head deeply indented, on the thorax there are three elevated and polished thick black lines, and on each wing-cover two small, square, impressed spots, a long, elevated, smooth, black line near the outer margin and another near the inner margin, with several thinner, shorter lines between them. The under side of the body has a coppery lustre, and is sparingly covered with short whitish down. It appears towards the end of May, throughout June, and occasionally later. The larva is a flat-headed white grub, with its anterior segments very much enlarged, which bores into the sap-wood of the white pine, and sometimes girdles the tree; its track begins as a narrow shallow groove on the surface of the wood, increasing in breadth as the larva grows, following an irregular course, and terminating in a large hole, at which point the grub changes to a chrysalis.

THE LIBERATED BUPRESTIS—*Chalcophora liberta*.

This is a closely allied species, much resembling the Virginian buprestis in all its stages. The beetle is about three-quarters of an inch long, of a brassy or coppery hue, sometimes glossed with green, in other specimens nearly black. The thorax and wing-covers are deeply furrowed by irregular longitudinal depressions. It differs from *Virginensis* in the width and character of the raised lines on the wing-covers.

## DICERCA TENEBROSA. (Kby)

Is another member of the family of Buprestians which is an enemy of the white pine. This species in the larval state mines under the bark of the tree, where it occurs as a medium-sized whitish grub, with a flat head, brown jaws, and enlarged anterior segments. The beetle occurs late in the summer, is of an ashy-bronze colour, with the thorax and elytra more or less furrowed, and densely pitted. The under surface is copper coloured. This insect is found in most parts of Canada and the Northern United States.

THE GOLDEN BUPRESTIS—*Buprestis striata*.

This species also deserves mention here. It is a very handsome beetle, from six to seven-tenths of an inch long, of a coppery-red colour, with a broad bluish-green stripe on each wing-cover, which varies in brilliancy in different specimens. There are four raised smooth lines on each wing-case, and a wide, shallow groove along the middle of



Fig. 21.

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the thorax. Both thorax and wing-covers are pitted with minute dots. The larva of this species, which is very similar to that of *tenebrosa*, is occasionally found in sound pine logs, but much more frequently in decaying logs and stumps.

HARRIS' BUPRESTIS—*Chrysobothris Harrisii*.

This lovely little beetle measures about one-third of an inch in length. The female is of a beautiful metallic green all over; the male has the legs and the sides of the thorax of a reddish-bronze, with a purplish tinge towards the tips of the wing-covers. The thorax has a conspicuous furrow down the centre, and is marked with some irregular indentations, which are repeated also on the finely-punctured elytra. The beetle is found on white pine saplings towards the end of May and in June; the larva lives under the bark of young trees and in the smaller limbs of older trees.

CYLINDRICAL PINE BORERS.

Eight species of cylindrical bark beetles belonging to the family *Scolytidae* are known to attack the white pine, of which perhaps the boring Hylurgus (*Hylurgus terebrans*) is one of the most common, and since they are all very similar in their appearance and habits, this may be taken as a representative species. The beetle is about a quarter of an inch long, of a nearly cylindrical form, a chestnut-red colour, and is thinly clothed with yellowish hairs. It is found in abundance in May in pine forests and amongst lumber in mill-yards and elsewhere throughout the greater portion of North America. The larva is a small, yellowish-white, footless grub, with a yellow, horny head, which bores winding passages in many directions in the inner layers of the bark of the tree, and also in the outer surface of the wood.

*Xyleborus xylographicus* (fig. 22) is another member of this family, which has proved to be a formidable enemy both to the white pine in the north and to the yellow pine in the south.



Fig. 22.

THE PALES WEEVIL—*Hylobius pales*.

Among the weevils, or snout beetles, there are also several species which injure the white pine, one of them is known as the pales weevil (*Hylobius pales*). It is a dark chestnut-coloured or black weevil, from three to four-tenths of an inch long, sprinkled with dots more or less bright, which are found, on magnifying them, to be clusters of very fine, short, yellowish-gray hairs. These insects are quite common in May and June among pine trees, and lumber piles. The female perforates the bark of the tree with her snout and in the excavation deposits an egg, where it shortly hatches into a white or yellowish-white larva, which burrows beneath the bark, consuming its substance and loosening it from the wood. In the autumn the larva bores into the sap-wood, forming a cell nearly a quarter of an inch deep, arched over the top with a roof of sawdust and woody fibre. Within this enclosure the larva changes before spring to a pupa, from which the beetle escapes early in the summer. It is found from Maine and Lake Superior to Florida.

THE WHITE PINE WEEVIL—*Pissodes strobi*.

This is a common weevil met with at all times during the season, but most commonly in May. They affect the upper shoots of the trees, depositing their eggs in the bark of those which are young and growing thriftily. When hatched the young larvae devour the wood and pith, causing the shoots to wither and die. The leading shoots being destroyed, the trees become irregular in their growth and much disfigured. The larva is white, and about one-third of an inch long. The beetle (see fig. 23) is of an oblong, oval form, rather narrow, about a quarter of an inch long, of a dull dark brown colour, with two dots on the thorax, and a short, irregular, white band behind the middle of the wing-covers. They are also ornamented with a few patches of tawny yellow.



Fig. 23.

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Fig. 21.

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## THE WOOLLY BARK LOUSE OF THE PINE.

This is an insect which, in some localities, is very destructive to the white pine. Large patches are frequently found on the trunk and branches covered with a white, cottony secretion, under the protection of which live myriads of tiny lice. These puncture the bark with their sharp beaks and feed upon the sap, thus exhausting the trees, and sometimes causing their death. Large numbers of these lice are destroyed by lady-birds, who feed on them both in the larval and perfect state. Two species are especially useful in this instance. One is shown in fig. 24, where it is represented in its three stages. This is known as the painted lady-bird (*Harmonia picta*); the other is black, with two red spots, and is called the twice-stabbed lady-bird (*Chilocorus bivulnerus*). The larva is shown in fig. 25.

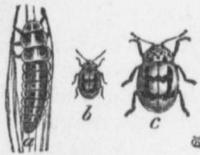


Fig. 24.



Fig. 25.

PINE LEAF SCALE INSECT—*Chionaspis pinifolia*.

Another allied species is the pine-leaf scale insect (*Chionaspis pinifolia*, Fitch). The leaves of the pine are sometimes found to be covered with innumerable elongate, snowy-white bodies, which, on examination, are found to be the scales of an insect; these when abundant give to the whole foliage a whitened appearance, and, if the insects are allowed to pursue their course unchecked, the leaves shortly become yellow or brown, and the trees languish and occasionally die. In fig. 26 is shown a tuft of leaves injured

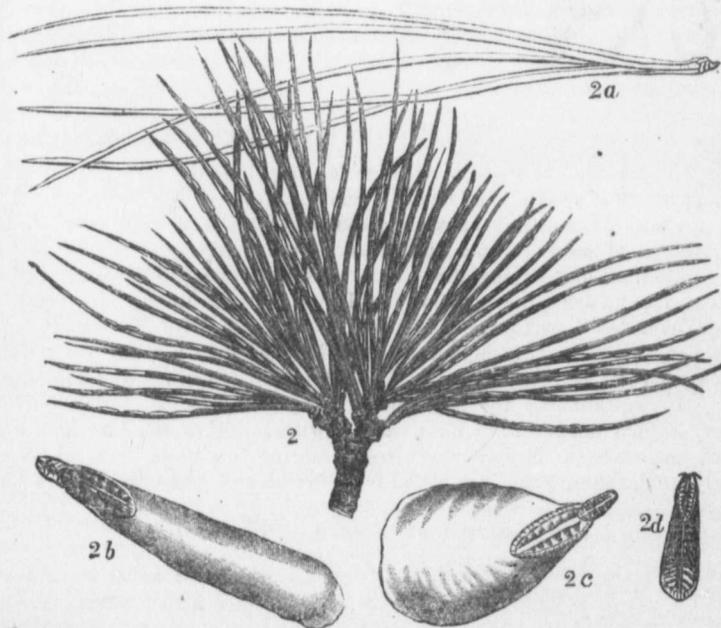


Fig. 26.

by this scale insect. The scale of the female, shown at 2c, is about one-tenth of an inch long, that of the male, shown partly grown at 2d and mature at 2b, is not more than one-thirtieth of an inch. Both male and female scales are much magnified in the figure. This insect has not yet proved troublesome in forests, but has chiefly affected trees in cultivation. It very closely resembles a species found on cultivated pines in Europe, and may possibly prove to be the same. The eggs are produced under the female

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scales, from fifteen to thirty under each scale; they are oval in form and of a red colour. The larvæ hatch early in May, and are also red. When first hatched the young females move briskly about until they have selected suitable locations for a permanent abode, when they attach themselves thereto and remain fixed. The males are less active, and often attach themselves to the leaves in the immediate neighbourhood of the parent scales. This insect produces at least two broods in a year, perhaps more, and is found throughout the United States from New York to Florida.

THE WHITE PINE SAW-FLY—*Lophyrus Abbotii*.

This species belongs to the family of saw-flies, a class of insects which are said to have greatly injured whole forests of pine in Germany. This American saw-fly is abundant in Indiana, Illinois, and Missouri, and is generally distributed elsewhere through the Northern and Western States and Canada. Fig. 27 represents the insect in its several stages. The larva is from eight-tenths of an inch to an inch in length, of a dingy white colour, with a black head, and several longitudinal rows of black spots along the body, and is found most numerous in the autumn. When full fed they enclose themselves in oval cocoons, which are sometimes spun up among the leaves on the tree, but more frequently among the fallen leaves and other debris on the ground. Within the cocoons the larvæ remain unchanged until the following spring, when the pupa

is formed, from which the flies issue in about two weeks. The male measures, when its wings are spread, about half an inch the female two-thirds of an inch across. The body of the male is black excepting the under side and tip of the abdomen, which are yellowish. The female is of a honey-yellow colour, with the head and thorax a little darker, the thorax with the abdomen being slightly marked with black. The wings are transparent, with black veins. The larvæ feed in flocks, and seldom leave a twig or branch until they have completely stripped it. When approaching full growth they consume a large quantity of food, and strip a tree of its leaves with wonderful rapidity. When disturbed they have the habit of throwing back the head and ninder part of the body, and if the tree or branch is violently shaken many of them will fall to the ground. A large proportion of these larvæ are destroyed by a parasitic fly.

THE PINE-BORING PYRALID—*Nephotyryx Zimmermani*.

In the months of June and July branches of the white pine often show that they are suffering from the attacks of an insect by the pitch which exudes; the wounds usually occur below the insertion of the smaller branches near the top of the terminal shoots. On cutting into the affected part, the injury is found to be caused by a small larva which, when full grown, is nearly three-quarters of an inch long. The head is shiny-brown, with black mandibles, the body blackish-green, naked, with a few black dots on each segment, from each of which arises a single rather stout hair. The larva devours the inner side of the bark, and making furrows in the wood, causes the exudation which, when excessive and continuous, especially in the case of young trees, sometimes proves fatal. In July the larva spins a thin, whitish, papery cocoon in the mass of exuding pitch, which seems to act as a protection to both larva and chrysalis. The chrysalis is smooth, and of a blackish-brown colour, and produces the moth in from ten to fourteen days. The moth, when its wings are expanded, measures an inch or more across. It is of a blackish-grey shaded with reddish, the hind wings are pale yellowish-white, and the abdomen greenish ringed with dull white. The species is probably single-

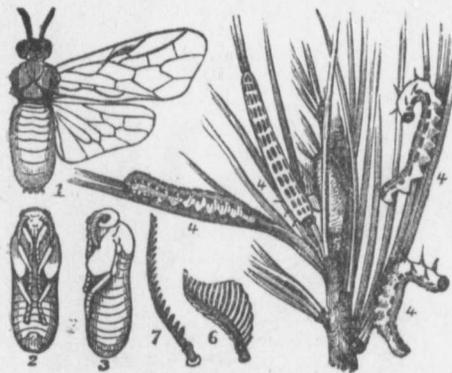


Fig. 27.

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Fig. 25.

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brooded. From the fact that the exuding pitch offers so much protection to the insect, it is scarcely likely that any remedy would reach it. The knife seems to be the only resource. A small four-winged parasite attacks the borer in the larval state, the chrysalis being often found filled with the cocoons of this useful friend.

COMSTOCK'S RETINIA—*Retinia Comstockiana*, Fernald.

This insect as yet has only been observed on the pitch pine (*Pinus rigida*), but as it is probable that it will sooner or later be found to attack the white pine it will be briefly noticed.

The perfect insect is a small moth of a light grey colour, varied with darker shades of rusty brown, which measures, when its wings are spread, nearly three-quarters of an inch across. The eggs are laid on the terminal shoots of the trees, and the larvæ are found in the early part of the summer boring into the twigs and small branches, causing an exudation of resin, and sometimes girdling them. The larvæ, when full-grown, are nearly half an inch long, of a yellowish colour, with a brown head, a patch of the same colour on the next segment, and a few polished brown dots on each ring, and from every one of these there arises a single hair. The larva changes to a chrysalis within the burrow from which eventually the moth escapes. In fig. 28 we have the insect represented in its several stages, also a small branch of an affected tree and a section of one of the bored twigs.

THE PINE LEAF-MINER—*Gelechia pinifoliella* (Comstock).

This insect was first described by Prof. Comstock in his report to the Department of Agriculture, Washington, for the year 1879. It has been found mining the leaves of different species of pine in many parts of the United States, and although as yet unrecorded in Canada, will very probably be found here. The larva is very minute, in the figure it is much magnified; the line below indicates the natural size. It lives within the leaf on the soft tissues, and its presence is soon indicated by the change in colour which takes place in the part affected; it becomes brown, and on examining the leaf, or that portion of it which is discoloured, it is found to be entirely eaten out, and to contain, if in season, the insect, either in the larval or pupal condition. In fig. 29 the work of this tiny insect on the leaves is shown. The moth, chrysalis, and larvæ are all represented, but much magnified.

The larva, when full-grown, is about one-fifth of an inch long, of a pale brown colour, with a black head and a black patch on the upper part of the next segment. It is also sparingly covered with short, fine hairs. The change to a chrysalis takes place within the mined leaf, and in summer the moth escapes in about a fortnight.

The perfect insect, when its wings are spread, measures about three-eighths of an inch across; it is of a brownish-yellow colour, dotted with fuscous scales. The fore-wings are crossed by three white lines, as shown in the figure; the hind-wings are pale grey,

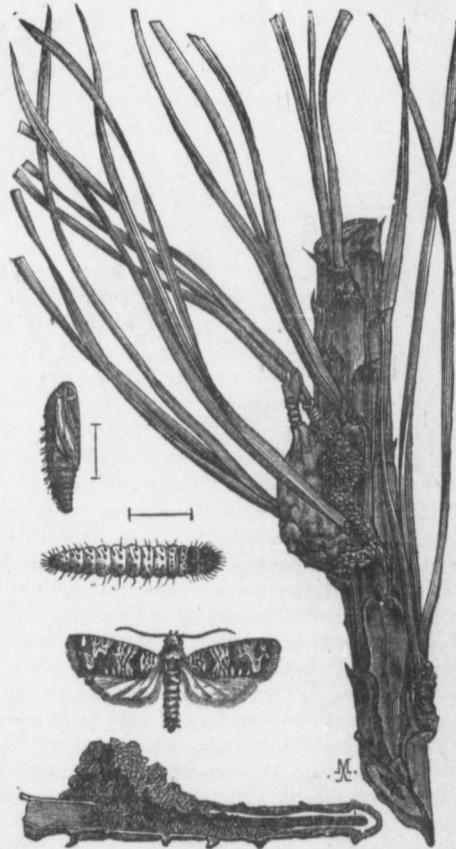


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and both pairs are deeply-fringed. There are two or three broods of this insect during the year.

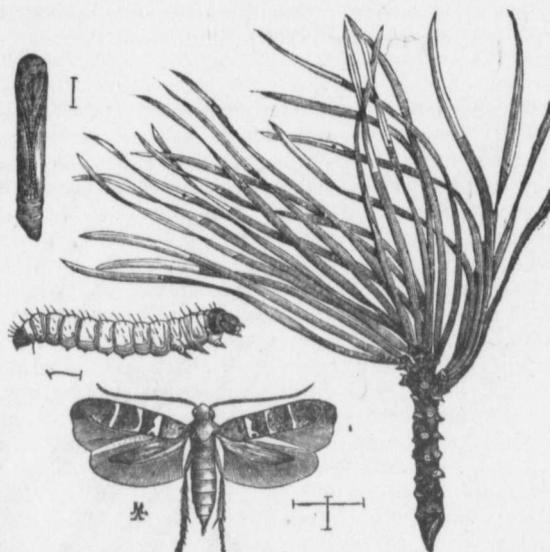


Fig. 29.

In addition to those enumerated, there are a score or two of species of insects which are known to devour the leaves of the pine, in some instances injuring them very much. Unfortunately it does not yet seem to be within the power of man to do much directly towards limiting the destructive work of these enemies to our forests, yet this should not deter us from studying their habits and life history, as a knowledge of these may help us much more than we anticipate. A few trees, such as a belt or group planted for shelter or ornament, may be protected from the leaf-destroyers by syringing them with a mixture of Paris green and water, in the proportion of a teaspoonful of the poison to a pailful of water. Bark lice may be killed by the use of alkaline washes applied with a brush or broom; such alkaline applications are also of use in preventing the borers from obtaining a lodgement in the trees, as these insects will not usually deposit their eggs on trees so protected; but it is scarcely possible that such remedies can ever be applied over extensive areas of forest. It is gratifying to know that in addition to the number devoured by insectivorous birds, almost every injurious species is preyed on by predaceous and parasitic insects, which seek out and destroy the pests with ceaseless diligence. Were it not for these friendly species, the destructive insects would long ere this have rendered the growth of trees an impossibility.

#### THE CHINCH BUG—*Micropus leucopterus*, Say.

By WM. SAUNDERS, LONDON, ONT.

This formidable insect pest has recently appeared in force in the adjoining State of New York, where it has within a limited area inflicted a very considerable amount of damage. That an insect so enormously destructive as this one is in the west, has domiciled itself so near us is sufficient to excite some alarm and induce our agriculturists to be on the alert and to use such defensive measures, in case of attack, as the science of economic entomology has suggested.

During the last week in September a package of insects was forwarded to the New York State Entomologist, with the following statement in regard to them, from Mr. M. H. Smith, of Redwood, Jefferson county, N.Y.: "I herewith transmit specimens of (to us)

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a new and formidable grass-destroying insect, together with portions of grass destroyed by them, and also some of the soil, for the purpose of examination. If the insect is known to you, and there is any known way to exterminate it, please inform us at once. The evidence of its destructive work was first discovered in June of 1882, by Mr. H. C. King, of Hammond, St. Lawrence county. At haying time, about the middle of July, he noticed about three acres of his timothy grass to be apparently prematurely ripened. In the fall he observed that there was no aftergrowth, and that the stubble was as dead as if it had been boiled. Search was made among the dead roots without any discovery. The following spring the field was entirely barren of timothy, but some clover seeds and thistles occupied the ground where at least one and one-half tons of timothy to the acre, under favourable circumstances, would have been cut. In June of 1883, Mr. King discovered other fields to be affected in the same manner, and instituted a search which has recently resulted in the discovery of myriads of the insect, not in the dead grass, but at the edge of the live grass, where they may be scraped up by handfuls. They have destroyed about fifteen acres for Mr. King, and several acres for each of several other farmers of his vicinity. They are causing extreme alarm, and if you can give any relief from this calamity it will be gratefully appreciated. This is an important grazing locality. In addition to the timothy, June grass and wire grass are also destroyed."

On examination this insect proved to be the notorious chinch-bug, a pest hitherto extremely rare in New York State, and never before recorded as destructive within that State. Prof. Lintner at once visited the district referred to, and thus records his personal observations made during the 5th and 6th of October. He says: "The cold weather of the past few days (ice was formed upon three nights), has doubtless driven most of the bugs to their winter quarters for hibernation, in crevices, beneath boards, rails, etc., in rubbish heaps, and to many other secure retreats, where such insects are accustomed to hide. Yet, upon parting the roots of the timothy, upon the borders of the killed portion, they were found in alarming numbers—in some spots sufficient to cover the ground with their bodies over an area of a couple of inches in diameter, being apparently congregated in such places. In one spot, upon the warm sloping side of a dead furrow, they could be seen, in numbers, running like ants over the ground. Elsewhere, they were concealed among the roots, near to and about the bulbs, upon which they appeared mainly to feed. Their presence in any spot could always be detected by bringing the nose near the ground by their peculiar bed-bug odour. This method of detection proved more convenient, and infallible than looking for them.

"The invasion is more extended than was at first supposed. Nearly all of the farms in the neighbourhood of Mr. King have been attacked, either last year or this, and discoveries of attack not before suspected, are, upon examination, being made daily. A present range of about eight miles is indicated. It is believed to occur throughout most of the town of Hammond, and to extend into Alexandria.

"Without any desire to play the role of an alarmist, I feel it my duty to say that, as the result of my observations, this chinch-bug invasion of northern New York threatens to be the most serious insect attack to which our State has ever been subjected. The following are my reasons for this belief:—

"It has planted itself, maintained a footing and has shown a rapid increase under unfavouring, unpropitious and unnatural conditions, such as these:

"First.—It is regarded as a southern insect (extending further northward, as do most animal forms, in the Mississippi valley), yet it has appeared in the most northern county of the State, and upon (if the report be reliable) the St. Lawrence river.

"Second.—Its attack has been made upon timothy. This seems to be its most unusual food plant, and therefore, we infer, the least suited to it. All previous accounts concur in giving it a preference for spring wheat above all things else; next in order, oats or corn, and last the grasses. Timothy is only mentioned as occasionally attacked by it.

"Third.—In all previous accounts, great prominence has been given to its being a hot and dry weather insect, dependent upon these conditions, not only for its multiplication, but for its existence. Heavy rains have been claimed to be invariably fatal to it. It could not abound, it is stated, in a wet season. Dr. Fitch had even made recommendation

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of sprinkling it with water (an artificial shower), as the best means for its extermination. In the present instance, the bug obstinately persists in multiplying, contrary to all rule. The past year and the present have both been years of excessive rainfall in St. Lawrence county. Spring, summer and autumn have been exceptionally wet. In the spring, I am told that heavy and continued rains flooded meadows now showing the chinch-bug attack. At haying time, when the bugs were young, and, according to all the statements hitherto made, readily killed by wet, the rains were so frequent and severe, that the grass cut could only be secured with difficulty. Upon Mr. King's farm, much of it was drawn in, upon favourable days, by improving the opportunity of extending the labour into hours after nightfall. At the present time grass is lying in fields in stacks, which could not be gathered, owing to continued rain, and fields of oats are still unharvested."

This insect belongs to the order Hemiptera, which includes all true bugs. These are all furnished with a sharp proboscis or beak by which the substance they feed on is pierced and its juices extracted by suction. This piercer when the insect is at rest is bent beneath the body. The chinch-bug belongs to a sub-division of the hemiptera known as the half-wing bugs (Heteroptera), and to this same group the well-known bed pest belongs, and they both give off the same disagreeable odour when touched.

The accompanying figures will aid in making clear the life history of this species.

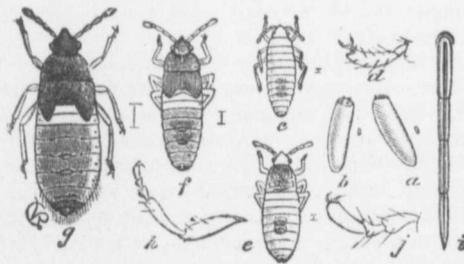


Fig. 30.

At *a* and *b* (Figure 30) the eggs are shown much magnified, the short lines at the side of all these figures indicate their natural size. These eggs are about one thirty-third of an inch long, of a long oval form with the top squarely cut off. When at first laid they are pale in colour and semi-transparent, but shortly they change to an amber shade and finally in part to red as they approach maturity. The newly hatched larva shown at *c* in the figure is pale yellow, with an orange-coloured patch on the abdomen; very soon the whole body becomes red, except the first two joints of the abdomen which remain yellowish. With the growth of the insect the red colour becomes quite bright and contrasts strongly with the pale band as shown at *e* and in a more marked manner at *f*. As the insect approaches full growth the head and thorax become dusky in colour, and the abdomen of a duller shade of red. At *g* the pupa is represented, in which stage the insect loses none of its activity but gradually becomes duller and darker in colour. At *h* one of the legs of the insect is shown enlarged and at *j* the tip of the same still more highly magnified, while at *i* the jointed proboscis or beak is represented.

In figure 31 we have a view of the perfect insect, also magnified, the short line behind it showing its natural size. It is about one-tenth of an inch long and about one-third of its length broad. In colour it is black, and when examined with a magnifying lens the body is seen to be slightly hairy. The wing covers, which lie flat upon its back, are white with black veins and a black spot on each side about the middle and towards the outer margin. The feet and the outer swollen joints of the antennæ are yellow, the legs and the basal joints of the antennæ black.



Fig. 31.

Its size seems to be quite out of proportion to its destructive powers, and minute though it be it nevertheless inflicts an almost incredible amount of injury in certain years upon the grain and corn crops. Prof. Lintner states that "In 1864, its injuries in the State of Illinois to wheat and corn alone were computed at seventy-three millions of dollars. This was a year of unusual excess, but it is not of rare occurrence that, a State should suffer a loss of from twelve to fifteen millions of dollars in a single year. When the

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insect abounds, it is so numerous as to cover the ground; it blackens the stalks of the plants upon which it feeds; it fills the air when, at seasons of its mating, it takes wing for flight; it marches to new feeding grounds in solid bodies, upon and over one another; its invading armies sweep over and utterly destroy a wheat or corn field in two or three days; and the nauseous bed-bug odour which they exhale sickens those who are compelled to breathe it.

"As the past history of the insect has shown that parasites and other enemies have entirely failed to arrest its multiplication, we are compelled to believe, from present indications, that it has come to stay, and that it will do so, unless effectual means are taken to prevent it. Its capability of increase is wonderful. Under the most conservative circumstances, a single chinch-bug, depositing its eggs about the 1st of June, would be, in the following August, the progenitor of a quarter of a million."

It is evidently most important that every practicable means should be employed in the endeavour to arrest as far as possible the progress of this mischievous foe, and to destroy it wherever found. Should it continue to increase, since it is already upon our borders, it will in all probability establish itself in force in the adjacent districts in Ontario, if indeed it has not done so already, and it may become to us a more formidable enemy than the wheat midge.

#### REMEDIES.

Where the insects are found among the roots of timothy, it is recommended to plough them under by turning over a flat (not overlapping) broad furrow as deep as possible, but not less than eight inches. It is said that the insect cannot survive this deep burial. Fire will certainly destroy it, and where the conditions of the grass will admit of burning, this measure should be resorted to; a thin covering of straw would prove a material aid in the burning. Where neither of these remedies can be applied the field should be heavily rolled as early in the spring as possible, for the purpose of preventing the bugs which have hibernated, from gaining easy access to the roots of the grass or grain on which to deposit their eggs. The use of common kerosine or coal oil has also been recommended, made into an emulsion by forcibly agitating it for a considerable time with an equal measure of milk, either sweet or sour, when it will become thick almost like butter, which, diluted with water, should be sprayed over the ground by means of a suitable pump; or the oil may be emulsified by agitating it thoroughly with a larger quantity of soapsuds and applied in the same manner.

#### OBSERVATIONS ON FORM AND COLOUR, AS EXHIBITED IN INSECTS.

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

The most careless observer can hardly have failed to notice some of the peculiarities in the motions of birds—the heavy flight of the heron, the short, quick strokes of the wild duck, the serene gliding motion of the hawk—and tracing backward, in a measure, the lines of causes and effects, to associate these with diversities of structure. But to those who are not careless—to those whom interest or pleasure has led to observe *attentively*, the movements of living creatures convey many a lesson. I once knew a man who had been brought up in a lonely cottage, on an extensive piece of common land—half moor, half fen—situated in the north-east of England. The spot was a favourite breeding-ground of numberless wild fowl—mallards, shovellers, grey geese, black-headed gulls, curlews, dotterels, red-shanks, etc. This man had made the study of natural history his delight, and turned his knowledge to account in procuring a livelihood. He made it a part of his business to supply plovers' eggs to the dealers; and so closely had he watched the green plover or lapwing that (as he assured me, and as my observations of his proceedings led me to believe), he could not only tell from her motions whether the

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mother-bird had eggs or young ones, but whether, in the former case, she had laid a part only or the whole of her complement of eggs.

That peculiarities in the flight of insects, too, have arrested the eye of the ordinary observer may be gathered from the common names given to different species, such as the Hawk moth, the Humming-bird moth, the Owlet moth, the Vapourer, etc. But the scientist regards nature with a keener eye than does the ordinary observer; and what American entomologist does not recognize at a glance the dash of *Clisiocampa Americana*, or the loose-jointed shambling flight of *Ctenucha Latreilliana*? What naturalist does not readily distinguish between the steady, shrill clarion of the mosquito and the fussy, impertinent buzz of the cattle-fly (*Stomoxys calcitrans*)? The late Reverend Chancellor Bird, who was an accomplished entomologist, was one night heard groping for a match by a friend, who enquired if anything were the matter. "No," he said. "Such a moth (naming it) is in my room. I know it by its hum; and I want it for my collection." And, in all probability, many a sound we cannot hear, and many a motion we cannot see, and many a scent our organs of smell fail to distinguish, have their messages to numberless living things.

First, a few words on the general form and build of insects. And, to illustrate the subject, let us take that philosophical toy named after the smooth-sailing bird of prey, the Kite. The school-boy, to secure the balance of his kite, attends to the weight and the disposition of the wings and the tail, and to the proper adjustment of the martingale. Now, take for example any species of the genus *Papilio* (such as *Papilio turnus*, fig. 32). The weight of the body of the insect answers to the tension of the string upon the martingale; the backward stretch of the hind wings, with their appendages, answers to the tail in the kite; and the adjustability of the wings secures evenness of flight. A number of insects have, more or less, the form of the *Papilionida*. Amongst them are the showy Canadian moth, *Attacus luna* (fig. 33), and the Brazilian, *Eudemonia Streckeri*.

Another remarkable form of insects may be called the Bat-like. *Attacus cecropia* (fig. 34) is an example of this; and so closely do the motions of the moth resemble those

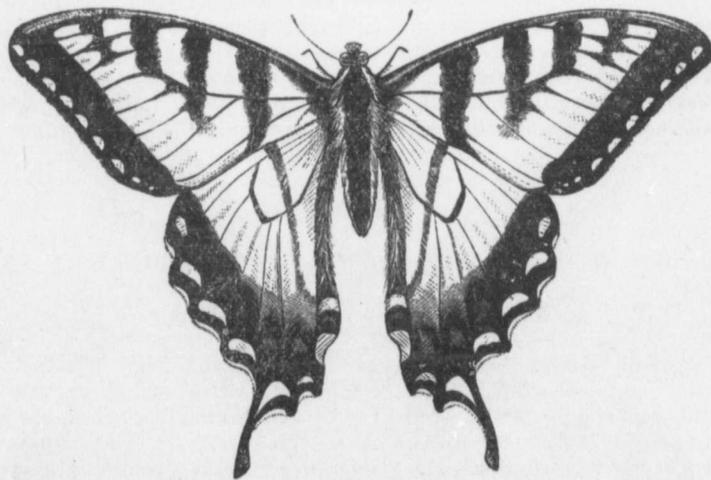


Fig. 32.

of the *Vespertilio* that, in the dusk of the evening, it requires the eye of a naturalist to distinguish between them. Many of our butterflies have more or less of this form.

A third is the Bird-like. In this, when the wings are expanded, the body projects beyond the lines of the wings. In some cases the abdomen is furnished with tufts, which serve, in a measure, the purposes of the tail in birds. For examples see *Amphion nissus* and *Sesia pelagrus*. To maintain the balance of insects of this form nature has many expedients. In the Diptera the absence of the under-wings, which, in other cases,



Fig. 33.

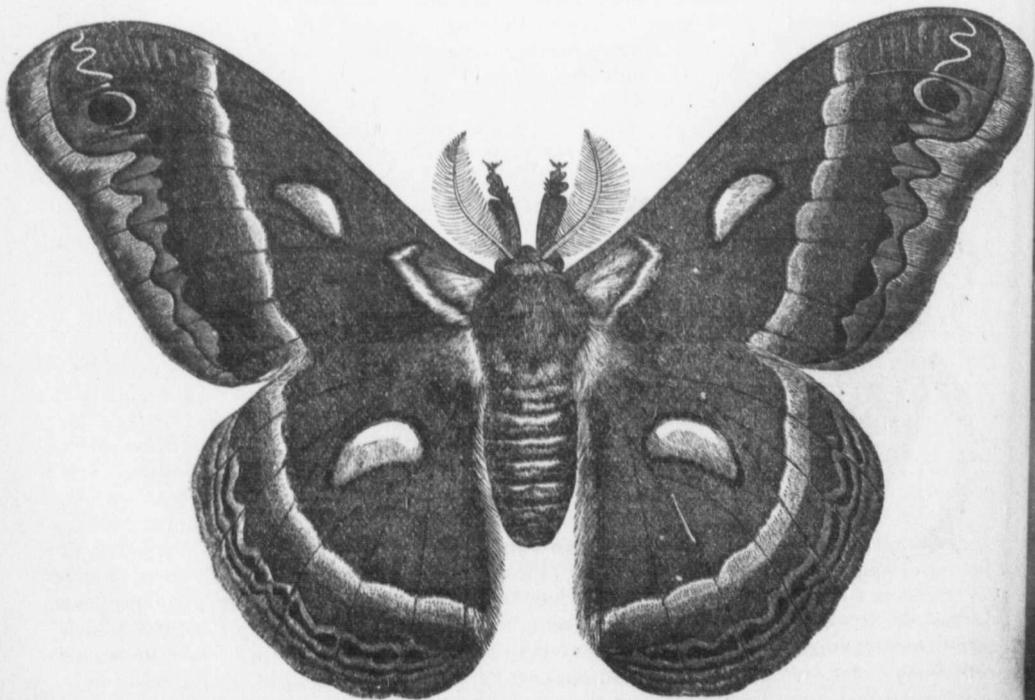


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represent the curved lower sweep of the secondaries and tertiaries in the wings of birds, *halteres* or balancers are supplied. In the Strepsiptera the lower-wings are largely developed, and the fore-wings degenerate into balancers.

There is a departure from this third form, in which all the four wings are nearly of equal length, and diverge considerably, as in the Dragon flies, of which fig. 35 is an example, and Lace-winged flies.

Where unusual projections are met with in the fore-part of the body, they are counter-balanced by a proportionate extension or development of the abdomen. The large head and scythe-like mandibles of the Horned corydalis are balanced by its dank and elongated body. In a dried specimen of this insect the want of symmetry, occasioned by the contraction of the abdomen, at once strikes the eye. The antennæ of the longicorn beetles are thrown over the back in flight, and the ovipositor of *Pimpla lunator* streams behind.

There are instances among the Hymenoptera in which the abdomen is provided with a foot-stalk, and, in this arrangement, the equilibrium of the insect is maintained without an inconvenient increase of weight.

Many beetles have what may be called the Tortoise-shape; and it will be found that, as a rule, these are sluggish in disposition, falling, when disturbed, inertly to the ground. They are, consequently, oftentimes in danger of being trodden under foot. But their form is admirably adapted to resist pressure; and an ox might tread one of them into the yielding sod without doing it an injury. The potato-beetle is a familiar instance of insects of this form, and so is the beautiful pie-bald beetle that frequents the silk-weed.

The water-beetles and bugs are admirably adapted to their environment. *Belostoma grandis* (fig. 36) is a wherry of the most approved form, having powerful sweeps with which it can urge its way through the water. It is also provided in its fore-legs with grappels, with which it can hold itself against the force of the current. Insects of this form—and there are many of them—may well be described as the Boat-shaped.



Fig. 36.

brings the creatures down when the force of the wing-stroke is abated. Renewed efforts, again and again, give an upward movement, and so the mazes of the airy dance are threaded.



Fig. 35.

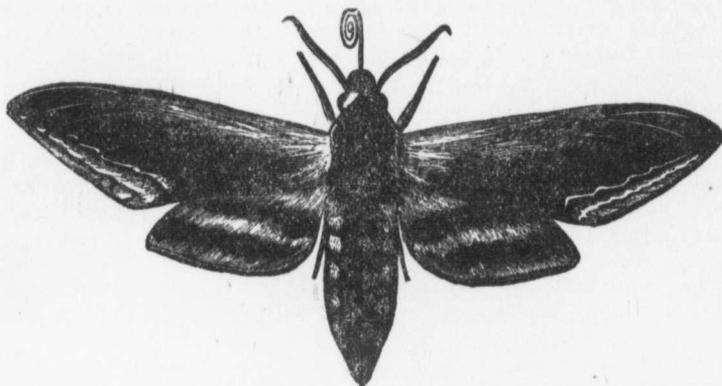


Fig. 37.

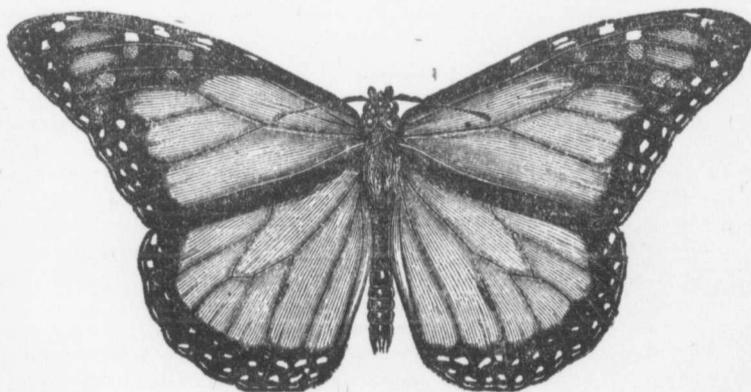


Fig. 38.

The honey-bee has the most business-like flight of any insect I know. With what calm, set purpose it passes from flower to flower! With what direct and eager flight it makes its way—in the summer, to the flowering basswood or the patch of white clover; in the autumn, to the field of buckwheat! How steadily it bears its burden to the hive! What a threatening twang it sends forth when annoyed by an intruder upon its haunts!

Some insect-sounds are produced by special arrangements, as the notes of the Cicada, produced by organs in the sides, and those of the Acheta and Gryllus by friction of the stiff membranous wings. But the various humming noises of insects are produced by alar vibrations more or less rapid. Everyone acquainted with the structure of a reed organ knows that the different notes are caused by vibratory tongues of different sizes, and of different degrees of weight and pliancy. The range of octaves of the grand insect scale has never been determined. It may be that the organs of the smallest Cecidomyia are sensitive to pulsations caused by the vibratory motions of the wings of its minute compeers.

To return to our illustration of the reed organ: Who is not acquainted with the jar caused by the intrusion of a filament or other obstacle upon the notes? Just such a jar is heard breaking in upon the sustained note of the humble-bee whenever the creature passes into the corolla of a flower. The regular vibrations are broken short and disturbed, and a harsh, discordant sound is the result.

If one with a well-cultivated ear for music wishes to become acquainted with insect sounds, let him, on a calm evening in the beginning of July, just as night is closing in, take his stand by an English honeysuckle, or a bed of perennial phlox, or amongst the

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plants of *Asclepia Syriaca* by the roadside, and, if the season be a good one, he will hear a concert that will probably be new to him. The performers usually found taking part in such entertainments in Canada are the Sphinges—*cinerea*, *kalmia*, *gordius*, *sordida*, *hyale*, with "stars" of lesser magnitude. As the creatures recede from and approach the auditor's stand-point, he will be able to mark very fine *diminuendo* and *crescendo* effects.

The wings of bees and other Hymenopterous insects are provided with catches, which unite them on either side of the insect, so that, while beating the air in flight, the two present but one resisting surface. Observing wings such as these, hooked together, clean cut, stoutly nerved, and free from scales and feathers, and comparing them with those of owlet moths, which are loose, ample, and heavy with scales, we can understand how it is that their vibrations produce a clear, musical note, which strikes the ear, whilst those of the latter fail to do so.

The subject of colour, as regards insects, presents an interesting field, in which comparatively few investigations have yet been made. Many unsolved problems meet the explorer at the very entrance. How is it, for instance, that the chlorophyll, in the pulp and juices of leaves, having passed through the digestive organs of a caterpillar with the nourishment that is assimilated to the substance of the creature, eventually develops into the gorgeous hues and brilliant metallic embellishments which so frequently adorn the imago? What physiologist or chemist will make this clear to our perception?

Attention has been drawn to the fact that the insects that feed on the silk-weed (*Asclepia Syriaca*) are generally coloured black and yellow or black and red. But who can tell us why it is that the chrysalis which succeeds the caterpillar of *Danais Archippus* is not of these hues, but of a delicate pale green?

That God has wonderfully ordered things, so that the colour of insects shall be a safeguard to them, is apparent to the most casual observer. Some instances of this providential care are more than usually interesting. The caterpillar of *Sphinx quadricornis* feeds upon the elm. The leaves of the elm, when slightly injured, have a tendency to curl up longitudinally, and the ribs of the leaf, which are prominent on the under side, become, in the curled portions, very conspicuous. The larva of *Sphinx quadricornis* is exactly the colour of the leaf, and has transverse markings that are the very counterparts of its ribs. This resemblance is remarkable enough, but there is a further development which is perfectly marvellous. As the season advances the curled portions of the elm leaves become sere and dead, and *S. quadricornis* also changes its colour, and takes a rusty brown hue.

There is a genus of insects called *Ennomos*, the various species of which are known in England as the "Thorns." We have in Canada a fine representative of the family in *Ennomos magnaria*. The insects appear in their perfect state late in the autumn—our own species (*E. magnaria*) appears in October. The interesting particular that I wish to mention is, that in colour they all resemble "the yellow leaf" that is characteristic of the season of their appearance.

The English peacock butterfly (*Vanessa Io*), the American polyphemus moth, and some others of the Lepidoptera, present in each instance, when displayed, the appearance of a mask. When disturbed, the insects have, moreover, the trick of closing and expanding their wings, which makes their *touch-me-not* grimness more striking. As the tiger has been known to turn tail at the sudden opening of an umbrella, so the troublesome child, or the busy titmouse would be likely to start back at the sudden presentation of the expanse of wing, with its eye-like spots and formidable markings. The flash of the metallic spots on the "fritillaries" and the changeful sheen of the purple emperor (*Apatura Iris*) may also act as deterrents against attacks of predatory birds.

The pleasing contrasts and exquisite harmony of colouring that are met with, not only in the diurnal Lepidoptera, but in the night-flying species also, exemplify the truth that "the works of the Lord are great, sought out of all them that have pleasure therein." It is marvellous to find the most brilliant and attractive hues in insects that seldom, if ever, meet the eye of the ordinary observer. Indeed, many an insect fails to reveal its glories to the unassisted vision at any time. It is only through the microscope that the richness of its velvet dress, or the hyaline splendour of its gauzy wings is made apparent.

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Among the pleasing contrasts in the colouring of insects the following are conspicuous:—

CONTRASTED COLOURS.

Black and white .....	<i>Melanippe hastata</i>
Black and yellow .....	<i>Papilio Turnus</i> ('Turnus' butterfly).
Black and red .....	<i>Chrysophanus Americana</i> (small copper).
Black and orange .....	<i>Melitæa phaeton</i> (Baltimore fritillary).
Black and grey .....	<i>Catocala relictæ.</i>
Black and Indian yellow .....	<i>Catocala subnata.</i>
Black and fuscous .....	<i>Danais Archippus.</i>
Grey and magenta .....	<i>Catocala concumbens.</i>
Grey and scarlet .....	<i>Catocala parta.</i>
Grey and crimson .....	<i>Catocala Briseis.</i>
Brown-madder and rose .....	<i>Philampelus Achemon.</i>
Buff and rose .....	<i>Dryocampa rubicunda.</i>

Then we have—

Blue-black barred with white .....	<i>Limenitis Arthemis.</i>
Black barred with red .....	<i>Cynthia Atalanta.</i>
Black barred with white .....	<i>Baptria albovittata.</i>
Black spotted with white .....	<i>Alypia Langtoni.</i>
Grey spotted with seal brown .....	<i>Harrisimemna trisignata.</i>
Rust red spotted with silver .....	<i>Calopistria monetifera.</i>
Fuscous washed with gold .....	<i>Plusia festuce.</i>
Olive green washed with bronze .....	<i>Plusia balluca.</i>

We cannot rise from the survey of any portion of the insect world, having examined the wonderful fitness to its surroundings that every individual in it displays, the adjustment of parts in the perfect whole in every case, the strength and compactness and exquisite finish of the most minute organs in even the least attractive species, the harmony of colouring presented by some kinds, the gradation of tints or the brilliant contrasts by others, without feeling a measure of the admiration that filled the breast of the ancient king, when he looked round upon the works of God, and without catching an echo of his inspired utterance, "O Lord, how manifold are Thy works! In wisdom hast Thou made them all; the earth is full of Thy riches."

NOTES ON WORMS.

BY JAMES FLETCHER, OTTAWA, ONT.

It is probable that some naturalists, on taking up this report, may be not a little surprised at seeing "Notes on Worms" as the title of a paper in an entomological report. Judging, however, from my own correspondence and the number of applications which, as a member of our Society, I have received for information on these interesting creatures, I am of the opinion that a large proportion of those for whom these reports are chiefly written will be considerably more surprised than these savants when they are informed that earth-worms do not legitimately come within the limits of an entomologist's studies. It must be borne in mind that our annual Report is prepared principally for the benefit of the farmer, the fruit grower, and the horticulturist; and it is in recognition of this fact that it is always bound up together with the report of the Fruit Growers' Association of Ontario. As only a small number, comparatively, of those engaged in these pursuits are scientific entomologists, the papers are all written in as popular a manner as possible, and with as many scientific names and phrases omitted as accuracy will allow.

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It is a source of considerable gratification to the Council to notice that the demand for information from this important class of the community concerning insects injurious to crops or to stock is daily on the increase. Special arrangements have been made by which, during the coming season, those engaged in cultivating the soil will be encouraged not only to make use of the Society as a source of reference, but also to take systematic notes, under instructions to be sent out by the Council in the spring, of their own observations made on any insect pests occurring in their neighbourhood. It is hoped by this means to elicit much valuable information, and also, at the same time, to increase the number of practical entomologists among those to whom, more than anyone else, a knowledge of the science is most essential.

In these "Notes on Worms" no account will be found of the multifarious pests regarding which, under the name of "a worm," information is often asked of an entomologist from a beetle, an aphid, a mite, a centipede, an iulus, or a gordius, to larvae of every description; nor either of that mysterious creature at whose door as "*the worm*" so much harm is laid when the cause is not apparent or is not understood. I shall confine myself to a consideration of that lowly, and, for want of better knowledge, much despised member of the animal kingdom, the Earthworm, and shall endeavour to secure for it a greater amount of consideration, by bringing forward some of the more interesting points in its history, gleaned from all the published accounts I could find on the subject, as well as from observations made by myself on individuals kept in my study. Worms may, at first thought, seem to be strange pets, but to anyone who will take the trouble to secure a good sized worm and place it in a large, clear glass jar partially filled with damp earth, there are so many interesting and instructive experiments which can be made, that any trouble taken will be much more than repaid. I have now before me an enormous specimen, which I have had thus housed for some months; when fully extended it measures nearly eighteen inches. From its large size it is, of course, much more easily examined than smaller specimens.

Worms "are by most people regarded as rather ugly, but harmless, wriggling things, slimy and disagreeable to touch, unsightly to look at, and about as destitute of interest as anything that lives, and moves, and has an independent existence. But all this is founded on a false estimate, and the false estimate is, as usual, founded on ignorance. The worm may almost be called a clever and intelligent creature; very shy indeed of letting its mode of action be seen, but showing by certain results, which readily come under our observation, that it has instincts which fall very little short of reasoning and design."—*Prof. Paley, Science Gossip, 1878, p. 121.*

"The idea of a worm of any kind is unpleasant to the refined taste, but there is nothing especially repugnant in the appearance of the earthworm. When a young lady, however, upturns one as she digs her flower bed, ten chances to one she will scream and run away, and dig no more that day; but, at the sight of it, her youthful brother has a beatific vision of a boat and a river, the bobbing of a cork, a struggle, the splashing of a broad tail in a leaky skiff; and the man with the microscope, as he passes by, takes it tenderly in the palm of his hand, and carries it into the house. Let us go in with him and see if he can find any item of interest in the anatomy of this humble dweller in the earth."—*Dr. A. C. Stokes, in Field and Forest, III, p. 124.*

Before passing on to the structure, or to the important work earthworms perform in the economy of nature, it may not be amiss to indicate the position these creatures hold in the animal kingdom.

From the historical introduction to a valuable report made to the British Association in 1851, by Dr. Thomas Williams, it would appear that this has been a point of considerable difficulty for naturalists to determine. Among the ancients the terms *Vermes* (a word conjugate with *verto* = to turn) and *σκώληξ* were used to denote, generally, all lower animals resembling in form the leech and the earthworm; this acceptance of the words prevailed down to the time of Lamarck. "The true zoological limits of the Annelida were only confusedly determined by the observers of nature, antecedently to the time of Pallas (1766). To the sagacity and industry of this naturalist, science is indebted for the first clear definition of the boundaries of this class" (p. 161). "Blumenbach it was who first observed that true worms are in no instance distinguished by the

possession of articulated organs of motion, a negative character in which they are separated from all insects and crustacea."

In 1798 Cuvier divided the *Vermes* of Linné into two leading groups—*Chaetopoda*, in which spines are present, and *Apoda*, in which they are absent. Even at this period he saw, though only with dim insight, the necessity of separating the entozoa from the true worms. In 1802 he read a paper before the "Institut," in which he first proposed to designate the *Chaetopoda* under the phrase *red-blooded worms*, adding to it the leeches and earthworms. "It was about this time that M. de Lamarck defined with increasing clearness the line indicated by Cuvier which divided the *Chaetopoda* from the *Intestina*. A new era in the history of the Annelida was now about to occur, for it was in the year 1812 that the class name *Annelides* sprang from the fertile and inventive fancy of M. de Lamarck. By this denomination, through various mutations, the worm tribe has ever since been known among naturalists." (P. 162).

The class ANNELIDA, of Lamarck, as now constituted, is composed of a series of animals which form only a portion of the heterogeneous class *Vermes* of Linné, which, in addition to those now understood, included also intestinal worms, mollusks, zoophytes, and sponges. Lamarck's *Annelida* are distinguished from all other worms by the possession of red or coloured blood, for which reason they are sometimes called by the name of Red worms. Cuvier considered this characteristic one of great importance. In his last edition of "Regne Animal" he arranged them under the *Articulata*, and on account of their red blood gave them the chief position, but they are now generally classified as a separate type below the latter; their general appearance seems to point them out as the representatives of the larval rather than the perfect state of insects, and thus to indicate their proper position to be below both *Insecta* and *Crustacea*. There is no doubt that a great many species have been confounded under the name of *Lumbricus terrestris*, L., which is the name of a common European species, and it is most probable that we have in Canada distinct species differing from those found in Europe. I do not know of any treatise which describes any of the North American species; but since I have turned my attention to them I have noticed at least four very distinct forms besides one specimen which upon being taken roughly in the fingers was distinctly and beautifully phosphorescent. It is evident, however, that, with the constant interchange of fruit trees and other plants, growing in pots and otherwise, between North America, Europe, and other parts of the world, the transportation of a species from one part of the world to another would be an exceedingly easy matter, and a small number of species in this way might be distributed over a large area. "However, in 1868, Vaillant had recognized in the several groups of the Oligochaeta ( $\delta\lambda\acute{\iota}\gamma\omicron\varsigma$  = few, and  $\chi\alpha\iota\tau\eta$  = a bristle), the order in which *lumbricus* finds its place, no less than twenty-five genera, including quite a large number of species from various parts of the world, which are represented in nearly all regions of the globe, and which he divides into two families, distinguished by the distribution of the setæ. (1) *Lumbricidæ*, with simple setæ, including the earthworms; and (2) *Naidæ*, with bifid, or hair-like setæ, embracing the fresh water species. These families are again each divided into two sub-families, the former into *Lumbricidæ*, *Lumbricinae*, where the setæ are isolated or grouped two by two, and *Lumbricidæ*, *Enchytraeinae*, where they are three or four in number in bundles. The *Naidæ*, in *Naidæ*, *Nainæ*, have the setæ in four rows (exceptionally biserial,) and then all hair-like; and in *Naidæ*, *Chaetogastrina*, they are biserial but never hair-like.—*Theodore Gill, in Johnson's Cyclopaedia of Universal Knowledge.*

The latest system of classification is, I believe, that of Claus who divides the Oligochaeta into Terricolæ, or terrestrial forms and Limicolæ or aquatic.

The structure of the body of the earthworm is very simple. In a large specimen it consists of from 100 to 200 segments closely approximated to each other. The first segment is elongated and proboscidi-form, and beneath there is what generally appears to be a small depression, but which, when the worm is feeding, is seen to be a very capacious mouth. The elongated first segment is the upper lip, and is used as an organ of prehension, by means of it the worm is able to take hold of any objects which it wants to take to its burrow, and if watched by means of a lamp at night, for they are almost entirely nocturnal in their habits, they may frequently be seen collecting any small objects which

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happen to lie near their burrows. They have three distinct methods of conveying objects to their holes. That usually resorted to, at any rate by those in confinement, is to suck into their mouths a portion of the object and then draw back by contracting the muscles of the body; another mode is to take hold of the edge of such objects as leaves or pieces of paper by folding the upper lip over the edge and holding it between the two lips; the other way is perhaps the most remarkable, and consists of pressing the mouth tightly against smooth objects, such as small stones embedded in a gravel walk, or even of a flat leaf occasionally; then by drawing back the pharynx a vacuum is created and the object is withdrawn with great force, on exactly the same principle as the toy made by schoolboys of a small piece of wet leather with a piece of string through the centre, and which, when trodden down evenly and tightly around the edges on a flat even stone will raise a very great weight. Occasionally, too, no doubt small pieces of leaves and other small objects are drawn back to their holes by sticking to the mucous covering of their bodies. After the first segment the body rapidly increases in size until it reaches the average dimension; but in a full grown worm, particularly at the season of reproduction, when it becomes a highly important organ "a part of the body, into which more or fewer of the segments, (according to the species) between the twenty-fourth and thirty-sixth inclusively, enter, is swollen, of a different colour from the rest, provided with abundant cutaneous glands, and receives the name of the *Cingulum* or *Clitellum*." This singular organ has sometimes given rise to the erroneous opinion that if worms were accidentally cut in two the two parts would come together again and join, or that the two portions would live, the head end forming a tail, and the tail end growing a new head. The absurdity of these views is however apparent when it is remembered that the nervous system consists of two cerebral ganglia or nerve centres, both of which are placed in the anterior end of the animal, they are lodged in the third segment, and are connected with the double chained nervous cord which extends through the whole length of the body beneath the intestine. The circulatory system consists essentially of a dorsal trunk situated, over the intestine, which carries the blood from behind forward, and a ventral or sub-intestinal one conveying the fluid in the opposite direction. The blood is red but has no corpuscles, and is quite different from that of vertebrates. The circulation may be easily observed. If a small worm is taken out of the ground for a short time and kept in water, it will void the earthy contents of its body, and will become sufficiently transparent to show the circulation, if slightly compressed between two slips of glass and examined with an ordinary magnifying glass.

The Oligochæta are hermaphrodite, the two sexes being united in the same individual, but two individuals pair together, the sexual elements are developed in certain anterior segments.

Earthworms do not possess any special respiratory organs, but breathe principally by the skin and partly by the vascular system on the walls of the intestine.

In vol. III. of *Field and Forest* (1877) there is an elaborate description of the muscular system of *Lumbricus*, written by Dr. A. C. Stokes. This article is of great value, as it is a record of extensive and careful original observations. At page 138 we find: "Down the back of the creature in the middle line, one in each intersegmental ring, is a row of circular openings. On the inner surface of each segment, therefore, below the longitudinal muscle, is a muscle parallel with the length of the worm, and extending from the lower edge of the orifice above to the upper edge of the aperture below. The two ends are thickened vertically and, slightly broadened, whence they gradually narrow toward the centre. What the use of these openings may be it is impossible to conjecture. They seem to have no connection with any of the internal organs, but to form a direct communication between the external air and the general cavity. The function of the muscles is evident. By their contraction they must widen the orifices, naturally found closed and invisible until pulled open by needles on the stage of the microscope, in imitation of the muscular action."

I must confess that I have been unable to detect these orifices; but as they are mentioned by other observers, this must have been owing either to want of skill on my part or to imperfections in my instrument. Is it not possible that these orifices may act as reservoirs for air, and that it is owing to their presence that earthworms can exist for

such a long time beneath water? We know that aquatic insects carry down a supply of air imprisoned by means of hairs beneath their elytra.

The muscular system is strongly developed. Worms can crawl backwards almost as well as forwards. When extended over the ground they can shoot back again beneath the surface with surprising quickness by the aid of their bristles and their tails which they flatten out to take firm hold of the walls of their burrows. The force required to dislodge them is great, and the only way to manage without breaking them in pieces is to copy the tactics of the blackbirds and thrushes, who take a firm hold and then keep up a steady pull until the worm lets go, which it will soon do, if the strain is kept up. This resistance is also greatly sustained by the setæ or bristles with which the body of the earthworm is provided, they run in four double rows, two lateral and two inferior, for the whole length of the worm's body. These setæ are doubtless of great assistance to worms and act in the same capacity as feet, they are shaped like the italic letter *f*. Dr. A. C. Stokes says at p. 128, "If, with a strong pocket lens, we look directly down upon the sides and ventral surface, there are visible, projecting from almost circular openings in the skin, and pointing backward, eight lines of glistening bristles, beginning at the very first segment, (considering the first segment to be the one immediately behind the two lips) and extending in unbroken order to the very last. These setæ are arranged in pairs forming four continuous rows, of four sets and eight bristles to every segment. In the central and terminal rings they are frequently accompanied by several aciculi, at times short, broad, and sharp, at others long and narrow. The worm has not only the power to project them from their proper openings, but to entirely withdraw them into the cavity of the body.

"Contained, as each seta appears to be, in a sheath, structureless and apparently identical in character with the skin, it is an object of interest, but when isolated it becomes a thing of beauty. The free end is roughened by friction against the earth, it is translucent, and its general outlines are of the most graceful form. I suppose when Hogarth drew his celebrated line of beauty, the thing most remote from his thoughts was an earthworm, but if he had prepared a line with the curves of all earthworm's bristle and named it the line of beauty, the difference between it and his original creation would have been slight. There is nothing new under the sun, the wise man said, the very line of beauty was hidden in an earthworm's skin when the great artist's pencil was making an unsuspected copy. These bristles, at every step, enable the worm to put into practical use one of the first principles of mechanics—that of the lever; for not only do they, by the aid of special muscles, hold the distance gained by muscular contraction, but also help by prying the body forward." There are two pairs beneath each segment and each one has an appropriate system of muscles attached to it. Dr. Williams states they are so sharp that if the polished surface of a deal board be examined with a microscope after a worm has crawled over it, there will be plainly discernable four series of minute perforations. In the act of burrowing, the anterior setæ are firmly placed in the ground, the head is then drawn back, and the strong pharynx, which is placed internally just behind the mouth, is pushed forward with great force; at the same time a new wave of muscular action starts from the tail and gradually travels towards the head, so that the whole muscular system is brought into play in making a burrow.

The body is divided into as many chambers as there are segments, by muscular partitions, which have openings to allow the fluid contents of the general cavity to pass from one chamber to another. By special preparation the body of a worm can be hardened so that a section may be cut from the middle, and if skilfully done, the sides will not collapse, nor will the disposition and shape of the internal organs be disarranged. If this is placed under the microscope, it will be seen first of all that the body is contained by a skin made up of two layers, through which protrude the four pairs of setæ. Outside is a thin and transparent chitinous cuticle, and inside this a much thicker gelatinous layer called the hypodermis. Internal to this lies a thick layer of circular muscles, the rings of which go quite round the body; inside of this layer we find a much thicker coat of muscular fibres of two sorts, but both running longitudinally, one kind composed of thin bands placed vertically to the circular row just mentioned, and the other of fibres running transversely to them. Inside this is the general body cavity, through the centre

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of which the intestine passes. This latter has first a glandular greenish yellow layer, which above is laterally produced into the lobes of the liver, and which are separated by the dorsal canal of the water vascular system. Inside the greenish yellow layer come successively a longitudinal and circular layer of muscles, and then inside these another glandular layer covered internally by thin cells. This has brought us to the cavity of the intestine, which is simply a tube running from the mouth to the end of the body, but it is peculiarly formed, having almost the appearance of a tube within a tube. This arises from the fact that the tube of the intestine is much larger than the space it has to occupy. The only way then it can be contained is by having the upper wall folded into a sort of loop inside the canal. This is hard to explain, but can be easily understood if the two ends of a piece of string about a yard long are tied together so as to make a large ring. Now let anyone take hold of this ring with the hands about a foot apart, and then bring their hands together so as almost to meet, when a small ring will drop down inside the larger ring. This will give just the shape of a worm's intestine. This curious fold is called the *typhlosole*. I have mentioned that between the two lobes of the liver and directly beneath the middle of the back and above the intestine is the dorsal canal of the water vascular system. Just beneath the intestine in one section will be seen four circular marks,  $\circ \text{---} \circ$ ; the top and bottom ones of these are the canals of the water vascular system, and the pair in the middle are the double chained nervous cord.

The simple digestive system or intestinal canal, which is in the form of a more or less muscular tube, is divided into a strong pharynx, which is pushed forward when the animal is forcing its head like an awl between the particles of loose soil, or drawn back either when it is used as a sucker to draw in food or when the mouth is used to draw heavy or smooth objects towards the burrow. This pharynx is analogous to the protrusible proboscis which is found among some Annelids (*Eunicidæ*, *Lycidicæ*, *Nereidæ*). The pharynx leads into the œsophagus, which bears on each side of the lower part three large calciferous glands. In most species there is a crop in front of the gizzard. This latter organ is surrounded by a double set of very powerful muscles. Grains of sand and small stones from one-twentieth to a little more than one-tenth of an inch in diameter may be found in the gizzard and intestines, and are supposed to serve like millstones to triturate the food. The gizzard opens into the intestine. The calciferous glands are very remarkable, for nothing like them is known in any other animal. Their use is largely a matter of speculation, and Darwin in his recent work, "The Formation of Vegetable Mould through the action of Earthworms," says of them; "Almost as many theories have been advanced on their use as there have been observers." The author of the above-mentioned work has, in it, collected together and himself verified almost all the facts which have been recorded concerning earthworms by previous observers. The results of his studies, too, are most reliable, from his character of scientific candour. He never neglected, in the discussion of any subject, to examine all sides of the question, and to weigh carefully all opinions, whether adverse to his own views or not. This work is the result of continued and persevering study for a space of nearly fifty years. I shall to a large extent use his words in this history of the work worms perform.

With regard to the calciferous glands, he thinks that they serve primarily as organs of excretion; and secondarily as aids to digestion. The food of worms consists of organic matter in a state of decay. This they either obtain from the soil, which they swallow in large quantities, both when they are excavating their burrows, but also for food, or else direct from the leaves of plants, which they drag into their holes.

He says, p. 49, "Worms consume many fallen leaves; and it is known that lime goes on accumulating in leaves until they drop off the parent plant, instead of being reabsorbed into the stem or roots, like various other organic and inorganic substances. The ashes of a leaf of an acacia have been known to contain as much as seventy-two per cent. of lime, worms therefore would be liable to become charged with this earth unless there were some special means for its excretion; and the calciferous glands are well adapted for this purpose." When these glands have excreted, a certain amount of lime it is expelled into the alimentary canal; from the four posterior glands in the shape of minute cells, and from the two anterior in the shape of large concretions. It is supposed that the carbonate of lime so formed aids materially the process of digestion by neutralizing

the acids which are always generated during the decay of vegetable substances, whether in the intestines of animals or on the ground; and in this case it is probable that concretions of lime are formed by some of the glands, so that they may be carried down to the posterior parts of the intestine before they are dissolved. Claparède thought that these hard bodies were formed to act as millstones, and thus aid in the trituration of the food; but as worms swallow many small stones, which may generally be found in their gizzards, Darwin's theory is the more probable.

Worms have no eyes, but yet are able to appreciate light by means of their nervous system through their skins. If a strong light is turned on them suddenly they will sometimes dart back into their holes with great quickness. This is not always the case, however, for if the anterior portion of the body is shaded, an intense light may be thrown on the rest of the body without any notice being taken. A moderate light is after some time generally observed by them, and they will retire to their holes slowly and apparently hesitatingly. Darwin found that the colour of light made no difference in their appreciation of it, and that a moderate radiant heat, such as that from a hot poker being held near them, did not cause them so much emotion as a bright light. Worms being nocturnal in their habits, an appreciation of the difference between day and night is, of course, useful to them, and this they possess. The sensitiveness to light is less when a worm is engaged in eating or in dragging leaves into its burrow—a fact which Mr. Darwin is disposed to consider analogous to what in higher animals we know as the distracting influence of attention. It is a curious fact that worms kept in confinement keep quiet during the day, and only crawl about and work at night.

Although worms are deprived of vision and have no sense of hearing, their sense of touch is most highly developed. In observing them the greatest care must be taken not to jar the table or touch the jar in which they are, nor even to breathe on them, or they will instantly retire to their holes. In watching them out of doors it is necessary to tread very lightly or very little will be seen of their habits. A heavy footfall is sufficient to send home all the worms for many yards around. This is doubtless the reason why most of the birds which feed on worms are able to run and walk as well as hop.

With regard to the sense of smell Mr. Darwin arrived at the interesting conclusion that it was very feebly developed, and only at all for certain natural objects which were suited for food. Pieces of cabbage, onions, the leaves of parsnips, celery and many other plants were placed on the pots, and certain ones were always chosen and others left. Worms appear to be omnivorous, bits of meat and fat were always taken and eaten as well as enormous quantities of earth, out of which they extract any digestible matter, they will eat sugar, liquorice and almost any other substances which are given them. They are even cannibals, for they will eat the bodies of dead worms if they find them lying near their burrows. It would appear that the leaves which they draw into their holes are smeared with a fluid which is alkaline, and which acts on the starch and other contents of the plant cells and very much hastens their decay, "it thus resembles in nature the pancreatic secretion, and serves partly to digest the leaves before they are taken into the alimentary canal—so constituting the only case of extra-stomachal digestion hitherto recorded in an animal." In this way worms do good service by quickly decomposing the dead leaves and mixing them with the soil, nor is this the only way in which the surface soil is improved by these insignificant creatures, for Mr. Darwin has shown by most careful experiments that what gardeners complain of so bitterly, that the worms spoil the appearance of their carefully cut lawns by raising up all over them the unsightly mounds which we call worm-casts, they are of very great importance to the agriculturist. For not only do worms, by sinking their burrows deep into the earth, render it permeable by air and water, and so bring about its disintegration; but they are most powerful and active agents in adding depth to the soil and in covering up comparatively barren tracts with a layer of rich vegetable mould. Mr. Darwin began his investigations by remarking two most striking characters possessed by vegetable mould. These were, that it was of nearly a homogeneous nature throughout, although overlying different kinds of subsoil, and the uniform fineness of the particles. This is easily seen in a gravelly country where in ploughed fields there are many stones visible, while in an adjacent pasture there will be no stones within some inches of the

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surface. Now this is entirely due to earthworms, as the following will clearly show. In a great number of instances it was found that certain materials had at different times been spread over the surface of pastures, and that after a few years they all disappeared, or as people were used to say "sunk into the ground." But it was found that they sank uniformly over the whole surface of the fields, and that this was not due to specific gravity was plainly seen from the fact that light cinders and small bodies sank at exactly the same rate as large and heavy stones. Moreover, added to this it was found that if all the worm casts were collected for the space of one year from one acre of good pasture land and were then dried thoroughly so as to be as light as possible, there were no less than the enormous amount of ten tons of earth annually thrown up by earthworms. And even these figures are not surprising to anyone who will carefully watch a small area of damp pasture land for a certain time, and notice the large quantities of earth thrown up. There are in different parts of the world worms of enormous size which throw up a proportional amount of prepared mould. One found in the Nilgiri hills, in south India occasionally throws up a tower, which when dried weighs a quarter of a pound. It must not be forgotten either that the earth of worm-casts is of the same nature as earth with a large proportion of decayed vegetable matter mixed with it; because the acids which form when leaves decay are formed much more quickly inside the worm, and are to a certain extent modified by the alkaline secretions of the worm's body. These humus-acids, too, have a decided effect in decomposing the small particles of rock and other hard mineral matters which are too small to be acted upon by the usual mechanical action of water, but which are swallowed by worms in large quantities.

Worms have effected what must to all seem cyclopean tasks, they have slowly undermined large stones, old pavements, low walls and even ancient cities, these little by little, as centuries have rolled by, have kept gradually subsiding until at last they have disappeared out of sight. The action of worms is not always perceptible where it occurs, for when castings are thrown upon the sides of hills they are liable to be washed down into the valleys by rain, or to be blown away in the shape of dust, when they have dried and became pulverized.

The burrows of worms do not often penetrate deep into the earth, but in winter and very hot weather they occasionally descend as deep as six feet from the surface. Worms must always have a large amount of moisture in the soil, and in fact so much is this the case that they may be called semi-aquatic. Perries kept a specimen entirely immersed for nearly four months, and the castings are always extruded in a semi-liquid state. The habit of lining their burrows with finely triturated earth, small stones and leaves, is thought by Dr. Darwin to be as a protection for their bodies against the cold of the earth; and for this reason they probably plug up their holes with small heaps of stones or leaves, pieces of string, feathers, and any other small objects which are not all certainly dragged in as food. Besides, by these tunnels materially helping the drainage of land and ventilating the ground, passages lined with fertile soil are opened for the roots of plants to descend, and also seeds are taken down by worms, and thus preserved for a long time to germinate and continue a species perhaps hundreds of years afterwards; and who can say that this is not the case, for do we not see plants spring up after forests have been cleared, where certainly the trees were hundreds of years old, and where these plants had not been able to grow from the time the country gradually turned by the increased growth of trees from a clearing into a forest. In this instance worms would prevent the germination of seeds, but sometimes they facilitate it by heaping their castings over small seeds and partially dragging large ones down their burrows.

I was much interested in seeing one of my worms dragging a small tuber of *Nymphaea tuberosa* down into the mouth of its hole, and it was curious to see that at first it was drawn across the pot by the air-tight sucker method, but when it would not fit conformably on the hole it was left alone for some time, and when a few hours later I looked at it, it had been turned half round and the neck was dragged down the hole which was thus tightly closed. I cannot finish this account of the working of these interesting creatures better than by giving part of the concluding paragraph of Dr. Darwin's important work.

"When we behold a wide turf-covered expanse, we should remember that its smooth-

ness, on which so much of its beauty depends, is mainly due to all the inequalities having been slowly levelled by worms. It is a marvellous reflection that the whole of the superficial mould over any such expanse has passed, and will again pass, every few years through the bodies of worms. The plough is one of the most ancient and most valuable of man's inventions; but long before he existed the land was in fact regularly ploughed by earthworms. It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organized creatures." The truth of this must be patent to all thoughtful observers, and when the work of these animals is considered together with that of those industrious little insects, the ants, (which it is perhaps just possible Dr. Darwin did not quite consider enough in the estimation of the work of the transversion of the surface soil,) the results are simply startling.

Just as I am finishing this off I have had my attention called to a short note in Cassell's Magazine for December, 1883, p. 63, in which earthworms appear in a new and unexpected role. It reads as follows: "It has been found by M. Pasteur that the bodies of cows and sheep which died of contagious diseases, when buried in the ground may yield germs of the disorder which are brought to the surface by worms." This is worthy of careful consideration. It is easy to understand how this might be, for these minute germs would also easily rise themselves to the surface through the tunnels of worms, even if the worms did not actually bring them there.

The paragraph gives the following advice which it would be well for us all to make a note of: "A more efficacious and economical mode of dealing with such carcasses has been proposed by a French chemist. It is to dissolve the entire carcase in sulphuric acid, and then treat the resulting solution by chemical means for the recovery of salts, which can be used in manure. The plan has been tried with great success at a 'usine' in France, and the profit realized on every dead sheep treated was four francs."

#### BOOK NOTICES.

CATALOGUE OF BRITISH COLEOPTERA, by Rev. W. W. Fowler, M.A., and Rev. A. Matthews, M.A. London: West, Newman & Co.

This Catalogue differs in some respects from all preceding lists of British Coleoptera. It is, namely, a partial adaptation of the American views by completely separating the Rhynchophora and Heteromera from the remaining series of the order, and the placing of them after the other series. The changes suggested in the relations of the families of normal Coleoptera, in the system of Drs. Horn and LeConte, are not yet in full favour with the conservative students of Great Britain, but may in future win approval as they become better known.

The American system, as it may be briefly termed, is fully set forth in the revised "Classification of the Coleoptera of North America," just published by the Smithsonian Institution. A notice of this work appears below.

The innovations of the system consist in a rearrangement of the bulk of the families into four sets; Adephaga, with the most perfected exo-skeleton and powers of locomotion; Lamellicornia, with the greatest visceral and nervous concentration, and highest development of sense organs; pseudo-tetramera; the remainder constitutes a vast complex of Clavicorn and Serricorn families, which may be divided into several ill-defined sub-series.

CLASSIFICATION OF THE COLEOPTERA OF NORTH AMERICA; by John L. LeConte and George H. Horn. Prepared for the Smithsonian Institution, Washington, 1883. Crown 8vo., 605 pages.

The Entomologists of America are placed under renewed and deep obligations to Drs. LeConte and Horn for this new edition of the classification of the Coleoptera.

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More than twenty years have passed since the last edition was issued, and during that time no branch of natural science has made more substantial and rapid progress than this department of entomology. The number of zealous workers in the field has greatly increased, and the accumulated stores of collectors have been subjected to close examination and critical study, chiefly by the distinguished authors of this work, and the results have added to our list of genera and largely to our list of species, which now includes more than 11,000 in all.

In the introduction the external organization of the Coleoptera is fully treated of, aided by illustrations and followed by a useful series of tables of the various orders. The whole of the classification has been revised and brought into harmony with the present advanced condition of knowledge on this subject. The work is very complete and bears evidence of the vast amount of labour and erudition bestowed on it. Collectors everywhere will find it a most valuable guide in their studies and in the arrangement of their collections.

THE PINE MOTH OF NANTUCKET, *Retinia frustrana*; by Samuel H. Scudder. Crown 8vo., 24 pages, with one coloured plate. Published by the Massachusetts Society for the Promotion of Agriculture, 1883.

We tender the author our sincere thanks for this excellent paper, containing the life history of this new enemy to pine trees, to which is appended a brief account of other native species of *Retinia*. The pamphlet is well gotten up, and the coloured plate a chromolithograph, beautifully executed. It represents the insect in its various stages along with the tips of the injured branches.

REPORT OF THE COMMISSIONER OF AGRICULTURE, of Washington, for 1881 and 1882; 8vo.

We have been favoured with a copy of the full report by the Commissioner, and have also received separate reports from the Entomologists, Prof. C. V. Riley and Prof. J. H. Comstock. The full report forms a large octavo volume of 703 pages, and is illustrated with a number of plates and diagrams. The report of the Botanist on grasses suitable for Texas, has twenty-five plates; that of the Veterinary division on Swine Plague, Fowl Cholera, and Southern Cattle Fever, twelve plates. The report of the Chemist contains the results of an extended series of experiments on varieties of sorghum and maize, with results of the analysis of the constituents of these plants at different periods of their growth, particularly in reference to the available sugar contained in them. This valuable section of the work is illustrated by twenty-one plates, and contains also much other useful matter in reference to analysis of soils, fertilizers, etc. There is also a report from the Superintendent of Grounds, in which he gives the good results of mulching the ground with refuse tobacco stems, as a remedy for thrips on foreign grape vines grown under glass, and submits notes on a number of tropical and sub-tropical plants, some of which might probably be cultivated with success in southern California or southern Florida.

That part of the report devoted to Entomology is extremely interesting, and contains much that is valuable; it occupies 154 pages and is illustrated by twenty plates. The chief subjects treated of in Prof. Riley's portion are Silk-culture in the United States; Pyrethrum, its history and cultivation; the Army Worm, Scale Insects of the Orange, including the results of experiments with emulsion of kerosene oil for their destruction; Insects affecting the Rice Plant; Corn Insects, the Cotton Worm, Clover Insects. In that part contributed by Prof. Comstock we find a very complete history of the Apple Maggot; also of some allied species of *Drosophila*; a chapter on Lady-birds, and another on Lac Insects, all illustrated by excellent plates drawn by Mrs. Comstock. Some valuable information is also given on methods for destroying Scale Insects with alkaline solutions.

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INSECTS INJURIOUS TO FRUITS ; by William Saunders. Philadelphia : Lippincott & Co.,  
1 vol., 8vo., pp. 436.

It is with very great pleasure that we announce to our readers the publication of Mr. Saunders' admirable work on the Insects Injurious to the Fruits of North America,—as the volume includes those affecting the orange, the olive and the fig, we think that we may fairly apply this extended title to it. As the readers of the *Canadian Entomologist* are aware, there is no one in Canada, and very few indeed in the whole of America, so competent as our esteemed Editor to produce a work of this character. It is needless for us, then, to say more in praise of the work than that it is the crowning achievement of one who has devoted a large portion of his time and labour during the last twenty years to the practical study of insects, and whose intimate acquaintance with fruit culture in all its aspects is only surpassed by his complete knowledge of the insects, both injurious and beneficial, that affect the labours of the horticulturist. The book is written clearly and concisely throughout, in our author's well-known terse and vigorous style, and is so free from scientific and technical terms that any fruit-grower, no matter how ignorant of entomology, can readily obtain from its pages all the information that he can possibly require in reference to most of the insect friends and foes of his trees and bushes. The copious illustrations, moreover, are so beautifully executed and so true to nature that any insect referred to can be at once identified, and the proper mode of dealing with it learnt from the accompanying descriptions. But while the work is so practically valuable to those who are specially interested in fruits, we can assure our entomological readers that they will find the volume to be an admirable scientific compendium, containing an epitome of the collective knowledge of the day, and bringing together into one convenient manual the results of the researches of all the leading entomologists of America. We do not, indeed, think that we are speaking too highly in praise of the work—though we admit that it is saying a very great deal—when we express our opinion that Mr. Saunders' volume will take rank with that standard of excellence, Harris' *Injurious Insects of Massachusetts*, and that he has done for insects affecting fruits at the present day what his justly-famed predecessor accomplished long ago for those injurious to vegetation in general.

The plan of the work, inasmuch as it is intended especially for the use of fruit-growers, is the most satisfactory that could be adopted. The insects treated of are grouped together under the name of the particular fruit that they affect, and are arranged in order according as they attack the root, the trunk, the branches, the leaves, the fruit itself. If, therefore, a gardener finds an insect of whose habits he is ignorant, and whose name he has never heard, doing damage to one of his fruit-bearing trees, or bushes, or vines, he has only to observe to what part of the plant the attack is directed, and then he can at once turn to an illustrated account of the pest, and learn from it all its life-history and what remedies he may most effectively employ for its extermination. On the other hand, if an entomologist wishes to know in a condensed form what information is available respecting an insect that comes within the scope of the work, he can at once find what he requires by means of the carefully prepared synonymical list and complete index at the end of the book.

The volume is beautifully printed on fine paper, and neatly bound in cloth ; the illustrations—440 in number—are thoroughly well done by competent artists and engravers. The fruits under which the various insects are grouped are twenty in number, viz., the apple, pear, plum, peach, apricot and nectarine, cherry, quince, grape, raspberry, blackberry, strawberry, red and white currant, black currant, gooseberry, melon, cranberry, orange, olive, and fig. As an example of the completeness of the work, we may mention that no less than sixty-four different species of insects are treated of as injurious to the apple alone, besides a number of beneficial parasites, and that these are made clear to the ordinary reader by 145 woodcuts.

We trust that the work will soon find its way into the hands of every intelligent fruit-grower, and that fresh editions of it may continue to be called for during many years to come.

C. J. S. BETHUNE.

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INSECTS INJURIOUS TO FRUITS. By W. Saunders. Philadelphia: Lippincott, 1883, 8vo. Illustrated with 440 woodcuts, pp. 436. Dedicated to the Fruit Growers of America.

No one will deny that this book supplies a long-felt want, and supplies it well. The author's long and well-known experience as a fruit grower and entomologist, gives just the qualification necessary for such work. He knows exactly what fruit growers want, and in which way and manner the needed information should be given to be useful and at the same time pleasing. Therefore the plan of this book is simple and to the point; the treatment of the enemies plain and sufficient, without tedious length; the remedies recommended backed by experience, and such as can be used by everyone. All this seems very simple and easy just as if everybody could do it. Often, I suppose, will it be said, Why was this book not published long ago? It is so eminently practical! But it is much easier to give long detailed descriptions than short ones, specially adapted to certain purposes. It is much easier to enumerate a number of proposed remedies than to select just the right one. After all, we should not forget that during late years the busy and prominent students of economic entomology have advanced this department of the science in a manner never equalled before this time.

The plan of the book is as follows: Twenty different fruits—all eatable without preparation (except quince and olive)—are treated in so many chapters. The insects injurious to them are arranged as attacking root, trunk, branches, leaves, fruit, always followed by the enemies of those enemies—the beneficial insects. The species are profusely illustrated with excellent, often superior, woodcuts; the well-known cuts of Mr. C. V. Riley are largely represented, and rather dangerous for all others.

The plain and judicious manner in which remedies are recommended is a decided and prominent feature of the book. There are no ambiguous, no large-mouthed sentences, no humbug about millions lost by such an enemy, or millions saved by such a remedy. There is nothing but plain truth, said in the most unpretentious words. I think every scientific student is deeply obliged to the author for his happy innovation.

Of course the author has, besides his own large experience, used all the rich and splendid discoveries and observations published by other scientists. The absence of quotation marks is entirely justified, as they belong to the history of the natural history, but not to a practical book intended for fruit growers. Scientific students know where such facts are published, and the author has in the preface fully satisfied all economic entomologists with his acknowledgments. It is obvious that in a book treating of the history of so many species, omissions and sometimes errors cannot be entirely avoided. Since the book is issued and the errors are insignificant, we may safely leave them to be corrected by the author himself. *Bene meruit!*

DR. H. A. HAGEN, Cambridge, Mass.

THE FOOD RELATIONS OF THE CARABIDÆ AND COCCINELLIDÆ. By S. A. Forbes. From Bulletin No. 6, Ill. State Lab. of Nat. Hist., Normal, Ill., Jan., 1883, 8vo, pp. 31.

Through the kindness of the author, we have been favoured with a copy of the above paper, which embodies the results of a very laborious series of microscopic examinations of the contents of the alimentary canal of insects belonging to the Carabidæ and Coccinellidæ. In the Carabidæ the results of the dissection and study of 175 specimens are given, representing thirty-eight species and twenty genera. Of the Coccinellidæ, the results of the dissection of thirty-nine specimens are given, accompanied by carefully compiled tables presenting the evidence in the most convenient and accessible forms. Prof. Forbes' experiments show clearly that the opinions hitherto held by entomologists as to the food of these insects are in many respects incorrect. While it is shown that the insects belonging to the genus *Calosoma* live almost exclusively on animal food, those of *Chlœnius* and *Galerita* to the extent of nine-tenths, and those of *Pterostichus* three-fourths; the species of *Harpalus* take only about twelve per cent. of animal food, *Anisodactylus* twenty-one per cent., *Amara* and *Amphasia* twenty-three per cent., and

Agonoderus about thirty-three per cent. ; the whole series of Carabidæ examined averaging fifty-seven per cent. of animal food, the remainder being vegetable and consisting mainly of the pollen of flowers and the spores of fungi.

Of the Coccinellidæ examined, animal food constitutes but little more than one-third of the whole, the other two-thirds consisting of forty-five per cent. of the spores of fungi, four per cent of those of lichens, and fourteen per cent. of pollen. Prof. Forbes has laid all who are interested in this subject under grateful obligations to him for his valuable contributions to our knowledge in this department.

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AN ILLUSTRATED ESSAY ON THE NOCTUIDÆ OF NORTH AMERICA, WITH "A COLONY OF BUTTERFLIES." By A. R. Grote, A.M. Large 8vo, pp. 85. Published by John Van Voorst, Paternoster Row, London, Eng.

This little volume is beautifully got up, printed in bold type on fine paper, and illustrated by four excellent coloured plates on which forty-five species of Noctuids are figured. These moths have been previously described in various works, but have not been figured before; and appear to have been selected to adorn this handsome little book on account of their striking beauty; they are the gems of the genera to which they belong, and well deserve to be thus made better known. Each specimen is numbered and accompanied by a brief reference or description.

In a preface of twenty-three pages the author gives a "brief" *résumé* of the sources from whence he has drawn his information; an account is also given here of the life history of the Cotton-worm from the egg to the perfect insect. This volume will commend itself for its excellencies to all those who are interested in the study of the Noctuidæ, as a valuable and beautiful contribution to this department of entomology.

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TRANSACTIONS OF THE OTTAWA FIELD NATURALISTS' CLUB. No. 3, 1881-1882. 8vo, pp. 66, with two plates.

We commend this record of the work of the Ottawa Field Naturalists' Club to all those who are interested in Canadian Natural History. In addition to the excellent address of the President, James Fletcher, Esq., it contains reports of the work accomplished by the Geological, Botanical and Entomological branches of the Club; a list of the birds found in the vicinity of Ottawa, and addresses which have been delivered on various natural history subjects at the soirees held by the Club.

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GENERAL INDEX OF THE THIRTEEN ANNUAL REPORTS OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

This useful work, covering the period from 1870 to 1882 inclusive, has recently been issued. The compiler, E. Baynes Reed, Esq., Secretary-Treasurer of the Society, has spared no pains or labour in making the Index complete in every particular. It is uniform in size with the Reports, and covers thirty-five pages. Beginning with a summary of the illustrations used, and of the orders illustrated, there follows a detailed list of all the figures used in each of the thirteen Reports. The second part consists of a classified list of the insects illustrated, while the third part is a general index which is very full and complete, and will be of much value to all who may have occasion to consult its pages. A copy will be mailed to each member of the Society.

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## OBITUARY NOTICES.

It becomes our painful duty to announce the death of one of the founders of our Society and its first President, Prof. Henry Croft. He died at Hermanitas, Texas, on the 28th of April, of dropsy, aged sixty-three years. Ever since the organization of our Society he has taken the deepest interest in its welfare. Early in life while in Europe he was an ardent collector, devoting most of his attention to Hymenoptera; but after accepting the position of Professor of Chemistry in the University of Toronto, which he filled with much credit for many years, his time was so fully occupied with his professional duties as to leave him but little opportunity for entomological pursuits. Yet he never lost his interest in this, his favourite department of natural history. For many years past his eyesight had failed to such an extent as to prevent his collecting, and his health also was too poor to permit of it. Several years ago he resigned his position in the University and removed to Texas with his family, with the hope of benefiting his health. His death was quite unexpected. One of his much esteemed colleagues thus writes of him: "His last letter to me, written about ten days before his death, showed much of his old interest in natural history, some of his familiar humour, and a kindly interest in his friends here. I look back with pleasure on many years of work with him as a colleague. I ever found him genuinely straightforward, guileless and upright." His memory will ever be cherished by those of us who knew him well as a kind and disinterested friend.

CHARLES ARNOLD,

of Paris, Ontario, died after a short illness on the 15th day of April, 1883. Although not an active worker in the entomological field, he was a close observer of the habits of insects, especially such as are injurious to agriculture and horticulture, and in this way a most useful member of our Society. He was quiet and unobtrusive, but his work, especially as a hybridist, made him widely known. He originated many good varieties of fruits, cereals and other useful plants, some of which are much appreciated. Few men have done so much good in so quiet a way.

PROF. TOWNEND GLOVER,

long so well known as Entomologist of the Department of Agriculture in Washington, died on the 8th of September from an attack of apoplexy, at the house of his adopted daughter in Baltimore, in his seventy-first year. He was a most careful and painstaking observer, a good draughtsman and an excellent engraver, and employed his every spare moment in producing figures of American insects. In the preparation of these plates his industry was incessant, and the wonder is how, in one short life, he could have accomplished so much. The plates, with the accompanying notes, have been purchased by the United States Government, and it is hoped that they will be published in sufficient number to admit of their being available to educational institutions and students of entomology throughout the country. A complete set of his beautiful works, of which only fifteen copies are extant, have been secured for the library of our Society. He was an honorary member of the Entomological Society of Ontario, and ever felt a deep interest in our work.

V. T. CHAMBERS,

a valued contributor to the pages of the *Canadian Entomologist*, died on the 7th of August, his fifty-second birthday, at his home in Covington, Kentucky. He laboured long and ardently on the micro-lepidoptera, and in his numerous descriptions of species and careful notes on their habits, has left behind him an enduring monument. He began a series of papers on micros in the third volume of our journal, published in 1871, publishing ten papers before the end of that year. These were followed by twelve papers in volume iv., nine in vol. v., ten in vol. vi., nine in volume vii., seven in vol. viii., ten in vol. ix., four in vol. x., four in vol. xi., one in vol. xii., two in vol. xiii., and one in vol. xiv., seventy-eight papers in all, besides a few communications on other entomological subjects. His writings have added greatly to the interest and value of our journal, and we shall miss him much.

DR. JAMES S. BAILEY,

of Albany, N. Y., died at his residence, No. 95 Eagle St., on July 1st, after a protracted illness. He was an enthusiastic student of insects, who devoted most of his attention to the lepidoptera, of which he possessed a fine collection. He has contributed a number of papers to the *Entomologist*, among others an illustrated one on the natural history of *Cossus centerensis*, in No. 1., vol. 11, and at the time of his death was engaged in preparing a paper on the tree-boring species of this genus for the Department of Agriculture.

PROF. P. C. ZELLER.

The death of this veteran lepidopterist has occurred, long expected and deeply regretted. Seven years younger than the century itself, Prof. Zeller was born on the 9th of April, 1808. Professor in the Prussian Real Schule at Meseritz, he was finally retired on a Government pension, and has lived since 1870 near Stettin, continuing his entomological labours in connection with the Entomological Society of Stettin. Commencing to write at an early age, Prof. Zeller has grown up with the modern science of lepidopterology. His earliest studies were upon the collections of Frau Lienig and the material brought by himself from a southern trip, which extended as far as Sicily. Zeller discovered the curious diurnal *Rhodocera farinosa*, besides describing certain *Lycenidae*, but his principal attention was given to the small moths of the families *Pyralidae* to *Tineidae*, the modern classification of which he may be said to have founded. He first cleared up the confusion as to the genera of *Phycidae*, and by using natural characters, chiefly secondary sexual ones, he succeeded in disentangling our minds with regard to the order of nature in this obscure and neglected field of enquiry. His species and genera are very numerous and almost always valid. It is a misfortune that his valuable monograph on the *Crambidae* was issued so nearly simultaneously with the worthless writings of Francis Walker on the same subject, so that some of our North American material has been twice named. The evidence seems to be that Zeller's paper may have been earlier. As a matter of justice it should have priority. In a series of articles, published since retirement from official duties, Prof. Zeller described a number of moths from North America. Rather more than the, unfortunately not to be avoided, proportion of synonyms mark the papers, which are otherwise models of what descriptorial work ought to be. Still later, Prof. Zeller has published a beautifully illustrated volume on micro-lepidoptera, and has given a classification of *Chilo*. As I remember him in 1867, Prof. Zeller was a white-haired gentleman of very kind manners and enthusiastic for his favourite science. He was moderately thin and tall, wearing a slight whisker, but otherwise with clean shaven mouth and face. His nose was large and well-shapen, his eyes bright and the whole expression of his face pleasing. He had high cheek bones, and his countenance was unmistakably German in its salient features. Lowe, the celebrated dipterist, was then living in Meseritz, and an entomological excursion which I made with these two celebrities is among the most pleasant of my European reminiscences. Prof. Zeller's home relations were of the happiest, and the sympathy of an amiable and considerate wife was his through life. And it was a life devoted to science and learning. His accomplishments as a linguist and teacher were well known and appreciated in Germany. We know him chiefly as a biologist, the describer of the exterior structure of lepidoptera. He was fortunate enough to avoid much of the controversial spirit which accompanies descriptive entomology. Although he felt deeply the uselessness of the British Museum Lists, and his own studies were impeded thereby, he has, on the whole, little to say in criticism of others. He was not only charitable, but had schooled all natural irritability. His assistance was freely given to others, and Mr. Stainton's work on the *Tineina* acknowledges its value. He was a type of a kindly German pedagogue and naturalist which hardly exists elsewhere.

A. R. G. in *Papilio*.

CHARLES G. SIEWERS.

Charles G. Siewers died at his residence, Newport, Ky., Sept. 6th, in the sixty-eighth year of his age. For many years he has been a devoted and enthusiastic student of entomology.

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logy. He spent much time in rearing the larvæ of lepidoptera, making coloured drawings of them through their stages of growth. He collected largely in coleoptera and was a very accurate observer of habits. It is due to his skill as a collector that some of the rarest species have been recorded as occurring in his locality.

DR. JOHN L. LE CONTE.

This eminent and world-renowned coleopterist died at his residence in Philadelphia, on the 15th November, 1883, after an illness of several months, in his fifty-ninth year. He was born in New York, but had made Philadelphia his home during the last thirty years. He graduated at the College of Physicians and Surgeons in 1846. In 1857 he spent several months in South America with a party of engineers who were engaged in surveying a railway across Honduras, he prepared the geological report of the party. At the beginning of the war he entered the army as a surgeon, was soon promoted to the position of medical inspector with the rank of Lieutenant-Colonel, and served in that capacity until 1865. In 1867 he was attached to the Kansas Pacific Survey, and made valuable reports on the country adjacent to the railway in Colorado and New Mexico. He was a student of science all his life, and an active or corresponding member of the leading scientific and philosophical societies of this country and Europe; but his specialty was entomology, and in the order of coleoptera he has long stood at the head of the list of American original investigators. On this subject he has been a voluminous and practical writer, and has probably done more to advance this department of science than any other man in America. His loss will be deeply felt, especially by all those engaged in the study of American beetles, since he was always ready and willing to do all in his power to assist students and collectors in every quarter.

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