REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

1872,

INCLUDING A REPORT ON SOME OF THE NOXIOUS, BENEFICIAL AND COMMON INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, MA.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario; and Editor of the Canadian Entomologist;

WILLIAM SAUNDERS,

Vice-President of the Entomological Society of Ontaio; and

EDMUND BAYNES REED,

Secretary-Treasurer of the Entomological Society of Ontario.

Printed by Order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 86 & 88 KING STREET WEST.

1873.

Annual REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

1872,

INCLUDING A REPORT ON SOME OF THE NOXIOUS, BENEFICIAL AND COMMON INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, MA.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario; and Editor of the Canadian Entomologist;

WILLIAM SAUNDERS,

Vice-President of the Entomological Society of Ontaio; and

EDMUND BAYNES REED,

Secretary-Treasurer of the Entomological Society of Ontario.

Printed by Order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 86 & 88 KING STREET WEST.

1873.

CONTENTS.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO.

1872,

INCLUDING A REPORT ON SOME OF THE NOXIOUS, BENEFICIAL AND COMMON INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario; and Editor of the Canadian Entomologist;

WILLIAM SAUNDERS,

Vice-President of the Entomological Society of Ontario; and

EDMUND BAYNES REED,

Secretary-Treasurer of the Entomological Society of Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF THE PROVINCE OF ONTARIO, FOR THE YEAR 1872.

To the Honourable the Commissioner of Agriculture,—

Sir,—In compliance with our Statute of Incorporation, I have the honour to submit the Report of the Entomological Society of Ontario for the year 1872.

The annual meeting of the Society was this year held at the City of Hamilton, when the various reports were read, and the officers for 1873 duly elected.

I also beg leave to submit herewith a Report on some of the Noxious, Beneficial, and Common Insects of this Province, which has been prepared by the Rev. C. J. S. Bethune, Mr. William Saunders and myself, on behalf of the Society.

The publication of the Canadian Entomologist is still regularly continued, and the value of its pages has been greatly enhanced by the contributions of Entomologists both on this continent and in England, whose learned researches have rendered them authorities in their several branches of this science.

I have much pleasure in being able to report an increase in our membership, which has now reached 300, and that under the fostering care of your Department a more general interest in practical Entomology seems to be making its way steadily among the agricultural community.

To Canadians generally it must be gratifying to know that the course pursued by your Department in encouraging the efforts of the fruit-grower, and in disseminating a knowledge of the various insect friends and foes, has called forth warm commendations from several of the English scientific papers, and strong suggestions have been made that a similar course should be pursued by the Home Department.

I have the honour to remain,
Your obedient servant,
EDMUND BAYNES REED,
Secretary-Treasurer of the Entomological Society of Ontario.

London, Ont., Nov., 1872.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The second annual general meeting of the Society was held at the Court-House, Hamilton, Ontario, on Thursday Evening, September 27, 1872.

The President, the Rev. C. J. S. Bethune, M.A., in the chair.

The minutes of the previous meeting were read and confirmed.

The President's address, the report of the Council, and the financial statement of the Secretary-Treasurer were then read, and on motion duly received and adopted.

ELECTION OF OFFICERS FOR 1873.

The following Officers were then elected:

President.—Rev. C. J. S. Bethune, M.A., Trinity College School, Port Hope, Ont.

Vice-President.—W. Saunders, Esq., London, Ont.

Secretary-Treasurer.—E. B. Reed, Esq., London, Ont.

Council.—Prof. J. Macoun, Belleville; R. V. Rogers, Esq., Kingston; J. M. Denton, Esq., London; J. Pettit, Esq., Grimsby, A. Macallum, Esq., Hamilton.

Auditors.—J. H. Griffiths and Chas. Chapman, London.

On motion duly carried, it was resolved that the sum of $100 be paid respectively to the President as Editor of the ENTOMOLOGIST, and the Secretary-Treasurer, for their services during the year 1872.

The state of the Library was discussed, and suggestions made with reference to its management.

The subject of the Report on Insects was laid before the meeting, and information elicited from the members respecting the prevalence of any special damage caused in their respective districts by the attacks of insects on field or garden crops. A vote of thanks was passed to Judge Logie for his courtesy in granting the use of his room for the annual meeting.

The meeting then adjourned.

REPORT OF THE COUNCIL.

In presenting the Second Annual Report, the Council feel highly gratified at the measure of success which has attended the Society during the past year. Confined, as its membership naturally is, to a small numerical portion of the public, it is yet very evident from the increased number of new members that the Society's efforts are appreciated, and that the science of practical Entomology is being gradually forced upon the notice of our most intelligent agriculturists and horticulturists. Fifty-four new members have entered our ranks this season, several of them being entomologists of some reputation. Our total number is now 300, made up as below:—

Ontario general	70	
London Branch	51	
Kingston	15	
	136	in Ontario
Quebec Province	14	
Nova Scotia	3	
British Columbia	1	
	154	in Canada.
United States	138	
England	8	
Total	300	Members.

The Quebec Branch has ceased for the present to exist; but we hope shortly to see it reorganized.

Our membership in the United States is steadily increasing, and from this source we derive much substantial assistance both to our funds and our magazine. The publication of the CANADIAN ENTOMOLOGIST is still continued; the fourth volume is now nearly completed. The ENTOMOLOGIST is at present the only regularly-issued periodical on this Continent devoted to the science of Entomology. We must not omit to return our hearty thanks to those friends who have so kindly sent material to the editors, and by whose active assistance the latter have been able to keep up the good reputation of our periodical. Especially would we make honourable mention of Mr. V. T Chambers, of Covington, Kentucky, whose admirable papers on the Micro Lepidoptera have attracted much attention both here and in England.

Some of our members have expressed an opinion that the ENTOMOLOGIST is too exclusively scientific, and that its pages have not been made sufficiently interesting to those amongst us who are at present only beginners in the study of the science. The Council feel that there is some justice in this remark, and we would suggest to our successors that perhaps it may be feasible to publish, in the pages of the ENTOMOLOGIST, the descriptions of our native Lepidoptera, taken from the original sources, as far as practicable, and thus give some assistance to those whose want of proper books, or inability to get even a reference to them, is an insuperable barrier to their working out for themselves the names of the various species in their collections.

The great drawback to the Society's efforts is a want of sufficient funds to procure the requisite scientific works on Entomology, many of which are very rare and costly, and also a proper supply of engravings and electrotypes of the various insects treated of. It is very difficult to meet the latter demand, owing to the want of a good artist who is well versed in the science, and able to give a correct representation of the originals; at the present time we have to send to the United States for the greater part of our wood-cuts and electrotypes.

The Council appointed a delegation to confer with the Commissioner of Agriculture on the subject of an increased grant, and there is every reason to hope that the result will be successful. In their application they will be strongly supported by the Fruit Growers' Association, who are making a similar appeal.

We have much pleasure in referring to the very generous donation of fifty dollars towards our library fund by the Fruit Growers' Association. It becomes indeed more manifest, as each succeeding year rolls on, that the cordial feeling existing between these two sister Societies is a strong element in their success, and furnishes fresh proof of the necessity of their continuing the work in the same friendly manner. We sincerely hope that this feeling will always continue.

The financial statement will, we think, be found satisfactory to the members.

The Council have thought it advisable to rent rooms at London for three years from July 1, 1872, at $80 per annum; of this the London Branch pays $30. We would here suggest and recommend that the expenses of fitting it up in a suitable manner be borne by the Society. The estimated cost is about $100. It must not be forgotten that hitherto the Society has had no proper place for keeping the stock of books, cabinets, pins, corks, etc.

The library has been largely augmented during the year, and is now the nucleus of a very fair collection of entomological books.

The property of the Society is insured for $850.

Arrangements have been made for the continuation of our Annual Reports, to be published as hitherto under the direction of the Department of Agriculture. If successful in obtaining the increased grant that we are now applying for, it is contemplated to issue with the Reports a coloured plate of insects, believing that by this means we shall be able to present to the public a much more definite and correct idea of the various insects treated of.

All of which is respectfully submitted.

EDMUND BAYNES REED,
On behalf of the Council.

FINANCIAL STATEMENT OF SECRETARY-TREASURER.

Receipts.

By Balance in Bank of Montreal		$ 233 73
" Members' Fees, including arrears		250 64
" Government grant for 1872		500 00
" Engraving, from Department for Annual Report, 1871		150 00
" CANADIAN ENTOMOLOGIST, sale of		40 98
" Pins, sale of		15 20
" Cork, "		13 87
" Library acct—Sale of Duplicate Pamphlets	4 75	54 75
" " Donation from Fruit Growers' Association	50 00	
" Expense acct, Exchange, &c		22 53
" Individual accts		18 06
		$1299 76

Disbursements.

To Expense acct., including Editor's salary for 1871	$267 01	
" Engraving for Annual Report	152 55	
" CANADIAN ENTOMOLOGIST, printing Nos. 7—12, vol. iii., and Nos. 1—8, vol. iv	428 16	
" Library acct	181 24	
" Individual accts	15 61	
" Balance in Bank of Montreal*	255 19	
	$1299 76	$1299 76

* *This will be exhausted in meeting liabilities due up to December* 31, 1872.

We certify that the above is a correct statement of accounts for the year ending Sept 19, 1872, as shown by the Treasurer's books, with vouchers for all disbursements.

CHAS. CHAPMAN, } *Auditors.*
J. H. GRIFFITHS, }

LONDON, Ont., Sept. 22, 1872.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1872.

To the Members of the Entomological Society of Ontario:

GENTLEMEN,—It is my happy privilege once again to congratulate you upon the completion of another year of progress in the annals of our Society. As you have already learnt from the very satisfactory Report of our excellent Secretary-Treasurer, the list of members of the Society has been largely added to during the past twelve months; the Library has been increased by the purchase of a number of valuable Entomological works; a cabinet and microscope have been bequeathed to us by our late lamented member, the Rev. Professor Hubbert, and our collections have been much improved; a comfortable and commodious suite of rooms has been procured in a central locality in London, Ont.—the present headquarters of the Society; the CANADIAN ENTOMOLOGIST has been regularly issued with, we trust, no diminution in the value and interesting character of its contents; our Second Annual Report on Noxious and Beneficial Insects, prepared by Messrs. Saunders and Reed, and myself, and containing notices of the insects affecting the Apple, Grape, Plum, Currant and Gooseberry, Wheat crops, Potato, Cabbage, Cucumber, Melon, Pumpkin and Squash, has been duly published by the Legislature of Ontario, and no doubt has long since been in the hands of you all. Such, gentlemen, is our record for the year that is now brought to a close, and, having in addition, a satisfactory balance-sheet from the Treasurer, we feel that mutual congratulations are not out of place, and that we who have been honoured with official positions in the Society, can look back upon our efforts in its behalf with at least the agreeable feeling that they have not been altogether in vain.

If we turn, moreover, from our own especial interests to the condition and prospects of American Entomology in general, we find much to afford us satisfaction and encouragement. No large work, indeed, on any particular order of insects has appeared during the past year, but many valuable reports of State Entomologists and portions of serial publications have been issued from the press,—among the latter, I may be pardoned, I am sure, for especially drawing attention to the exquisite illustrations of North American Butterflies contained in Mr. W. H. Edwards' invaluable work, which has now reached its Tenth Part. It speaks well, too, for the growing popularity of this branch of Natural Science, that Dr. Packard's useful "Guide to the Study of Insects" has already reached a *third* edition. A pleasing recognition of American Entomological work has recently, I may add, been manifested in England by the publication there, in a collected form, of the writings of the late Dr. Brackenridge Clemens, on the *Tineina* of North America, under the editorial supervision of Mr. H. T. Stainton the well-known authority in that department of Lepidopterology.

Apart, however, from the position attained by the growth of our Entomological literature, the Science has this year received a recognition that cannot fail to be of great and permanent benefit to it. I allude to the formation of a special sub-section of Entomology at the recent meeting of the American Association for the advancement of Science. It will now be practicable for American Entomologists—to whatever part of the continent they may belong, whether to a Province of the Dominion or a State of the Union, from the Atlantic to the Pacific—to meet together for mutual conference on matters Entomological. Questions affecting the Science in general can hardly fail to arise from time to time, and demand the consideration, and, possibly, the decision of some such united council. Certainly, the proceedings of such a gathering will be of great interest and value to all who take part in them, if not, indeed, to the whole circle of Canadian and American Entomologists.

At the informal meeting at Dubuque, in August last, one subject was specially brought forward for discussion, which I cannot forbear alluding to more particularly here, especially as it may justly be considered the great question of the day in the Entomological world. I refer to the subject of the Specific and Generic Nomenclature of Insects. For some few years past indications have not been wanting of a growing inclination amongst the mass of Entomologists to resist the efforts made by some few able and distinguished writers to impose, year after year, new sets of names upon our common insects. This has been done partly by the revival of the long-forgotten names published at the close of the last century, or the beginning of the present one; and partly by the perpetual formation of new genera, and the re-distribution of species. The ability of the writers and the good work they have done in other respects, have caused these annoying changes to be acquiesced in for the most part, even though the object in view appeared to be rather the exhibition of their powers of research among antiquated tomes, or the supposed immortalization of themselves by the attachment of their own names to those of our familiar insects. I do not say that these men were actuated entirely by such motives, but assuredly one can hardly be accused of ill-natured criticism in ascribing much of the work to such causes. All must admit, I think, that nomenclature is but a means to an end, and that end is surely best attained by the preservation of all names that have been in universal acceptation for a period of years, and that cannot be set aside without disturbing the cabinets of every Entomologist in the land.

Matters in this respect have been brought to a climax by the recent publication of Mr. Scudder's "Systematic Revision of some of the North American Butterflies." I esteem Mr. Scudder so highly as a friend, and value so greatly the good scientific work that he has done, that it pains me exceedingly to say a single word against anything that he may put forth. His projected "revision," however, is so sweeping and so revolutionary that I cannot forbear to make some remarks upon it. I know that his scientific labours are perfectly unselfish, and that he is entirely destitute of any of the conceit that I have just now referred to; I feel sure, too, that he is actuated only by the desire to benefit the science: yet I do deeply deplore the mode that he has adopted, and am convinced that if his views are pressed, a very great obstacle will be thrown in the way of the advancement and popularization of this department of Natural History. We all, I am sure, look forward with eager anticipation to the publication of his great work upon North American Butterflies, and have no doubt that it will be the most complete, the most scientific, and the most conscientious work of the kind in America; but assuredly its value will be very greatly marred and its general acceptance impaired, if he continues to insist upon all these radical changes.

To show you what these changes are, I will briefly state that in the pamphlet already published, and which is intended as a forerunner of the author's great work on the Butterflies, the following alterations are made in the received nomenclature:—The 228 species enumerated are distributed among 96 genera—almost a genus for every two species; of these 96 genera, 42 are entirely new, and 39 others are obsolete names of Hubner and others that have never been generally adopted; there are thus 15 familiar generic names left, but of these several are transferred from their present position to entirely different groups of species; for instance, the name of *Papilio* is removed from the genus of "Swallow-tailed Butterflies," and handed over to the sole use of the insect at present known as *Vanessa antiopa!* Further, among the 96 genera, there are no less than 45 that include but a single species apiece; and among the 228 species there are only 16 left with their present names unchanged! These figures are surely quite enough to show that I have not misapplied the terms "sweeping," "revolutionary," and "radical," as characterizing this work of revision. I would, then, most earnestly entreat Mr. Scudder, for the sake of the science itself, to reconsider his projected changes,—to discard all antiquated names in favour of those that have been for years in general acceptation and to reduce his list of new genera to as small a number as he conscientiously can. If he does not, if he persists in his revision, I fear that his great work—most valuable as it will undoubtedly be in all other respects—will introduce more confusion, trouble and discord into American Entomology than a generation can get rid of. If these difficulties can be avoided in no other mode, it will remain for us all to unite together and agree to ignore all old forgotten names that may be brought forward, and retain all remaining of familiar species, until a general settlement of the question can be satisfactorily arrived at.

I fear, gentlemen, that I have now completely exhausted your patience; I shall therefore hasten to a close. But before doing so, let me remind you that, since our last annual meeting, our Society has lost by death one of its most valued members, Mr. B. Billings, of Ottawa, Ont. He was one of those devoted lovers of science who do good service by their honest, hearty work, but who, from their innate modesty and retiring disposition, shrink from all publicity. At times he contributed valuable papers to our little periodical, but he could never be induced to make any display of the knowledge he had acquired by his patient diligence both at home and in the field.

Permit me now, gentlemen, to resign into your hands the office that you have done me the honour of investing me with. I thank you for your kindness and courtesy towards myself and my colleagues, and with every wish for the continued success and prosperity of your Society.

I have the honour to be, gentlemen,
Your obedient servant,
CHARLES J. S. BETHUNE.

Trinity College School, Port Hope,
September, 1872.

THE LONDON BRANCH.

The following officers were elected for 1872:—

President............Mr. E. B. Reed,	*Secretary-Treasurer*......Mr. H. Beck,
Vice-President .... Mr. J. M. Denton,	*Curator*. ....Mr. Joseph Williams.

The Branch numbers some 50 members

Since the establishment of the head quarters of the Parent Society, weekly meetings are held every Monday evening, at the Society's Rooms, on the corner of Dundas and Clarence Streets; and every effort is made to increase the interest felt in the Society's work.

The Monthly Business Meetings are also kept up, and fairly attended.

The Cabinet belonging to the Branch is being gradually arranged, and the various orders are now well represented both by Canadian and Foreign Specimens.

A resolution was passed at the annual meeting, That a local collection of Insects should be made of specimens obtained within walking distance of the city.

It was also resolved that Books should be received in the Library on Deposit, proper means being taken for their safe keeping.

Prizes were taken by the members of the Branch at the Western Fair held in October, the proceeds of which were devoted by the recipients to the general work of the London Branch.

It is in contemplation to establish a small Museum of Natural History Specimens in connection with the Branch.

Kingston Branch.

The Officers for 1872 were:—

President............Prof. N. F. Dupuis,	*Secretary-Treasurer*.........Mr. R. V. Rogers, Jun.
Vice-President......Mr. E. H. Collins,	

It numbers about 20 members.

Meetings have been regularly held during the year.

Additions to the Library.

Drury's Exotic Entomology, 4to.	3	Volumes.
British Beetles: by Janson. 1863	1	"
Farm Insects: by J. Curtis	1	"
British Moths: by E. Newman	1	"
Agassiz's Lake Superior. 1850	1	"
Transactions of American Entomological Society, vols. 1-2	1	"
Illustrations of British Entomology: by J. Stephens	12	"
Histoire Generale des Lepidoteres de l'Amerique Septentrionale: par Le Dr. Boisduval et M. Le Conte. Paris, 1833	1	"
Newman's History of Insects: 1841	1	"
Fitch's Reports on Noxious Insects in State of New York: 1-2	1	"
Packard's Guide to the Study of Insects	1	"
Entomological Correspondence: Harris	1	"
The American Naturalist: 1-5	5	"
The Canadian Journal, vol 3, O. S.; vols. 1-6, N. S.	7	"
Systema Naturæ: Linnæus. 1756	1	"
The Canadian Naturalist: Gosse	1	"
Life of North American Insects: Jæger	1	"
Stainton's Manual of British Butterflies and Moths	2	"
Hind's Essay on Wheat Insects	1	"
Stephen's Manual of British Beetles: 1839	1	"
The Entomologist's Weekly Intelligencer	9	"
Insects At Home: by Rev. J. C. Wood. 1872	1	"
Reports of Commissioner of Agriculture and Arts, Ontario. 1870-1	1	"
Worcester's English Dictionary, Library edition	1	"
Geological Survey of Canada, 1853-56	1	"

Geology of Canada. 1866.	1	Volume.
" " Atlas. 1863	1	"
Geological Survey of Indiana. 1869	1	"
" " Maps	1	"
Transactions of Indiana State Horticultural Society. 1870	1	"

Books Lent on Deposit.

By Joseph Williams—

The Canadian Naturalist and Geologist: O. S., 1-5	5	"
" " " N. S., 1-8	8	"
Binney's Mollusks. vols. 1-4	2	"

By E. B. Reed—

Noel Humphrey's British Butterflies	1	"
Elements of Entomology: by Dallas.	1	"
Origin of Species: by C. Darwin	1	"
A Naturalist's Voyage Round the World: by do.	1	"
Animals and Plants under Domestication: by do.	1	"
Siebald on True Parthenogenesis	1	"
Variation of Species: by V. Wollaston	1	"
The Naturalists' Note Book 1868	1	"
The Naturalists' Library: (Jardine). Insects	4	"
The Entomologist's Annual, 1856, 1860-1	3	"
Coleman's British Butterflies	1	"
The Insect Hunters: by Newman	1	"

REPORT

ON SOME OF THE

NOXIOUS, BENEFICIAL, AND COMMON INSECTS

OF THE

PROVINCE OF ONTARIO.

INTRODUCTORY.

It has been a source of no small gratification to the writers of these Reports to receive so many kind expressions of appreciation of their labours. The favourable notices too, that have appeared in many English and American publications, afford them much encouragement in the pursuit of their Entomological labours, to which they regret they are unable to devote more than a small proportion of their time: each of them being necessarily engaged in other deeply engrossing pursuits, and having but little leisure at his command. The writers would again remind their readers that they are responsible only for their individual portions of the Report.

E. B. Reed.

London, Ont., November, 1872.

INSECTS INJURIOUS TO THE GRAPE.

ADDENDA TO REPORTS FOR 1870-71.

BY W. SAUNDERS, LONDON, ONTARIO.

No. 17. The Rose beetle, *Macrodactylus subspinosus*, Fab.
18. The Achemon Sphinx, *Philampelus achemon*, Drury.
No. 19. The Abbot Sphinx, *Thyreus Abbotii*, Swainson.
The Grape Seed Insect, *Isosoma vitis* Saunders.
20. A Cut-worm, *Agrotis*—?

In addition to the insects already referred to as injurious to the grape in Ontario in the Entomological Reports for 1870 and 1871, we have the following to submit to our readers.

No. 17. THE ROSE BEETLE (*Macrodactylus Subspinosus*, Fab).

This insect commonly known as the Rose-bug, which for some years past has been reported as doing damage to grape vines in the United States, has always been present with us; but it has not, heretofore, as far as we know, been much complained of by grape growers in any part of Ontario. In the latter part of May, 1872, we received a note from Mr. John Ferguson, of Union, near Port Stanley, Ont., accompanied by a box of these insects, asking for information as to what he should do to get rid of them as they were destroying his grape vines. In a subsequent note he says, "they eat the leaves especially of the Clinton. I found a few on my Concords, but the number was small in comparison to those found on the Clinton; they seem to prefer it, and if left alone, they soon eat all the outer tissue of the leaf, and leave nothing but the net-work."

The fact of this insect showing a preference for the Clinton vine has been remarked before by the late Mr. Benj. D. Walsh, State Entomologist of Illinois, who suggested the taking advantage of this preference on the part of the insect, as a means of lessening the labour attending their destruction. In his first annual report on the "Noxious Insects of Illinois", page 24, he says "In particular seasons, as is well known, and in particular localities this insect occurs in prodigious swarms, and gathers upon grape vines so as to strip them almost entirely of their leaves. The only known remedy that is practically available, is to jar them off the vines and kill them; and of course if we can induce them to concentrate their forces upon one particular vine, and leave the rest alone, the labour of destroying them will be very greatly diminished."

Luckily for the grape grower this can be done. There is concurrent evidence from a great number of different sources, that the Rose-bug prefers the Clinton to all other cultivated varieties, and will gather upon that and leave the others unmolested.

In the *Canada Farmer* for 1867, page 327, the Rose Beetle is referred to as occasionally injurious to the vine, as well as many other shrubs and trees, and mention is made of its great abundance every year in one locality at Oakville; it is also spoken of in Harris' "Insects Injurious to Vegetation" as hurtful to the vine.

Fig. 1.

In Figure 1, we have a representation of the perfect Beetle. It is called the Rose-bug on account of its appearing annually at the time of the blossoming of the rose, and of its having been first noticed as injurious to that flower. The body of this beetle measures a little more than one-third of an inch in length; it is slender in form and tapers a little towards each extremity. Its colour is dull yellowish when fresh, arising from its being covered with a greyish yellow down or bloom; and its long sprawling legs are of a dull pale reddish hue, with the joints of the feet tipped with black, the feet are also armed with very long claws. The down on its body is easily rubbed off, and when this is done there is quite a change in the appearance of the insect, the head, thorax, and the under side of the body becoming of a shining black. The following excellent account of its history is given by Dr. Harris.

"The unexpected arrival of these insects in swarms, at their first coming, and their sudden disappearance at the close of their career, are remarkable facts in their history. They come forth from the ground during the second week in June, or about the time of the blossoming of the damask rose, and remain from thirty to forty days. At the end of this period the males become exhausted, fall to the ground and perish, while the females enter the earth, lay their eggs, return to the surface, and after lingering a few days die also."

"The eggs laid by each female are about thirty in number, and are deposited from one to four inches beneath the surface of the soil; they are nearly globular, whitish, and about one-thirtieth of an inch in diameter, and are hatched twenty days after they are laid. The young larvæ begin to feed on such tender roots as are within their reach; and when not eating they lie upon the side, with the body curved so that the head and tail are nearly in contact; they move with difficulty on a level surface, and are continually falling over on one side or the other. They attain their full size in the autumn, being then nearly three-quarters of an inch long, and about an eighth of an inch in diameter. They are of a yellowish white colour, with a tinge of blue towards the hinder extremity, which is thick and obtuse, and rounded; a few short hairs are scattered on the surface of the body; there are six short legs, namely, a pair to each of the first three rings behind the head, and the latter is covered with a horny shell of a pale rust colour. In October they descend below the reach of frost, and pass the winter in a torpid state. In the spring they approach towards the surface and each one forms for itself a little cell of an oval shape by turning round a great many times, so as to compress the earth and render the inside of the cavity hard and smooth. Within this cell the grub is transformed to a pupa during the month of May by casting of its skin, which is pushed forward in folds from the head to the tail. The pupa has somewhat the form of the perfect beetle; but it is of a yellowish white colour, and its short stump-like wings, its antennæ and its legs are folded upon the breast: and its whole body is enclosed in a thin film that wraps each part separately. During the month of June this filmy skin is rent, the included beetle withdraws its body and its limbs, bursts open its earthen cell, and digs its way to the surface of the ground. Thus the various changes, from the egg to the full development of the perfect beetle, are completed within the space of one year."

Although these insects have many natural foes, such as carnivorous ground beetles, dragon flies, toads, insectivorous birds, domestic fowls, &c., yet they often need the intervening hand of man to keep them within due bounds. The best means of disposing of them is to jar them from the vines on which they are resting with a sudden and violent jar, to sheets spread below to receive them. They are naturally sluggish, and do not fly readily, and are fond of congregating in masses on the foliage they are consuming; and hence, in the morning, before the day becomes warm, they can be easily shaken from their resting places, and disposed of, either by burning them, or by throwing them into scalding water.

No. 18. THE ACHEMON SPHINX. (*Philampelus Achemon*, Drury.)

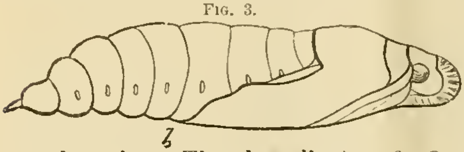
Fig. 2.

a

The caterpillar of this species (see figure 2) is a formidable looking creature, measuring, when full grown, if at rest, about three inches, and, when crawling, about three and a half inches. While young, as this larva feeds singly, it does not attract much attention, but, as it approaches maturity, it consumes in a short time, large quantities of leaves, rendering long branches of the vine quite leafless. It is usually met with of full size late in August, and feeds on the American ivy *(Ampelopsisquinque folia)* as well as on the grape vine. The following descriptions of the larva and perfect insect are compiled chiefly from Mr. Riley's second report on the insects of Missouri.

The largest segment in the body of the larva is the third behind the head; the second is but half its size, and the first still smaller; and, when at rest, it usually withdraws the head and the two next segments within the third, as shown in the figure. This caterpillar varies much in colour; when young, it is usually green, with a long slender reddish horn, rising from the last segment but one, and curving backwards. When full grown, the general colour is sometimes green, but more frequently a pale straw, or reddish brown, and the long recurved horn has disappeared, its place being occupied by a polished tubercle. The pale straw colour, or reddish brown deepens at the sides, and finally merges into a rich brown. A broken line of brown runs along the back, and another unbroken, with its upper edge fading gradually, extends along each side. It has six scalloped cream coloured spots on each side, and is covered more or less with minute spots, which are dark on the back, but light and annulated at the sides. There are also from six to eight transverse wrinkles on all but the thoracic and caudal segments. The head, front segments and breathing holes incline to flesh colour, while the prolegs and caudal plate are deep brown

Fig. 3.



When full grown, and about to transform to a chrysalis, the colour of the worm often changes to that of a beautiful pink or crimson. It then descends to the ground, and burrows underneath, and undergoes its change there within a smooth cavity. The chrysalis (see fig 3) is of a dark shining mahogany brown colour, roughened, especially on the anterior edge of the segments in the back.

Fig. 4.

The moth (figure 4) is of a brownish grey colour, variegated with light brown, and with the dark spots shown in the figure deep brown. The hind wings are pink, with a dark shade across the middle, still darker spots below this shade, and a broad grey border behind. It is usually single brooded, the chrysalis remaining in the ground through the fall, winter and spring months, and producing the moth towards the latter part of June.

This insect has rarely presented itself in sufficient numbers to prove alarming to the vine grower, either here or in the United States. Indeed, with us, it has hitherto been a rare insect; nevertheless, since some usually rare insects occasionally appear in comparative abundance, we have thought it best to present our readers with a history of the species, so that all may be able to recognize it. Should it at any time prove troublesome, its large size makes it so conspicuous, that it might be easily controlled by hand picking.

No. 19. THE ABBOT SPHINX. (*Thyreus Abbotii*, Swainson.)

We have never yet met with the larva of this insect, but have seen specimens of the moth, which were captured in the neighbourhood of Hamilton, Ont. Doubtless, some of our readers will have met with it. Figure 5 shews both larva and moth. The following description of this species occurs in Mr. Riley's second report, already alluded to, which we shall take the liberty of copying:—

Fig. 5.

"This is another of the large grape feeding insects occurring on the cultivated and indigenous vines, and on the Virginia Creeper, and having, in a full grown larva state, a polished tubercle, instead of a horn at the tail. Its habitat is given by Dr. Clemens as New York, Pennsylvania, Georgia, Massachusetts, and Ohio; but, though not so common as the Sphinx moths previously described, yet it is often met with both in Illinois and Missouri. The larva, which is represented in the upper part of figure 5, varies considerably in appearance. Indeed, the ground colour seems to depend in a measure on the sex, for Dr. Morris describes this larva as reddish brown, with numerous patches of light green, and expressly states that the *female* is of a uniform reddish-brown, with an interrupted dark brown dorsal line, and transverse striæ. I have reared two individuals, which came to their growth about the last of July, at which time they were both without a vestige of green. The ground colour was dirty yellowish, especially at the sides. Each segment was marked transversely with six or seven slightly impressed fine black lines, and longitudinally with wider non-impressed dark brown patches, alternating with each other, and giving the worm a checkered appearance. These patches become more dense along the subdorsal region, where they form two irregular dark lines, which, on the thoracic segments, become single, with a similar line between them. There was also a dark stigmatal line, with a lighter shade above it, and a dark stripe running obliquely downwards from the posterior to the anterior portion of each segment. The belly was yellow, with a tinge of pink between the prolegs, and the shiny tubercle at the tail was black, with a yellowish ring around the base. The head, which is characteristically marked, and by which this worm can always be distinguished from its allies—no matter what the ground colour of the body may be—is slightly roughened and dark, with a lighter broad band on each side, and a central mark down the middle, which often takes the form of an x. This worm does not assume the common sphinx attitude of holding up the head, but rests stretched at full length; though, if disturbed, it will throw its head from side to side thereby producing a crepitating noise."

"The chrysalis is formed in a superficial cell on the ground; its surface is black and roughened by confluent punctures, but, between the joints, it is smooth, and inclines to brown; the head case is broad and rounded, and the tongue case is level with the breast; the tail terminates in a rough flattened wedge-shaped point, which gives out two extremely small thorns from the end."

"The moth appears in the following March or April, there being but one brood each year. It is of a dull chocolate or greyish brown colour, the front wings becoming lighter beyond the middle, and being variegated with dark brown, as in the figure. The hind wings are sulphur-yellow, with a broad dark brown border, breaking into a series of short lines, on a flesh-coloured ground, near the body. The wings are deeply scalloped, especially the front ones, and the body is furnished with lateral tufts. When at rest, the abdomen is curiously curved up in the air."

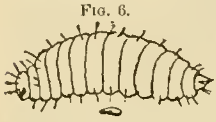
Should this worm at any time become sufficiently numerous to prove destructive—

which is scarcely probable—we could not suggest a better remedy than that given for the preceding species, namely, hand picking.

THE GRAPE SEED INSECT. (*Isosoma Vitis*, Saunders.)

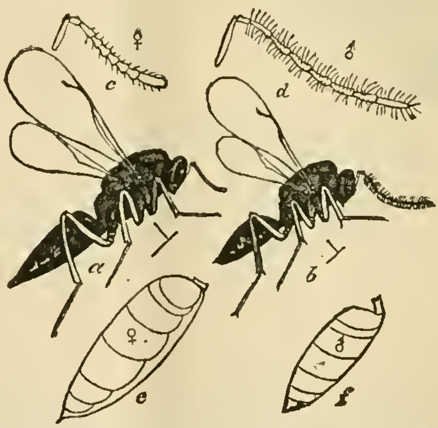
This insect, which was fully described in the report of the Entomological Society for 1870, has not, as far as we have been able to ascertain, affected the grape to any extent in Canada during the past year. It seems, however, to be much more widely distributed than we at first supposed. During the latter part of August, we spent a few days at Dubuque, Iowa, and while there paid a visit to the market, where there were offered for sale large quantities of a species of wild grape, which was fully ripe at that early period in the season, and which, we were told, was much used for wine making. On opening the seeds of these grapes we found a large proportion inhabited by the larvæ of this insect, a small, fat white grub. See figure 6, where it is shown much magnified. An outline of the little creature of the natural size is given below. The larvæ at that time were more than two-thirds grown.

Fig. 6.



For the benefit of those who may not have access to the report for 1870, we give a figure also of a perfect fly, almost identical in appearance with that from which this larva is produced, and well serves the purpose of illustrating

Fig. 7.



it. See figure 7. *a* Represents the female; *c* and *e*, her antennæ and abdomen; *b*, *d*, and *f* give similar details of the male. The larva lives within the seed, and consumes the kernel during the summer; undergoes its change to chrysalis also within the seed, and eats its way out of it in the early part of the summer following, when in the perfect or winged state.

No. 20. A CUTWORM. (*Agrotis—?*)

This destructive pest, which is referred to at length in this report, when treating of the insects affecting the strawberry, has also proved very destructive to the vine. For details of the history and habits of this insect, the reader is referred to No. 7, Injurious to the strawberry.

INSECTS INJURIOUS TO THE STRAWBERRY.

By W. Saunders, London, Ont.

1. The Strawberry Root or Crown Borer (*Anarsia lineatella*, Zeller).
2. The White Grub (*Lachnosterna quercina*, Knoch).
3. A Strawberry Leaf-Roller (*Anchylopera fragaria*, Riley).
4. A second Strawberry Leaf-Roller (*Exartema permundana*, Clemens).
5. A third Strawberry Leaf-Roller (*Lozotænia fragariana*, Packard).
6. Other Strawberry Leaf-Rollers.
7. A Cut Worm (*Agrotis*).
8. The Measuring Worm (*Angerona crocaotaria*).
9. The Smeared Dagger (*Acronycta oblinita*, Sm. & Abb.).
10. The Strawberry False Worm (*Emphytus maculatus*, Norton).
11. *Osmia Canadensis*, Cresson.
12. A Strawberry Bug (*Corimelaena* —— ?)

Fortunately, there are not many insects injurious to this useful and now extensively cultivated fruit. It has, however, several special foes, which have in some localities at times proved troublesome, and there are a few other general feeding insects, which take to strawberry, if it lie in their path, as readily as they will to any other green thing they may meet with. Still, in any case, the strawberry grower must not look upon insects as an unmixed evil, admitting of no toleration, for he would find it very difficult indeed to secure a good crop without their aid. In some varieties of strawberries, the flowers are more or less imperfect, the male organs being more fully developed in some, the female organs in others, so that fertilization can rarely take place, excepting through the agency of insects, who visit flower after flower, and carry and scatter the fertilizing pollen with them wherever they go; and even with the perfect flowers their presence and unconscious labour is required to ensure a liberal crop of well formed fruit.

AFFECTING THE ROOT.

The Strawberry Root or Crown Borer (*Anarsia lineatella*, Zeller).

This is a very troublesome insect where it occurs plentifully, and takes a liking to the strawberry; but, happily, this is not often the case. We have never seen it affecting this fruit anywhere excepting on the grounds of Mr. Luke Bishop, of St. Thomas, Ont., who first called our attention to it about the middle of May, 1869, when he brought us a few specimens. During 1868 and 1869, they played sad havoc with his plants, destroying a large proportion of them. We believe they have been less troublesome since. The borer is a small grub or caterpillar, nearly half-an inch long, and of a reddish colour, which eats irregular channels in various directions, through the crown and larger roots of the plant, causing it either to wither and die, or else to send up weakened and almost barren shoots.

The following description of this larva was taken on the 20th of May, 1869 :—Length, ·42 inch. Head rather small, flattened, bilobed, pale brownish yellow, darker in colour about the mouth, and with a dark brown dot on each side.

The body above is semitransparent, of a reddish pink colour, fading into dull yellow on the second and third segments ; anterior portion of second segment smooth and horny-looking, and similar in colour to head. On each segment are a few shining reddish dots—yellowish on the anterior segments—or faintly elevated tubercles, from each of which arises a single, very fine, short, yellowish hair, invisible without a magnifying power. These dots are arranged in imperfect rows, a single one across the third, fourth, and terminal segments, and a more or less perfect double row on the remaining segments.

The under surface is of a dull whitish colour, becoming faintly reddish on the hinder segments, with a few shining whitish dots ; those on the fifth, sixth, eleventh, and twelfth segments, being arranged in transverse rows, in continuation of those above. Feet and prolegs yellowish white, the former faintly tipped with dark browu. It spins a slight silken thread, by means of which it can suspend itself for a time at a short distance from its place of attachment. The specimen described produced the moth on the 8th of July following.

On the 8th of June, we visited the grounds of Mr. Bishop, and found his strawberry beds badly infested—indeed, almost destroyed—by this pest, along with a leaf-roller, to be presently described. We believe there are two broods of this borer during the year. That which we call the first brood is the one in which the larva passes the winter in a young or half-grown state, in the crowns and roots of the plants ; while the second brood infests the young runners, soon after the fruiting season is over. The borer eats irregular channels through the crown, sometimes excavating large chambers, at other times merely girdling it in various directions, here and there eating its way to the surface. Whether these various chambers and channels are due to the presence of more worms than one in a single root we were unable to determine with certainty. Most of the cavities contained a moderate-sized soft silky case, which, when opened, appeared nearly full of exuviæ. These cases had served as a place of retreat during winter. Most of the larvæ found at this date had eaten their way to the upper part of the crown of the plant, just under the surface, and were found about the centre, with a hole eaten through the surface. From the fact that a large number of roots were examined, and although almost every one was more or less injured, but very few larvæ were to be found, we inferred that the probabilities were that the larvæ, when mature, usually leave the root, and undergo the change to chrysalis, either under the surface of the ground, or amongst rubbish at the surface. One chrysalis only was found, and that was in the cavity of a root. As soon as Mr. Bishop had discovered the destructive character of this pest, he, with commendable caution, refused to sell any more plants until the insect was subdued, for fear of spreading the evil. He is of opinion that the insect came to him from some part of the United States, with some plants of the Hooker strawberry, as it was in a patch of these, so obtained, that he first noticed the insect working.

Specimens of the larvæ got late in the season wintered over, and were examined on the 12th of January following, when they did not appear so plump in body as those examined in July. They appear to spend most of the winter in a torpid state within the silken cases before mentioned. Several were found thus sheltered at this time, and one, whose original abode had been disturbed in the fall, had prepared for itself a similar casing within the fold of a strawberry leaf. In this latter instance, the larva seemed quite active, moving itself briskly about whenever touched.

The chrysalis of this insect is very small, and of the usual dark reddish brown colour. That one which was found on the 8th of June produced the moth on the 12th of July.

The perfect insect is a very small dark grey moth, which was accurately described by the late Dr. Clemens, in the *Proceedings of the Academy of Natural Sciences, Philadelphia*, for 1860, page 69, under the name of *Anarsia pruniella*, as he at that time supposed it to be distinct from the European insect. We quote his description :—" Head and face pale grey ; thorax dark grey. Labial palpi dark fuscous, externally, and pale grey at the end ; terminal joint grey, dusted with dark fuscous. Antennæ grayish, annulated with dark brown. Fore wings grey, dusted with blackish brown, with a few blackish brown spots along the costa, the largest in the middle, and short blackish brown streaks on the median nervure, subcostal, in the fold, and one or two at the tip of the wing; cilia fuscous-grey. Hind wings fuscous-grey; cilia grey, tinted with yellowish."

"The larva was taken, June 16, full-grown, and about to transform on the limbs of the plum. Its head is black, body uniform reddish brown, with indistinct papula, each giving rise to a hair, and with pale brown patches on the sides of the third and fourth segments; shield and terminal prolegs black. One specimen had secreted itself under a turned-up portion of the old bark of the trunk. The cocoon is exceedingly slight, and the tail of the pupæ is attached to a little button of silk."

Mr. C. V. Riley, who has kindly determined this moth for me, draws attention to the coarse nature of the scales on the wings, appearing something like minute granulations. He also observes that, in some specimens of the moth, the dark marks are more or less obsolete. Mr. Riley has bred this moth from larvæ boring into tender peach twigs, and remarks that "the larva, when young, is paler, with a paler head, the body being yellow, each joint with a crimson band superiorly, narrow on the thoracic joints, and broad, and divided transversely by a fine pale line on the feet." Mr. J. Pettit, of Grimsby, Ont., has bred it from the twigs of the peach, and it breeds in peach twigs, also, in Europe; and Professor Townend Glover, of the Department of Agriculture, Washington, has found it feeding on the buds of the peach.

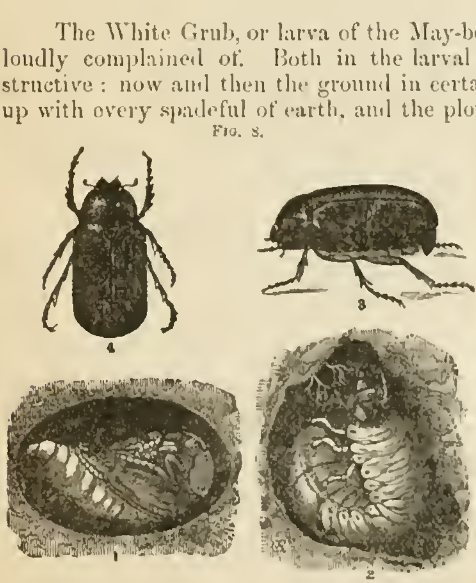
Since this moth is found in Europe as well as in this country, it is in all probability an imported insect, and one that is widely disseminated. We are not aware that it has been recorded as injurious to the strawberry before, and we sincerely hope that this apparently lately developed liking for this food plant will be limited to the specimens residing in the district referred to. Should it ever become general, it would prove a most grievous pest to the strawberry grower.

Remedies.—Happily even this small creature is not without its enemies. Among some larva sent to Mr. Riley, several, he says, contained parasites; probably these tiny friends have been doing much in the past, and are still doing much, to limit their increase. Nature's operations, although often silent, are usually sure. Possibly severe cold or extreme heat may also affect them. Man can do little in this instance, unless he digs up his strawberry roots and burns them.

2. The White Grub (*Lachnosterna quercina*, Knoch).

The White Grub, or larva of the May-beetle—*Lachnosterna quercina*, Knoch—is often loudly complained of. Both in the larval and perfect conditions, it is at times very destructive: now and then the ground in certain localities seems full of the larvæ, they turn up with every spadeful of earth, and the plough will expose them by hundreds.

Fig. 8.



In figure 8, we give representations of the insect in its different stages:—2 illustrates the full-grown grub; 1 the chrysalis, and 3 and 4 the perfect beetle. Everyone must be familiar with the May-beetle, or May-bug, as it is sometimes called—a buzzing beetle with a rapid, but wild and erratic flight, which comes thumping against the windows of lighted rooms at night, in May and early in June; and where the windows are open it dashes in without a moment's consideration, bumping itself against walls and ceilings, occasionally dropping to the floor; then suddenly rising again, it sometimes lands unexpectedly against one's face or neck, or it may be on one's head, where its sharp claws get entangled in the hair, and its further progress is stayed until a forcible removal takes place. At such times it is quite a terror to those whose nerves are weak.

Although thousands of these summer-evening tormentors are yearly, yea, nightly, trodden to death during their brief season, yet thousands of others rise to supply their places, and sometimes they are reinforced by armies of tens of thousands. Then it is that oftimes serious damage is done to trees whose foliage they consume, their powerful and horny jaws being admirably adapted for cutting and grinding the leaves. Cherry trees are frequently injured in this way ; indeed, these beetles are not at all particular as to what they eat—the oak, the Lombardy poplar, and many other kinds of trees, are just as readily attacked, if in their way.

The *Canada Farmer* for July, 1866, contains an excellent article on this subject, by our esteemed friend, Rev. C. J. S. Bethune, Port Hope, with details of the habits and history of this insect, which we cannot do better than re-produce : —

"A friend in Cobourg has recently mentioned to us, that his strawberries have been very much injured by a large white grub which attacks the roots, and thus destroys at once the vitality of the plants. From his description of the marauder, we have no doubt that it is the larva of the common May-beetle or Cockchafer—*Lachnosterna Quercina*, Knoch —which is so abundant just now. In the western part of Cobourg, and, indeed, almost all over the neighbourhood, these beetles may be seen on any fine evening, in perfect myriads flying about the trees, the leaves of which they devour in this stage of their existence.

"This insect has been long and most unfavourably known as very destructive to vegetation, both in its larval and winged state. In the former, it is commonly called the 'white grub :' it is then a soft, white worm, with a brownish head, and six legs, becoming, when fully grown, about as large as one's little finger. It is usually found partially coiled up, near the root of the plant on which it is feeding. Unlike many of our destructive insects, the devastations of each individual are not confined to a single year, but it continues several years in the grub state, and, finally, changes early in the spring into a dark chestnut brown beetle, nearly an inch long, with rather long legs, and its breast covered with yellowish hairs. It flies about at night with a loud buzzing noise, and in a most clumsy manner, as if it had very little control over its movements, to the great discomfort and perturbation of nervous persons, especially when attracted into houses, as it often is, by the light. Its period of flight is usually limited to the months of May and June, though it is sometimes met with a little later in the season. The grubs are very commonly dug up, early in the spring, in gardens, in various stages of maturity ; the plough, too, brings many more to the light of day. It is hardly necessary, we suppose, to tell our readers that in such cases they should be destroyed at once, and without mercy, by treading under foot. The perfect insects may be collected and put an end to, by shaking them from the trees they infest, into a cloth spread beneath for their reception, and then throwing them into boiling water ; the specimens thus cooked will be readily eaten by pigs, which, in fact, root up and devour multitudes of the grubs without waiting for any previous culinary operations. The best time to shake them from the trees is early in the morning, when they become sluggish and stationary, their flight being confined to the hours of darkness."

The larva of this May-bug does not by any means confine its attention to strawberry roots, but devours potatoes, corn and other vegetables, also the roots of grass, and this to such an extent that at times meadows are utterly ruined by them, so that the turf may be turned up like a carpet, so utterly are the roots consumed.

After the pairing of the sexes, the males soon die, while the females burrow into the ground some six inches or more, where they deposit their eggs from fifty to a hundred in number, after which they come out again from the earth, but their mission having now been accomplished, they soon die. The eggs soon hatch into white grubs, which begin at once to feed on the roots of any plants within their reach. During the summer, they burrow about and feed not far from the surface ; but as winter approaches, they dive deeper into the soil, below the reach of frost, where they remain torpid until spring. At the close of the third summer, they cease feeding, and bury themselves sometimes two feet deep in the earth, and there, in an oval cavity, formed by the motions of the larva from side to side, the change to chrysalis takes place, the beetle digging its way through and appearing at the surface in due season. Sometimes the transformation to the beetle state takes place in the fall, for we have several times found fresh specimens at this season, showing by their softness that they had but lately escaped from the pupa case. Such perfect insects secrete themselves under ground during winter, and appear with the rest of their troop in spring.

Remedies. Man can do but little towards checking the ravages of this insect pest, but nature has provided many means for keeping them within due bounds. Some birds, such as the crow and common fowl, eat them greedily, indeed the crow may often be seen following the track of the plough in search of these choice morsels. As already stated pigs eat them with avidity, and will root up the ground most thoroughly in their search for them, and no doubt many other insect eating animals and birds devour them with equal delight. These grubs are also liable in some parts to the attacks of a peculiar disease, which manifests itself in the development of a fungous growth, which sprouts out in a curious manner from about the head, and the result is the death of the insect so occupied. The beetles, as already stated, may be best destroyed by shaking them from the trees and throwing them into scalding water.

Affecting the Leaves.

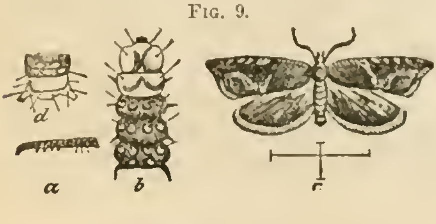
3. A Strawberry-Leaf Roller (*Anchylopera fragaria*, Riley.)

This insect, which is also known in some parts of the United States as *the* strawberry leaf-roller, is but one of the several insects which affect the strawberry in this way. It has been found very troublesome in some of the adjoining States for several years past, and in all probability it occurs in Canada also. In the *Canada Farmer* for August, 1867, some account is given of a leaf-roller found by Mr. Chas. Arnold, of Paris, Ont., eating the leaves of his strawberry plants, which has been referred, and probably correctly so to this species. Possibly some of our readers may recognise the insect after reading the following description of its appearance and mode of working, condensed chiefly from a paper by Mr. C. V. Riley, State Entomologist of Missouri, and published in the *American Entomologist* for January, 1869 :

The larva or caterpillar measures when full grown a little more than one third of an inch. It is largest on the front segments, tapering slightly towards the hinder ones. In colour it varies from a very light yellowish brown to a dark olive green or brown, with a body soft and somewhat semi-transparent. Its head is of a shining yellowish brown colour, with a dark eye-spot on each side. The second segment has a shield above similar in colour and appearance to the head, and on each segment or ring of the body are a few pale spots, from each one of which arises a single hair. The hinder segment has two black spots, while the under-surface, feet and prolegs are about the same colour as the body above. In certain parts of North Illinois and Indiana this insect has been ruining the strawberry beds in a most wholesale manner. It crumples and folds the leaves, feeding on their pulpy substance, and causing them to appear dry and seared. It most usually lines the inside of the fold with silk. There are two broods during the year, and the worms of the first brood, which appear during the month of June, change to the pupa state within the rolled up leaf, and become moths during the fore part of July.

The moth has the head, thorax, and fore wings reddish brown, the latter streaked and spotted with black and white ; the hind wings and abdomen are dusky. The wings when spread measure nearly half an inch across. After pairing the females deposit their eggs on the plants, from which eggs in due time there hatches a second brood of worms, which come to their growth towards the end of September, and changing to pupæ pass the winter in that state.

Fig. 9.



In the accompanying figure 9, drawn from nature by Mr. Riley, *a* represents the larva natural size, *b* the head and four succeeding segments of the body, and *d* the terminal segment, all magnified ; *c* the moth, also enlarged, the hair lines at the sides showing the natural size.

4. A Second Strawberry Leaf-Roller (*Exartema* (*Tortrix*) *permundana*, Clemens.)

This species was found in immense numbers attacking Mr. Bishop's strawberry vines in 1868 and 9, along with the "crown borers" already described. All these leaf rollers have the habit of rolling up the leaves and fastening them with silken threads, and living within the enclosure, but this little creature prefers taking the flowers, expanded and unexpanded, and bringing them together with silken threads into a sort of ball, it feasts on their substance. This peculiarity makes its attacks much more annoying and destructive than any mere consumption of leaves would be. It is small in size, of a green colour, and with very active habits, wriggling itself quickly out of its hiding place when disturbed. It is the progeny of a small moth, with its fore wings yellowish varied with brown streaks and patches, and darker hind wings, who lays her eggs quite early in the spring, placing them upon the developing leaves, where the newly hatched larvæ may be sure to enjoy an abundance of tender and juicy food, and these attain to nearly their full growth, and are just then capable of most mischief, at the time when the plant is coming into full flower. During 1869, Mr. Bishop must have lost nearly half his crop of strawberries from this cause alone. We have found this species attacking the wild strawberry in different localities, and have little doubt but that it is widely disseminated; but why it should so persistently attack the plants in one locality, and multiply so amazingly there, while comparatively unknown in other places, we are unable to do more than guess at: possibly they may have been kept under in other localities by parasites which feed on them. The larvæ of most moths are liable to attack from one or more of such enemies, and we know that this species is not exempt, for several of the larvæ which we succeeded in bringing into the chrysalis state, instead of producing moths, yielded specimens of these small parasitic flies instead.

We are indebted to Mr. C. V. Riley for determining this species for us. It was described by Dr. Clemens in the Proceedings of the Academy of Natural Sciences, Philadelphia, for August, 1860, where the author states that "the larvæ bind together the terminal leaves of Spiræa." Hence it would appear that this insect does not confine itself to the strawberry as a food plant, and may possibly be quite a general feeder.

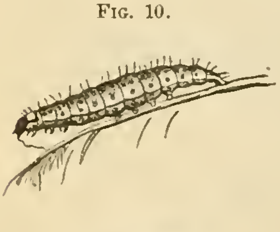
The chrysalides of this species were of the usual dark brown colour, from which the moths made their escape from the eighth to the twelfth of July.

5. A Third Strawberry-Leaf Roller (*Lozotœnia fragariana* Packard.)

This insect has been reared by Dr. A. S. Packard, of Salem, Mass., from the wild strawberry, and is described in his "Guide to the Study of Insects." The larva was found in Maine early in June, in folds of the leaves; the moth appearing about the middle of the same month. The moth is very pretty, and measures, when its wings are expanded, eight-tenths of an inch. Its fore wings are red, darker on the outer half, and with a large triangular white spot near the middle of the front edge; the outer edge of the spot is hollowed out. The outer edge of the wing is pale especially in the middle, and about the same colour as the head and thorax; the hind wings and abdomen are of a whitish buff, underneath they are whitish. It is quite likely that this species occurs also in Canada, although it has not yet been observed.

6. Other Strawberry Leaf-Rollers.

Fig. 10.



Several other species have been observed by us affecting the strawberry, all of them green, with pale or dark brown heads, and more or less semi-transparent bodies, sometimes tinged in parts with yellowish. One of these, the oblique banded leaf-roller *Lozontœnia rosaccana*, Harris' is a very general feeder, and has been already referred to in the reports of the Entomological Society of Ontario for 1870 and 1871, and to these the reader is referred fer its full history. We shall, however, reproduce the figures relating to this insect, as they will serve somewhat to illustrate all the leaf-rollers spoken of, since

Fig. 11.

they have more or less of a family resemblance in all their different stages. Fig. 10 shows the caterpillar and chrysalis, and Fig. 11 the perfect moth, with its wings expanded as well as folded.

The life history of the other leaf-rollers referred to above has not yet been fully worked out, and as they have not thus far attracted much attention, we pass them over with this brief notice.

Remedies. Since all these leaf-rollers feed on the foliage and come out of their hiding places for this purpose, an application of hellebore and water on the leaves would probably destroy many of them. It has also been recommended to plough deeply either in the Autumn or Spring, such beds as may be badly infested, with the view of burying the chrysalides sufficiently deep to ensure their destruction. Hand-picking may also be practised with advantage, as the curled leaves are easily seen.

A Cut-worm (*Agrotis*).

This is an insect which has been most unusually injurious during the past season on the fruit plantations of Mr. Mountjoy and Mr. Bunning, on the borders of Lake Huron, near Sarnia. At first its habits were not understood, and it pursued the "even tenour of its way" uninterrupted night after night; the perplexed fruit growers not knowing why it was that every day the foliage on their fruit trees and strawberry patches grew slimmer. But soon it was found that the enemy was a night worker, and this knowledge of its habits was at once turned to account, and night watches instituted with the view of counteracting this insidious foe, and with good results, as many as 1800 having been killed by Mr. Mountjoy in one night.

Their manner of life may be thus described. The moths from which the worms are produced appear on the wing during the month of August, and soon after pair, and deposit their eggs on the ground or on some plant or other substance near the ground; they probably hatch in the fall, and feed for a time on the leaves of grass and other plants then abundant, and after attaining but a small measure of their growth, they burrow into the earth, and there remain in a torpid state during the winter; but the warmth of spring revives them and soon they are abroad and active. During the first few weeks while they are still small, the quantity of food they consume is not sufficient to attract much attention; but as they approach nearer maturity, that is about the time when the trees first put out their tender foliage, the quantity of food they consume is enormous. In the day time they rest tolerably secure from harm, by burrowing a short distance underground, and towards night they sally forth from their hiding places to begin their work of destruction. They are extremely active in their movements, and travel over quite a space of ground in a very short time, eating almost everything green in their way; they climb the trunks of trees, and consume not only the young foliage, but the buds also, leaving the limbs almost bare, and before the light of another day dawns they retreat to their hiding places and rest in quiet. When full grown they burrow deeper into the earth, and form for themselves an oval cell or chamber, in which they change to chrysalis, and from which the moths are produced early in the autumn to continue the race.

In this instance these caterpillars took a decided liking for the strawberry vines, and in spite of the most vigilant search for them day after day and night after night, they defoliated a large patch of the vines to such an extent that they were utterly ruined. Nearly all through the month of June they literally swarmed and scarcely a night passed without considerable damage being done by them. It was late in the month when we received a package of the larvæ from Mr. Mountjoy, and from which the following description was taken on the second of July:—

Length one and a half inches, cylindrical, coiling the body up when disturbed, and discharging a green liquid freely from the mouth when handled.

Head small, rather flat, scarcely bilobed, of a dull brownish yellow colour, with a triangular looking furrow in front, the base of the triangle being towards the mouth; between the lobes the colour is of a slightly darker shade. On the upper part of each lobe is a blackish dot, and two or three more on each side near the base of the palpi ; mandibles or jaws tipped with dark brown.

The body above is greenish grey and semi transparent ; on the second segment or ring there is a horny plate above, similar in colour to the head, slightly bordered behind with dark brown. There is a dark greenish line down the middle of the back with a whitish centre, the green colour becoming fainter and almost disappearing on the anterior portion of the body. Along the sides, about half way down is a dull whitish line, and another of the same colour just above the stigmata or breathing holes. while close to the under surface the body is bordered with an irregular band of the same hue. On each side of the dorsal or central line above, is a small dark brown dot, on each ring or segment of the body. Stigmata nearly round and of a deep black colour.

The under surface is more transparent than the upper, especially on the anterior and terminal segments ; the colour is dull yellowish with a greenish tinge, from the internal organs showing through. The feet and legs are yellowish and semi-transparent.

In colour these caterpillars vary somewhat, some are of a deeper shade, becoming greenish brown, with the whitish lines fainter ; in these the green in the band down the back, can be seen alternately contracting and expanding when the larva is at rest, the greater transparency of the skin showing the working of the internal organs through it. Many of them died in confinement, and only six or seven completed their various stages. going into chrysalis early in July, and producing the moths late in August.

The chrysalis is about $\frac{6}{10}$ths of an inch in length, and of a pale brown colour, and is contained in a little oval chamber or cell of earth a few inches below the surface.

The moth, when its wings are expanded measures about an inch and a half across. The fore wings are pale brownish, streaked and spotted with grey ; the hind wings are of a uniform pale brownish grey, with a white fringe around the margin. There is a whitish grey band across the front just behind the head, the anterior portion of the body is dark brownish grey, and the abdomen the same colour as the hind wings.

Experience seems to indicate that these insects are much more numerous in light sandy soils, than they are where the soil is heavier.

Remedies.—This is a very difficult insect to cope with. In all probability the moths which are attracted by light might be trapped, or poisoned by hanging about pieces of cloth or flannel daubed with a mixture of molasses and a strong solution of arsenic, but as they fly late in the season, when the sense of pressing danger is past, it would be difficult perhaps, to induce people generally to take much pains with them then. Hence the battle must be fought with this insect while in the larva or caterpillar state, and then the surest way of disposing of them is to catch and kill them. By searching around the vines just under the surface of the ground during the day, many may be turned up and destroyed, and by inspecting again at night when they are active and busy their ranks may be s ill further thinned, and by continuing this treatment, day after day, they may no doubt be kept under. Probably dusting the vines with hellebore would poison them as it does other leaf-feeding insects ; this measure is at least worthy of a trial.

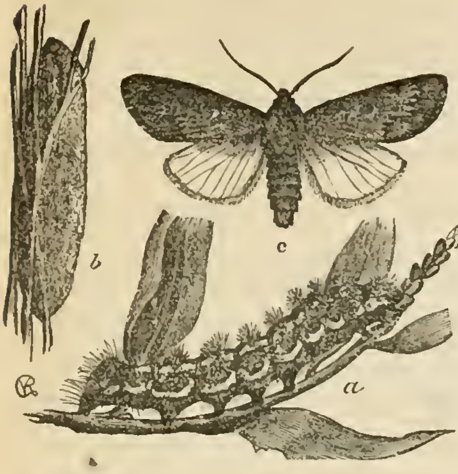
8. The Measuring Worm (*Angerona crocaotaria*, Guenee).

Fig. 12.

This larva, which was described in last year's report as injurious to the currant and gooseberry, has also been found attacking the strawberry. The caterpillar is yellowish-green, with longitudinal whitish lines, and is about an inch and a half long. The moth, see Fig. 12, varies in colour from a pale to a deep yellow, with dusky spots and dots, in some specimens few, in others quite numerous, and in the latter case the larger ones are so arranged as to form an imperfect band across the wings. For further details repecting the life-history of this insect,the reader is referred to the report of the Entomological Society for 1872, page 37.

9. The Smeared Dagger (*Acronycta oblinita*, Sm. and Abb.).

Fig. 13.



The accompanying figure illustrates this insect in its various stages. The larva is a brightly ornamented, hairy caterpillar, about one and a quarter inches long. Its head is flat in front, rather below medium size, with a few yellow hairs; its jaws are black.

The body above is of a deep velvety black, with a transverse row of prominences or tubercles on each segment, those above are bright red, and set in a band of the same colour, extending far down on each side. From each tubercle there arises a tuft of short stiff hairs, those on the upper part of the body being of a red colour, while below they become yellowish or mixed with yellow. On each side of a line drawn down the centre of the back, is a row of bright yellow spots, two or more on each segment, and below these and close to the under surface, is a bright yellow band deeply indented on each segment, the indentations being on a line with the rows of tubercles. The spiracles or breathing holes are pure white, and are placed in the indented portions of the yellow band; there are also a few whitish dots scattered irregularly over the surface of the body.

The under side is dull reddish along the middle, and brownish black along the sides; the feet are of a shining black, and slightly hairy, while the thick fleshy hinder legs, called the prolegs, are reddish tipped with brown, with a cluster of short hairs on the outside of each.

This caterpillar is conspicuous from its beauty, and at first one can scarcely believe that such a handsome caterpillar could produce so plain and quiet looking a moth. Since this larva does not usually feed in company, but is scattered about singly, and as it is such a general feeder, there is no probability of its ever becoming very injurious, but its brilliant appearance is sure to attract the attention of every beholder. We have found it feeding very commonly on strawberry, also on raspberry, and occasionally on the Lombardy poplar. Mr. Riley has found it very common on smartweed, and a correspondent of his in Jefferson City, Mo., has found them very numerous on his peach trees, and has known them to denude both apple and willow trees.

As soon as this larva is full grown it draws together a few leaves or other loose material and constructs a rude case, within which it changes to a dark brown chrysalis. In this enclosure it remains a considerable time; those that we have bred have changed to chrysalis early in September, and did not produce the moths till June following. Mr. Riley says that in Missouri there are two broods each year, and it is possible they may be double-brooded with us also, in which case the summer brood must pass through the various stages of its existence in a much shorter time.

The moth, Fig. 13, *c*., is shown of the natural size. Its fore wings are grey, with a row of blackish dots along the hind border. There is a broken, blackish, zigzag line —sometimes indistinct— crossing the wing beyond the middle, and some darker greyish spots about the middle of the wings. The hind wings are nearly pure white.

In Mr. Riley's third "Report on the Insects of Missouri," he says, "there are at least three natural enemies which serve to keep this insect in check. The largest of these is the Uni-banded Ichneumon fly (*Ichneumon unifasciatorus*, Say) a large black fly, 0·60 inch long, and characterized by a white annulus about the middle of the antennæ, a large white spot about the middle of the thorax, and a white band on the first joint of the abdomen."

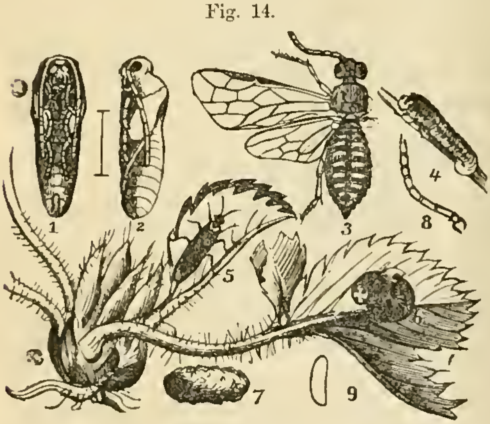
"This fly oviposits in the larva of the Smeared Dagger, but the latter never succumbs till after it has spun up and become a chrysalis, for I have always obtained the ichneumon from the chrysalis. The other parasites are smaller and work differently. They cause the larva of the Smeared Dagger to die when about full grown, and its contracted and hardened skin, which may often be seen during winter, with the head attached, fastened to the twigs of apple and willow trees, forms a snug little house, where the parasite undergoes his transformations, and through which it gnaws a round hole to escape the latter part of April. One of these flies (*Aleiodes Rileyi*, Cresson) is of a uniform reddish yellow colour. The other is a black fly of about the same size, but belonging to an entirely different genus, *Polysphincta*."

The only artificial remedy which has been recommended is that of hand-picking.

10. The Stawberry Falseworm, (*Emphytus maculatus*, Norton).

This insect, although it has not yet been observed in Canada, will very probably be with us before long. It has been common in the adjoining Western States for some time past, and as the perfect insect is winged, and during the hotter portion of the day quite active, and since the strawberry now is so widely cultivated, there is nothing to hinder the spread of this destructive insect, the habits of which it will be well for us to fully understand, so that we may know how to treat the enemy on its first appearance. We know that a near relative of this insect, the gooseberry saw-fly (*Nematus ventricosus*) has spread in a short time over a large section of our Province. Since we have had no personal experience with this foe to the strawberry grower, we shall avail ourselves of an excellent description of its life, history and habits, written by Mr. C. V. Riley, of St. Louis, Mo., and pdblished in the first volume of the "American Entomologist," p. 90.

Fig. 14.



The adjoining Figure 14, drawn from nature by Mr. Riley, admirably illustrates this insect in its various stages. 1 shows the under side of the pupa or chrysalis. 2, a side view of the same. 3, an enlarged view of the perfect fly, showing the arrangement of the veins of its wings. 4, the larva or worm crawling. 5, the perfect fly of natural size. 6, the larva at rest. 7, the cocoon. 8, one of the antennæ of the insect enlarged, showing the joints. 9, an enlarged egg of this insect. The fly belongs to the order *Hymenoptera*, and is known in popular language as one of the saw-flies. The larva is a soft dirty yellow worm, which feeds externally on the leaf of the strawberry. It is a little more than six-tenths of an inch long when full grown. Its head is of a more decided yellow colour than the rest of its body, and usually has a dark brown spot above, one nearly of the same size at the upper front, and two rather smaller ones at each side, joined by a brown line. It has twenty-two legs.

"The parent flies may be seen hanging to and flying around strawberry vines about the beginning of May, in North Illinois, Iowa and Michigan, in all three of which States we know them to occur. They are dull and inactive in the cool of the morning and evening, and at these hours are seldom noticed. They are of a pitchy black colour, with two rows of large transverse dull whitish spots upon the abdomen. The female, with the saw-like instrument peculiar to the insects of the great family (*Tenthredinidæ*) to which she belongs, deposits her eggs by a most curious and interesting process, in the stems of the plants, clinging the while to the hairy substance with which these stems are covered. The eggs are white, opaque and 0·03 of an inch long, and may be readily perceived upon splitting the stalk, though the outside orifice at which they were introduced is scarcely visible. They soon increase somewhat in bulk, causing a swelling of the stalk, and hatch in two weeks—more or less, according to the temperature—and from the middle of May to the beginning of June the worms attract attention by the innumerable small holes which they make in the leaves. The colours of these worms are dirty yellow and grey green, and when not feeding they rest on the under side of the leaf, curled up in a spiral manner, the tail occupying the centre, and fall to the ground on the slightest disturbance. After changing their skin four times they become full grown, when they measure about three fourths of an inch."

"At this season they descend into the ground, and form a very weak cocoon of earth, the inside being made smooth by a sort of gum. In this they soon change to pupæ, from which are produced a second brood of flies by the end of June or beginning of July. Under the influence of July weather the whole progress of egg-depositing, &c., is rapidly repeated and the second brood of worms descend into the earth during the fore part of August, and form their cocoons, in which they remain in the caterpillar state through the fall, winter and early spring months, till the middle of April following, when they become pupæ and flies again, as related. This fly has received the name of *Emphytus Maculatus*, by Norton, in allusion, doubtless, to the whitish transverse lines on the abdomen."

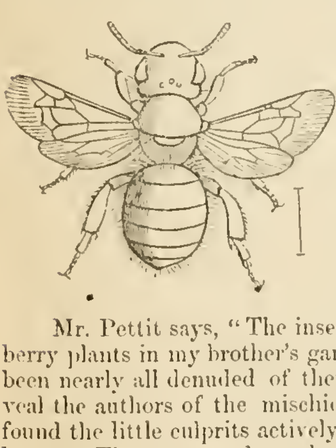
"With the facts here given, it will be no difficult matter for anyone interested to make war in his own way. The worm's habit of falling to the ground enables us to destroy them with a solution of cresylic acid soap, or any other decoction, without necessarily sprinkling the vines; while knowing that they are in the earth during the fall and early spring, when there is no fruit, the ground may be stirred and poultry turned in with good advantage."

Doubtless, also, our well-known panacea for the gooseberry sawfly, powered hellebore mixed with water, would do as good service here as it is known to do with that pest, as they both belong to the same family and have similar habits.

[Note.—Since the above was in type, I have heard of the occurrence of this insect in Warwick, Ontario, and also in Brantford, Ontario, where they are said to be so numerous, that thay soon strip a bed entirely of its foliage.]

II. Osmia Canadensis—*Cresson.*

This is the name of a small hymenopterous insect, a sort of wild bee, which has proved destructive to the foliage of some strawberry plants during the past season, in the Township of Oxford. It was observed by Mr. Johnson Pettit, of Grimsby, who kindly furnished me with specimens of the insect. For the accompanying Figure 15, which represents the female, I am indebted to my esteemed friend, Mr. E. T. Cresson, of Philadelphia, who very kindly made the drawing from which the cut was engraved. I am also indebted to him for the determination of the species. Mr. Cresson first described this species in the *Proceedings of the Entomological Society of Philadelphia*, vol. 3, p. 33. In the figure the fly is represented on an enlarged scale: the hair line at the side shows its natural length. In both sexes, the head, thorax and abdomen is green and more or less densely covered with whitish down or short hairs, those on the thorax being longest. The wings are nearly transparent, with blackish veins. The female is larger than the male.



Mr. Pettit says, "The insects were taken in East Oxford, July 2nd, on a few strawberry plants in my brother's garden. The plants, perhaps nearly 100 in number, had been nearly all denuded of their leaves, and a search in the evening having failed to reveal the authors of the mischief, I examined them again in the heat of the day, and found the little culprits actively engaged in nibbling away the remaining shreds of the leaves. They appeared to chew the fragments into a pulp and carry it away, but the little time I spent in observing them was insufficient to determine anything further respecting their habits."

Doubtless in this instance the leaves so consumed were used in the construction of suitable nests, in which to deposit the eggs and rear the young of those insects.

A Strawberry Bug (*Corimelæna—?*).

The insect above referred to belongs to an entirely different order from any of those already treated of, its place being among the *Hemiptera* or true bugs, but in its general appearance it very much resembles a small beetle, and indeed it is often mistaken for one. This bug is about one-tenth of an inch long, nearly round, and of a deep shining black colour. Its habit is to puncture the stem of the fruit and thus cause it to wither. In the *Canada Farmer* for 1867, page 328, and also in that for 1868, page 189, references are made to this insect, and it would seem that about that time it was very troublesome to the strawberries in the grounds of Mr. Chas. Arnold, of Paris, Ont., but it does not appear to have continued its devastations sufficiently since then to attract much attention. Mr. Riley refers to it as occurring in the west quite abundantly in some localities.—See *Amer. Entomologist*, vol. 1, page 207. Besides being injurious to the strawberry, it is said to have affected the raspberry, the cherry and the quince.

INSECTS AFFECTING THE HOP.

By the Rev. C. J. S. Bethune, M.A.

1. The Hop Aphis (*Aphis humuli*, Curtis).
2. The Hop-vine Snout-moth (*Hypena humuli*, Harris).
3. The Semicolon Butterfly (*Grapta interrogationis*, Godt).
4. The Hop-vine Plusia (*Plusia balluca*, Geyer).
5. The Io Emperor Moth (*Hyperchiria varia* Walker).

The cultivation of the hop has never attained to any very large dimensions in Canada, though at times, when prices have been high, it has attracted no little attention amongst the farming community. Just now the acreage occupied by this plant in Ontario is probably considerably below what it was some four or five years ago, but even yet many a lovely trellised field may be seen here and there as one travels through the country. As, however, there is nothing in our climate or soil that is unsuited to the successful growth of the plant, we have little doubt that its culture will one day become an object of great and extended importance, unless, indeed, the Canadian entirely relinquishes his English taste for malt liquor in favour of the far more baneful spirits that are now a curse to so many. The present production of malt liquor in the Dominion of Canada averages nearly eight millions of gallons a year ; in the manufacture of even this amount a very considerable quantity of hops is consumed, and if we add to it the quantity that is exported to England and the United States, it is apparent that the culture of this plant cannot be considered an unimportant item in the resources of the Canadian agriculturist. There is no doubt too, that if our hop growers paid more attention to the selection of the most approved English varieties for cultivation, and were more particular in regard to the picking and curing of their hops, they would be enabled to obtain much better prices for their crop, and would secure an unfailing market in Europe for all that might not be required here. But even should the hop, as is by no means likely, cease to be a sufficiently attractive article of commerce to lead our agriculturists to devote any of their broad acres to its cultivation, it will never fail, at least, to occupy a conspicuous place in the good wife's kitchen garden on account of its value in the production of yeast. Such being the case, then, we imagine that some account of the insects affecting this plant will not be out of place in these reports, and may prove of interest, and possibly of value, to many.

Before proceeding to the discussion of its insect enemies, we may remark that the common hop plant (*Humulus lupulus*, Linn.) is apparently indigenous to the western parts of this country as well as to Europe. We have seen it growing in great luxuriance and gathered sprays of its clustering flowers on the fertile banks of the Kaministiquia River, a few miles above Fort William, Lake Superior. It is said also to be found in a wild state on the borders of the Mississippi and Missouri rivers. The hops of commerce consist of the female flowers or seeds—the plant being diœcious *i.e.* with stamens and pistils in separate flowers on different individuals. The male flowers are very different in appearance from the female, and are grown in hop yards at about the rate of six plants to an acre, for the purpose of fertilizing and maturing the hop blossoms.

The Hop Aphis (*Aphis humuli*, Curtis).

1. Hemiptera Homoptera—Aphidæ.

It would almost appear as if no catalogue affecting any particular plant could be complete without referring to some species of Aphis, or Plant-louse, so ubiquitous and destructive are these tiny creatures. We have already noticed in these reports* the particular species that infest the apple and the wheat, and have recounted the damage that they oftentimes inflict. But when we come to the Hop we find that the Aphis, or "Fly" as it is termed in England, is, *par excellence*, its greatest enemy, and that the profits of the grower depends very largely upon the presence or absence of the hordes of this minute foe. As Kirby and Spence so strongly state, "the hop-grower is wholly at the mercy of these insects ; they are the barometer that indicates the rise and fall of his wealth, as well as of a very important branch of the revenue—the difference in the amount of the duty on hops (in England, being often as much as £200,000 per annum, more or less, in proportion as the *fly* prevails or the contrary." In this Province we have seen the produce of a field of many acres almost utterly ruined by this insect—the amount of hops. produced being diminished more than one-half below the average, and the quality of that which was gathered very much impaired.

The Hop Aphis resembles very closely in size and appearance the species that infest many other plants. As we have already described similar species in these Reports (*1st Report*, p. 77 ; *2nd Report*, p. 57), we need do no more than state that the enemy of the Hop is green in colour, and about one-tenth of an inch in length when fully grown. The accompanying illustrations display the shape and structure of the creature. Fig. 16 represents a highly magnified winged male above ; below it, on the right hand side, a male of the natural size, and on the left a magnified female. Fig. 17 represents a female on a very much larger scale. Notwithstanding the similarity in colour which exists between these insects and the leaves and stems of the Hop-plant, their presence may be immediately detected by the blackish discolouration of the leaves below where they are at work. This is caused by the continual exudation from the insects of a sweetish fluid called "honey-dew," which is emitted from the two processes that project from each side of the extremity of the abdomen. As we have remarked on a previous occasion, many insects, and especially ants, are very fond of feeding upon this sweet substance ; the latter even go so far as to perform upon the Aphis an operation analogous to that of milking a cow, for the purpose of obtaining this sweet fluid. And not content with this, some species of ants make a property of these Aphis cows, jealously guarding them, and using every means to keep them to themselves. As related by Kirby and Spence : "Sometimes they seem to claim a right to the Aphides that inhabit the branches of a tree or the stalks of a plant and if stranger ants attempt to share their treasure with them, they endeavour to drive them away, and may be seen running about in a great bustle, and exhibiting

Fig. 16

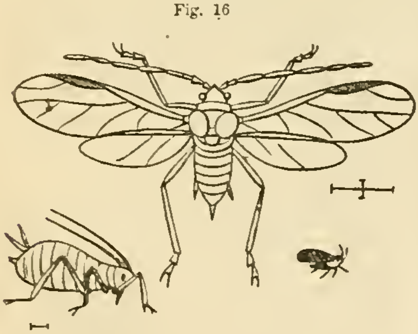


Fig. 17.

* *First Annual Report*—Insects affecting the apple, p. 77 ; *Second do*—Insects affecting the wheat crops, p. 57.

every symptom of inquietude and anger. Sometimes, to rescue them from their rivals, they take their Aphides in their mouth; they generally keep guard round them, and when the branch is conveniently situated, they have recourse to an expedient still more effectual to keep off interlopers. They inclose it in a tube of earth or other material, and thus confine them in a kind of paddock near their nest, and often communicating with it."

Another curious and noteworthy fact in the history of Aphides is their occasional migration from one place to another in enormous swarms. Nearly a century ago Gilbert White observed at Selborne, in Hampshire, a shower of Aphides, which covered persons walking in the street, hedges, garden plants, and everything else that came in their way; he considered that they were borne by the east wind from the great hop fields of Kent and Sussex. Kirby and Spence mention similar swarms in the vicinity of Ipswich in 1814, and at Hull in 1836. To come to later times, Mr. Knaggs relates (*Entomologists' Monthly Magazine*, No. 5, p. 123) that on the 14th of July, 1864, "whilst walking along the beach from Bournemouth towards Poole, a strange mossy-looking, green track, which varied in width from one to three or four inches, arrested my attention; this moss-like line, left at high-water mark by the tide, extended, so far as my observation went, for a mile, though probably to a far greater length, and consisted of millions upon millions of Aphides." The following year, it is stated by Mr. Haswell (*Ent. Mag.*, No. 18, p. 142) that the Aphides were a perfect pest in Edinburgh and other parts of Scotland in September and October; they swarmed over everything even in the streets of cities, and to such an extent that "they rendered one very uncomfortable by their numbers, especially when they got into one's mouth or eyes!"

The numbers and devastating powers of the Hop Aphis being so great, it becomes necessary oftentimes to apply some artificial remedy in order to save the crop from entire destruction. In parts of England where the labour of women and children can be obtained at a cheap rate, it has been recommended to clear the plants of insects by hand; but any such mode of dealing with them is quite out of the question in Canada. We must then have recourse to some other expedients. The following we believe to be the most efficacious:

(1.) Make a mixture of strong soap-suds; add to it salt and saltpetre till a brine is made about half as strong as ordinary beef pickle; add further a pound of copperas dissolved in warm water to every five gallons of liquid. Or

(2.) Make a strong decoction of tobacco by boiling at the rate of a pound of stems and refuse parts, or other cheap tobacco, to a gallon of water.

As soon as the insects are observed on the vines (or *bines*, as hop-growers term them.) they may be at once detected by the discolouration that we have referred to above. Go through the rows with a supply of either of these mixtures, and sprinkle them thoroughly with it. As the insects are for the most part congregated on the under side of the leaves, it is necessary to use a strong syringe, or better, a small garden engine with a rose-nozzle attached, and squirt the liquid upon the insects from beneath. Constant watchfulness and a diligent application of these means will keep a hop-yard clear of these insects, without incurring any very great expense. The modern system of training the vines upon horizontal trellises, instead of long poles, renders easy the successful employment of this method.

Another remedy that has been highly spoken of is the dusting of the affected plants with powdered plaster, which not only kills the Aphis, but is of benefit to the soil as well. Instead of plaster, sulphur, or lime may be employed with advantage, the former being especially useful also as a preventative for mildew.

In addition to the use of the artificial remedies just referred to, much benefit may be derived from the encouragement of various insects that prey almost exclusively upon the various species of Aphis. As we have before stated, when giving an account of the enemies of the Grain Plant Louse (*2nd Report, p. 58*), "the most common and useful are the different species of Lady-birds (Fig. 18); the Lace-wing Flies (*Chrysopa*), both in their perfect state (Fig. 19), and in their larval condition (Fig 20);

Fig. 18.

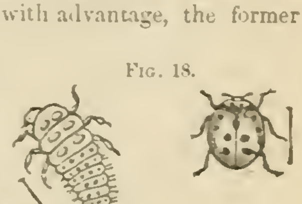
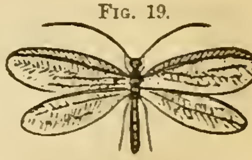


FIG. 19.



the Syrphus Flies in their larval state (Fig. 21); Fig. 22 represents a winged Syrphus Fly; Dragon Flies, &c.; all of which should be heartily encouraged by the husbandman."

It is a singular fact that the Lady-birds (*Coccinellidæ*), the first mentioned of the foes of the Aphis, occurs at times in immense swarms, like those of its prey to which we have already referred. Vast numbers of these little beetles are sometimes found on the shores of lakes

FIG. 20.

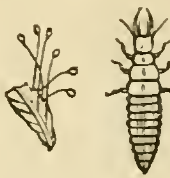


FIG. 21.

FIG. 22.

and rivers, and along the sea coast. Kirby and Spence state that "many years ago the banks of the Humber in England were so thickly strewn with the common Lady-bird, that it was difficult to avoid treading upon them." On another occasion they were observed in vast numbers on the sand-hills of the sea shore in Norfolk; again they covered the cliffs of Kent and Sussex, "to the no small alarm of the superstitious, who thought them forerunners of some direful evil!" In the summer of 1870, they were observed in various parts of England in countless numbers, while some other places were visited by swarms of Syrphus Flies—another enemy to the Aphis. The sudden appearance of all these creatures is accounted for by the supposition that the simultaneous hatching of a large number in one locality caused a scarcity of food there, and compelled many of them to move elsewhere. On coming to some obstruction, such as the sea they would accumulate in masses and so attract general attention. In *Newman's Entomologist* (No. 73, p. 16), it is stated that during the prevalence of the swarms of Lady-birds in 1870, "Mr. Jansen had an apple tree completely covered with black aphides, the whole of which were cleared off in three or four days by Coccinella septempunctata.

We trust that all who read these Reports,—farmers, gardeners, and hop-growers especially—will make it a rule never to destroy any of these most useful little creatures, and will also impress upon all connected with them the importance of following their example in this respect.

2. THE HOP-VINE SNOUT-MOTH (*Hypena humuli*, HARRIS).

LEPIDOPTERA PYRALIDÆ.

Next in destructiveness to the Hop-aphis comes, in this country, the Snout-moth; at times, indeed, it more than rivals in its injuries the other noxious insect. In the month of June, earlier or later according to the season, the Hop-grower may frequently observe the leaves of many of his vines riddled with holes, or eaten down to the ribs. On inspection, he finds a small caterpillar at work, pale green in colour, with a dark, almost blackish longitudinal stripe on the back, and two narrow white lines on each side. Sometimes these lines are wanting. The body is long and slender, with its wings or segments very prominent; each segment is furnished with two transverse rows of black dots, from each of which proceeds a short hair. The head is rather deeply divided into two lobes, and is covered with similar dots and hairs; the mouth is yellowish, with the jaws tipped with black. Unlike the majority of caterpillars, this creature is furnished with only seven instead of eight pairs of legs, being destitute of the first pair of pro-legs beneath the middle of the body. The result of this deficiency is that the caterpillar is obliged to loop itself up to a slight extent when crawling, though not to the same degree as the Geometer or measuring worms, (*Geometridæ*). When fully grown it is over half an inch in length. It is a particularly active creature, and when disturbed jerks its body from side to side, and leaps from one spot to another; it is also able to let itself down from its leaf by a fine silken thread. After it has attained to maturity it descends to the ground, and crawling into any crevice or other place of concealment, forms a slight silken cocoon and changes into the chrysalis state. In this condition it remains for a fortnight or three weeks, and then comes forth at the end of June or early in July as a dusky brown moth, measuring an inch and a quarter across its expanded wings. The fore-wings are marbled with gray beyond the middle, and have a distinct gray spot on the tip; they are crossed by two wavy blackish lines, one near the middle and the other near the outer hind margin. These lines are formed by little elevated black tufts, and there are also two similar tufts on the middle of the wing. The hind wings are dusky brown or light brown, with a pale fringe, and are without bands or spots."—(Harris). A peculiarity of the insect, from which it derives its common name of "Snout-Moth," is that it has a pair of very long and slender compressed palpi or feelers, which project from the head in the form of a snout. The accompanying wood-cut (Fig. 23) represents the creature in all its stages. There are two broods in the year; the caterpillars of the second appear in July and August, and attain to the imago state in September.

FIG 23.

This insect is rather variable in its appearance, but is oftentimes excessively destructive. In 1869 we observed two Hop-yards in the County of Peel almost ruined by it, while in the preceding and succeeding years no great number of the caterpillars was to be seen. Dr. Fitch considers it "the most universal and formidable of the depredators of the Hop, making its appearance suddenly, in a few days sometimes, and before their presence is noticed completely riddling and destroying the leaves of whole fields." In Europe there is a similar insect, termed the Beaked Snout-Moth (*Hypena Rostralis*, Linn), which may be identical with our species; probably, indeed, our insect, like so many of our greatest pests, has been introduced from the other side of the Atlantic.

The most approved remedy for the insect is to drench the vines with strong soap-suds. To shower them with powdered white hellebore mixed in water—an ounce of the drug to a pailful of water—would, we should think, be even more effective. Much might also be done by jarring the poles among which the Hops are entwined, and crushing under foot all the caterpillars that fall to the ground.

3. THE SEMICOLON BUTTERFLY. (*Grapta interrogationis*, GODT.)

LEPIDOPTERA—NYMPHALIDÆ.

The two species already described are by far the worst insect enemies that the hop-grower has to deal with. The others to which we now desire to draw attention are seldom found in sufficiently large numbers to cause much alarm, though at times their depredations are somewhat serious, especially when they attack a few hop vines in a garden.

The species before us, the Semicolon Butterfly (*Grapta interrogationis*, Godt), is a large handsome insect, with wings above of a tawny orange colour, spotted with black and brown; beneath, the wings are in some specimens rusty red, in others marbled with red and brown tints; in the middle of the underside of the hind wings there is a conspicuous silvery mark, shaped like a small semicolon (;), from which the species derives its name. The modern semicolon is employed in the Greek language as the mark of interrogation; hence both common and technical specific names have the same meaning and refer to the same characteristic. The wings of this butterfly measure, when expanded, as much as two and a half to three inches. There are two broods of them in the year, the first late in June, the other in August.

The larva feeds upon the leaves of the elm and basswood, as well as upon the hop. When partially grown, in the early part of August, it is thus described by our friend Mr. Saunders:*—"Length, half an inch. Head black; body above, black, with transverse

*Canadian Entomologist, vol. 1, p. 76.

rows of branching spines, those on the third, fourth, and terminal segments black, with a row of the same colour along each side, close to the under surface; all the other spines pale whitish. Under-surface nearly black, with dots of a pale hue." When fully grown, and an inch and a quarter in length, Mr. Saunders describes it as follows:—"Head reddish black, flat in front, somewhat bilobed, each lobe tipped with a tubercle, emitting five simple black pointed spines; head covered with many small white tubercles mixed with a few blackish ones. Body above, black, thickly covered with streaks and dots of yellowish white. All the segments, except the second, with either four or seven branching spines yellow with blackish branches. Under surface, yellowish grey; feet, black and shining; pro-legs, dull reddish."

The chrysalis is ashy-brown in colour, with the head deeply notched, and surmounted by two projections resembling ears; on the thorax is a long, nose-like prominence, giving the creature the appearance of a grotesque mask; and on the back are eight silvery spots. It is suspended by the tail, frequently under the leaves of the plant, at other times under any convenient projection. In this state the insect remains from twelve to fourteen days; the later brood usually somewhat longer.

This insect is greatly kept in check by a minute parasite belonging to the family of Ichneumons; it is called by Dr. Harris the *Pteromalus Vanessæ.* We have oftentimes been disappointed in our attempt to raise the butterfly of this species by this little fly. Everything apparently goes on well, and the caterpillar assumes the chrysalis state, but by-and-by, instead of a butterfly, out comes, through a hole in the side, a swarm of tiny flies. If it were not for these creatures the caterpillar would soon become a most formidable and destructive pest.

Fig. 24.

There are two other species of American Butterflies, whose larvæ feed upon the hop; one, not uncommon in Canada, the Comma Butterfly (*Grapta Comma,* Harris), is like the preceding species, in general appearance and habits; instead of a semicolon, it has a silvery comma on the middle of the hind-wings beneath.

Fig. 24 represents this butterfly.

The caterpillar feeds also upon the currant and elm. The other species is the Hop vine Thecla (*Thecla humuli,* Harris; *melinus,* Hubner). It ranges from the New England States to Texas and California, but we are not aware that it has yet been taken in Canada.

4. The Hop-vine Plusia (*Plusia balluca,* Geyer).

Lepidoptera-Plusidæ.

The larva of this very handsome moth feeds upon the hop, and is occasionally found in some numbers; seldom, if ever, however, is it so numerous as to become a source of serious trouble. It is essentially a Canadian insect, being but very rarely observed to the south of us.

The larva was found by Mr. W. Saunders, of London, Ontario, on the 13th of June, 1872, and is thus described by him in the January No. (1873) of the *Canadian Entomologist*:—

"Length, 1·20 inch. Body, thickest on middle, and posterior segments tapering towards the front; the body is arched or looped along the middle segments, when in motion.

"Head rather small, bilobed, of a shining green colour, with a few whitish hairs.

"Body above yellowish green, streaked and spotted with white, intermixed all through with green, thus dividing the white into a series of streaks, dots, and broken lines; there is also a line of greenish white on each side, close to the under surface. Each segment has a few tubercles of a green colour, striped with white; these are small on the 2nd, 3rd, and 4th segments, but much larger from 5th to 12th inclusive, and entirely wanting on the terminal segment. On each of the hinder segments, with the exception of the last, there are ten or twelve of these tubercles, which almost cover the whole surface, and from each of the tubercles throughout there arises a single whitish hair.

"The under surface is of a deeper green than the upper, with a few short whitish hairs, chiefly on 5th, 6th, 7th, 8th, 11th and 12th segments; feet, green; pro-legs, of which there are three pairs, green also.

"This larva became a chrysalis on the 18th of June, and produced the moth on the 13th of July."

Fig. 25.

The Moth (Fig. 25), into which this caterpillar turns is a remarkably handsome creature; the fore-wings are almost entirely covered with brilliant metallic green scales, darker below the middle, and paler towards the inner angle; they are crossed by two oblique dark lines. The hind-wings are a dusky grey, without markings. The wings expand about an inch and three quarters. We have usually taken the moth in the month of August, and have found it in various parts of this Province.

As this species is seldom numerous, it is unnecessary to suggest any remedy. In all probability its numbers are prevented from becoming excessive by some insect parasite.

5. The Io Emperor Moth (*Hyperchiria varia*, Walker).

Lepidoptera-Saturniadæ.

Besides the foregoing, there are two other insects that affect the hop-vine, respecting which we would say a few words before leaving this subject. One of these is so very general a feeder that it can hardly be termed a Hop insect; it is the larva of what is commonly known as the Io Emperor-Moth, of Harris (*Hyperchiria varia*, Walker). It feeds indiscriminately upon the leaves of willow, elm, white poplar, cornel, sassafras, cherry and locust, as well as the Hop; it is even said to eat clover and the leaves of Indian corn. When first hatched out, the caterpillars are dark brown, and covered with bristles; later on, when about a third of an inch in length, their general colour is black, the body being entirely covered with long sharp branching spines, and having two reddish white lines along the sides. When fully grown, they attain to a length of two and a half inches, and are of a delicate yellowish green colour, with a reddish lateral band, not extending the whole length of the body towards the head; the spines are then of a pale yellowish green colour, and have an irritating property, like that of the stinging nettle. Specimens that we have reared formed their cocoons in September, and appeared in the perfect state in the following June. The Moth varies very much in the two sexes, but both are remarkably handsome. The male is of a deep yellow colour, with a few darker lines across the fore-wings; the hind-wings are broadly bordered with purplish red next to the body, and have in the middle of each a large and beautiful eye-like blue spot. The female, which is usually larger, has its fore-wings, of a purplish brown colour, with grey transverse lines, and its hind-wings coloured like the male, and with a still larger eye-like spot.

The insect is quite common throughout Canada and the Northern States, but never so numerous as to be considered destructive. The Moth is one of our most beautiful species.

One other insect, to which we just now referred, is one of which we do not know the name, as we have only seen it in its larval state.

On the 27th of June, 1868, about a pint of larvæ were sent us by Mr. Wm. Magrath, of Erindale, Credit, which he had taken from the roots of his hop-plants. They fed upon the crown of the root, at its junction with the stem, and ate out a roundish cavity in it;

two or three often worked together at the same root. We endeavoured to rear them to the perfect state, but did not succeed, and have never had an opportunity since. We give a full description of the larva taken at the time, in the hope that some of our readers may be able to identify it.

Length, 1·25 to 1·50 inch. Ground-colour, dirty white ; head, chestnut-colour ; mandibles, black. Body, with a pale narrow dorsal line ; first segment above, with a glassy shield-like patch, dirty yellow, with a black edge in front ; below this, on each side and above the first pair of legs, two black shining dots, the anterior one larger than the other, which contains the spiracle. On each side of the dorsal line, a dusky lilac stripe ; and on each segment a darker flat wart in front, and a blackish dot behind, on the lower side of the stripe. Next, a pale line, broader than the dorsal line ; a lilac line of the same width ; another pale line ; a lilac tubercled stripe, having on each segment a black-tipped wart in the middle above, a tiny black dot lower down, behind it the shining black spiracle, and then another black-tipped wart ; next, a pale stripe, with a black wart on each segment, except the first and the tenth, which have each two small warts ; below this another faint lilac stripe, along the top of the pro-legs. The anal segment shining black above, white elsewhere ; and pro-legs blackish exteriorly. From each of the warts alluded to there proceeds a single dark bristle. The larva has its full complement of sixteen legs.

The more mature specimens have the lilac-stripes more obscure, and the black warts, therefore, more conspicuous ; while the less mature specimens have the lilac stripes much more developed and spot-like on the segments, rendering the black warts much less apparent.

INSECTS INFESTING MAPLE TREES.

BY E. B. REED, LONDON, ONT.

1. The Maple Borer or Beautiful Clytus (*Clytus speciosus*, Say).
2. The Rosy Forest Caterpillar (*Dryocampa rubicunda*, Fab.)
3. The American Silkworm (*Telea polyphemus*, Linn.).
4. The Cecropia Emperor Caterpillar (*Platysamia cecropia*, Linn.).
5. The Maple Owlet Moth (*Apatela Americana*, Harr.).
6. The Banded Maple Moth (*Ophiusa bistriaris*, Hubner).
7. The Maple Leaf Cutter (*Ornix acerifoliella*, Fitch).
8. The Maple Measuring Worm (*Stegania pustularia*, Guènee).

The cultivation and protection of our forest trees is a subject which is, as each succeeding year rolls by, being slowly but forcibly brought to the notice of our Canadian agriculturists.

The rapid destruction of timber trees for fuel and building purposes, and the very evident effect that is being gradually produced on our climate and soil, added to the lessons that experience in other countries affords, ought certainly to attract the attention of every well-wisher to our future prosperity. Whilst the forests of Canada are justly a source of much pride and material wealth to the community, the Maples amongst all our native trees are perhaps the best known and the most highly and widely esteemed.

Admirably adapted for shade and ornamentation, whether for garden, park, or field, most excellent for fuel, exceedingly beautiful when worked up by the cabinet maker, and especially valuable for their saccharine matter, the Maples surely stand preëminent among our native Canadian forests.

It is, therefore, very desirable that we should examine and learn something of the habits and history of any insects whose depredations would affect the growth or well-being of these beautiful trees.

1. THE MAPLE BORER (*Clytus speciosus*, Say).

Order, COLEOPTERA ; Family, CERAMBYCIDÆ.

This destructive insect belongs to a family of beetles known as the Long-horns or Capricorns, the grubs or larvæ of which are all *borers*, penetrating with ease the hardest timber, and causing immense devastation amongst the respective trees which they severally affect.

In consequence of their habits, which are exceedingly varied, the proceedings of the larvæ are difficult of observation, some living altogether in the main trunk of trees, while others attack the branches only, some devouring the wood, others the pith.

The number of species in this family is very large, and there is hardly a single kind of tree that is exempt from the attacks of one or other of these Borers.

The Maple Borer or *Clytus speciosus* was first observed and described in its beetle state by Mr. Thomas Say, in 1824. It is a very beautiful insect, and may readily be distinguished by its brilliant black and yellow colours, giving it much the appearance of a large hornet, so much so, indeed, that very few persons except Entomologists would at first sight care to touch it. In England there is a similar but smaller beetle, *Clytus arietis*, popularly known as the Wasp beetle, a member of the same family as our Maple Borer. The latter, when arrived at its perfect state (See Fig. 26), varies from 9 to 12 tenths of an inch in length, and from 3 to 5 tenths in width. The head is yellow and furnished with powerful mandibles or jaws ; the eyes and a band above them extending across the head are black ; the antennæ or horns are also black, and are curved somewhat after the fashion of those of a goat, a similarity which gave rise to their general name of *Capricorns* or goat-horns. The thorax is deep black, with two yellow oblique stripes on each side ; it is very large, somewhat globular, and flattened or depressed above. The body is deep black, oblong, somewhat cylindrical, a little flattened above, and tapering behind. The elytra or wing covers have yellow bands, the first o which forms a regular arch, of which the keystone is composed of the yellow scutel or little shield-shaped spot at the top of the wings, just behind the centre of the thorax ; the second band is in the form of the letter W, each V receiving a termination of the first band ; the third band is nearly transverse, and placed across the middle ; the fourth is bent obliquely backward, parallel with and near to a large terminal spot or band, which latter has a large black central spot on each wing case.

Fig. 26.

Colours—Yellow & black.

The elytra are each tipped with a short blunt tooth. The legs are long and yellow, with a brown line on the inner side of the thighs ; they are made for standing securely, being very broad, and with the third joint deeply notched. The underside of the abdomen is reddish-yellow, variegated with brown. Figure 26 represents the male. The female is larger and stouter than the male, and has rather shorter antennæ. She may also be easily distinguished by having a jointed tube at the end of the abdomen, which is capable of being extended or contracted at will, and is used for the purpose of conveying the eggs into the crevices or holes of the bark of the trees. These insects emit a shrill, screeching noise on being handled or disturbed. This noise is caused by rubbing the joints of the thorax and abdomen together.

The beetles may generally be seen reposing quietly on the trunks of the trees during the day time, as they are more active at night, which period they select for their excursions in search of their mates. According to Mr. Harris, the beetle lays its eggs on the trunk of the maple in the months of July and August.

The larvæ hatched from these eggs are long, whitish, fleshy grubs, with deeply marked transverse incisions on the body. Their legs, which are six in number, are only rudimentary and are of no service in locomotion ; it is by means of the alternate contraction and extension of the rings or segments of the body that these little creatures force their way through the wooden tunnels in which they live, and in order to further assist their progress each segment is furnished with fleshy tubercles capable of protusion, and which, being pressed against the sides of their retreats, enable them to thrust forward by degrees the other segments. As the grub has to feed upon very hard material it is provided with strong horny jaws, and the head, which is slightly bent downwards, is also covered with a strong horny skin. The grubs penetrate the bark, under which they lie dormant during the winter, and in the succeeding spring and summer they pierce further in, running long winding galleries up and down the trunk. The larvæ probably remain more than one year in this condition and then change into pupæ, in which state they are at first whitish and very soft, but gradually harden and darken until the time arrives when the beetle is perfectly matured, and forcing a passage through the outer bark, near which it has instinctively eaten its way whilst yet a grub, emerges into the open air.

Although the attacks of these beetles are not as yet of any great extent, still in some localities they have done a good deal of harm. In and near London, especially, we are aware of many fine and valuable maples, chiefly the hard or sugar maple, *Acer saccharinum*, that are being gradually destroyed by the operations of these insects. Their attacks can readily be detected by the sawdust and exuviæ that they cast out of their burrows, and in the spring, whilst still near the surface, it is quite possible to kill them by means of a stout piece of wire, or the judicious use of a good sharp knife.

2. THE ROSY FOREST CATERPILLAR (*Dryocampa rubicunda*, Fab.)

Order, LEPIDOPTERA ; Family, DRYOCAMPA.

The last described insect, as we have seen, attacked the wood only of the trees, but the insects we are about to treat of devour the leaves, and by their attacks on the young buds materially affect the growth of the young maples.

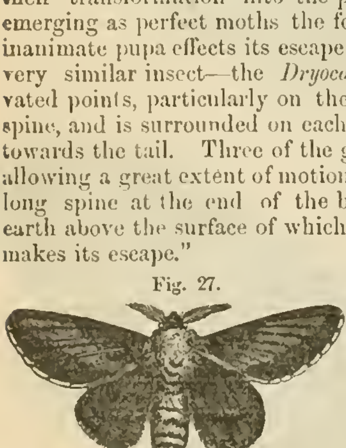
The name *Dryocampa*, signifying oak or forest caterpillar, was originally applied by the late Dr. Harris, the talented Entomologist of the State of Massachusetts, to certain insects found sometimes in great numbers on oak trees, and of which one species, *Dryocampa senatoria* is exceedingly common in the larval state. The Ruby Forest Caterpillar, however, is generally found on the silver maple, *acer dasycarpum*, or the swamp maple, *acer rubrum.*

The caterpillars are hatched about the month of July, and their presence may often be detected by their droppings on the ground beneath the trees, although it is not always easy to discover the insect itself. Mr. William Saunders has bred the moth from the larva, and we therefore avail ourselves of his description published in the *Canadian Entomologist*, Vol. II., page 75.

The larva when full grown is about one inch and three quarters long. The head is rather small, flattened and bilobed in front, of a pale orange colour, and having a black dot on each side below, near the mandibles or jaws. The body above is yellowish white, with a stripe of rather indistinct pale green on the back, and three stripes of the same hue on each side. *The third segment has two black horns fully one tenth of an inch long*, one on each side of the dorsal stripe, and spreading outwards. On each segment are several black dots or tubercles, those on the twelfth and thirteenth segments being the most distinct. On the sides of the posterior segments is a pale reddish, orange patch, nearly the colour of the head. The under surface is deep, glossy green, with a faint whitish line down the middle, and many small blackish dots or tubercles. The feet are pale reddish ; the pro-legs pale green, dotted with black.

The larvæ having arrived at maturity seek shelter in the ground, and there undergo their transformation into the pupal state, remaining thus all the winter and spring, and emerging as perfect moths the following summer. The method by which the apparently inanimate pupa effects its escape has been well described by Dr. Harris in writing of a very similar insect—the *Dryocampa imperialis:* "The Chrysalis is rough with little elevated points, particularly on the anterior extremity, and ends behind with a long forked spine, and is surrounded on each ring with a notched ridge, the little teeth of which point towards the tail. Three of the grooves or incisions between the rings are very deep, thus allowing a great extent of motion to the joints, and these with the notched ridges and the long spine at the end of the body, enable the chrysalis to work its way upwards in the earth above the surface of which it pushes the fore part of its body just before the moth makes its escape."

Fig. 27.



Colours—Pale yellow and rose.

The perfect insect, of which Fig. 27 represents the male, is a very beautiful and delicately coloured creature. The forewings are rose coloured crossed by a broad pale yellow band ; the hind wings are pale yellow with a short rosy band behind the middle, this in some specimens especially males is wanting ; the body is yellow ; the abdomen and legs are rose coloured. The male expands about one inch and three quarters, while the female reaches fully two inches, the body of the male does not extend beyond the hind wings as does that of the female. The antennæ of the latter are simple and thread like in form while those of the male, as will be seen on referring to the figure, are deeply pectinated or comb shaped to much beyond half their length, and minutely serrated or saw-shaped from thence to the tips. Dr. Harris, conjectured that sometimes two broods might occur in the season ; as in 1842, he captured specimens of the larvæ in July which produced the moth in August, and in September following, he took many more caterpillars. He, however, accounted for this on the ground, "that all insects have their periods of increased numbers which in some instances may be unfixed and irregular, but in others their periods of numbers are as fixed and regular as that of the seventeen year locust.

For young trees which are easily accessible the caterpillars may be collected by hand and destroyed.

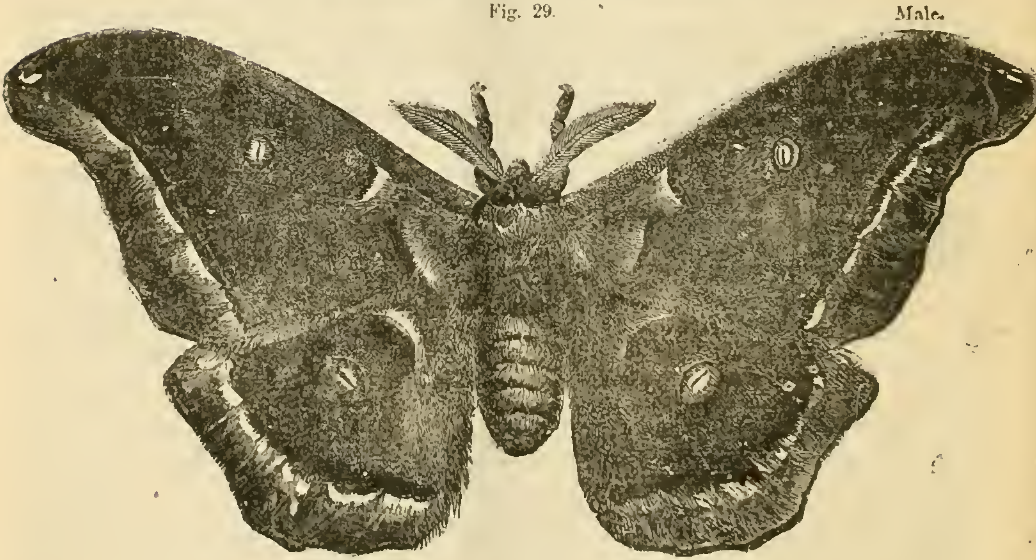
As the moths, being night fliers, are not very often seen, it might be a good idea to try the entomologist's plan for collecting moths viz: Placing a piece of rag saturated with sugar at night on the trunk of the tree, and visiting it occasionally with a lantern, and capturing with a net any of the moths that are sure to be found feeding on the attractive sweets.

3. THE AMERICAN SILK WORM (*Telea Polyphemus*, Linn.)

Order, Lepidoptera; Family, Bombycidæ.

Fig. 28. Female.

Fig. 29. Male.



Colours—Dull ochre yellow—purplish bands and eyes.

This magnificent insect belongs to the same Family as the well known Chinese Silk Worm, *Bombyx mori*. It has received the especial name of THE American Silk Worm, because for all practical purposes it is the only American silk-spinner now known that can be rendered of any commercial value. For many years *Sericiculture* or the art of raising silk producing insects, has been very seriously threatened with great loss if not entire destruction by the various epidemic diseases that affect the Mulberry silk-worm. Much attention has therefore been paid lately towards acclimatizing in Europe and elsewhere, other silk producing Bombyces in order to supersede if necessary the mulberry species. *Telea Polyphemus* being found easy of propagation, its whole history is well known and we, therefore, purpose to give our readers a detailed account of its various transformations, the more especially as it is a tolerably common insect and from its size and splendid appearance both as larva and moth, it is sure to attract attention and excite the curiosity of those who see it. Hitherto it has been supposed to feed only on oak, and those who have bred it in large numbers for the silk market have raised it exclusively on oak leaves, but it, nevertheless, frequently attacks the maples and from the enormous size of the caterpillar and its voracious appetite, a great deal of damage is often done. Figures 28, 29 are admirable illustrations of the perfect moth, male and female. Dr. Harris thus describes its appearance: "Its wings are cut off almost square at the corners. It is of a dull ochre-yellow colour more or less clouded with black in the middle of the wings, on each of which there is a transparent eye-like spot, divided transversely by a slender line, and encircled by yellow and black rings; before and adjoining to the eye spot of the hind wings is a large blue spot shading into black; near the hinder margin of the wings is a dusky band edged with reddish white behind; on the front margin of the fore wings is a gray stripe which also crosses the fore part of the thorax, and near the base of the same wings are two short red lines edged with white." On the under side the colours are paler, but the bands are more distinct. The antennæ are broad especially in the male and deeply pectinated. The wings expand from five to six inches. When at rest the wings are held elevated above the body like those of a butterfly, but if disturbed they are spread out flat, both pairs being displayed. The moth usually flies towards dusk or in the early part of the evening. The moths make their first appearance about the month of June. The female lays a large number of eggs; she deposits them on the underside of the leaves leaving but a single egg in each place.

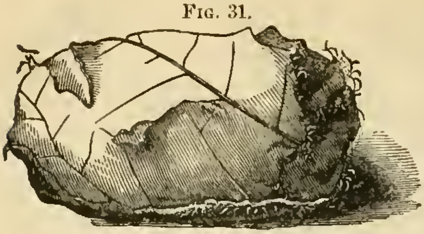
Mr. L. Trouvelot, in an admirable article in the *American Naturalist*, has given a very interesting account of his success in raising large broods of these caterpillars, having had in 1865, five acres of woodland swarming with insect life, numbering not less than a million. According to him "the incubation of the egg lasts from ten to twelve days." The caterpillar eats its way out of the egg, the shell of which it devours. The Larva (Fig 30) attains its maturity in about 70 days, having changed its skin five times during that period. It is about three inches in length, though it has a peculiar fashion of contracting its body, and hunching up its segments, when not in motion. Its colour is pale bluish green. The segments are covered with orange or reddish warts, or tubercles which have a pearly lustre, and are furnished at their extremities with a few hairs. The head and feet are brown, and the tail or anal segment is bordered with a brown V-shaped line. The sides of the body are striped obliquely with white.

FIG. 30.

Colour—Pale, bluish green—orange spots.

The cocoon, (Fig 31) which is of a regular oval shape and about two inches long, is formed

Fig. 31.



by fastening together a few leaves with silken threads, in the interior of which the larva spins a second strong and very close cocoon in which it changes into the pupa (Fig 32). These cocoons fall with the leaves in the autumn, and remain on the ground during the winter until the perfect insect emerges. The pupa is very thick and short, and shows very clearly the antennæ and wings. The larva takes about a week to complete its cocoon. The silk of which the inner one is formed is very glossy, rather coarser than that of *Brombyx mori*, and according to M. Trouvelot, can be used very extensively in commerce. It has a continuous thread and can be readily unwound. We are not aware what the actual length of the silk in each cocoon amounts to, but it must be something very great, if one may judge it by comparison with that of the Chinese silk worm. Rennie, in his *Insect Architecture*, in speaking of the latter states, "that the length of the unbroken thread in a cocoon varies from six hundred to a thousand feet; and as it is all spun double by the insect, it will amount to nearly two thousand feet of silk, the whole of which does not weigh above three grains and-a-half; five pounds of silk from ten thousand cocoons is considerably above the average." When we see the enormous difference in size between the cocoons of *Polyphemus* and *mori*, we can well believe that it may be very advantageous to the silk grower, to do all he can towards developing the experiments already made in the culture of our American silk worm. We must not forget, however, that amongst our ornamental and forest trees the larva is capable of doing much harm, and in the present instance we can only regard it as a noxious insect, and therefore one to be destroyed. Like everything else in the insect world, it has its special enemies, being very subject to the attacks of an Ichneumon fly, named *Ophion Macrurum*. Hand picking is the only remedy we are aware of.

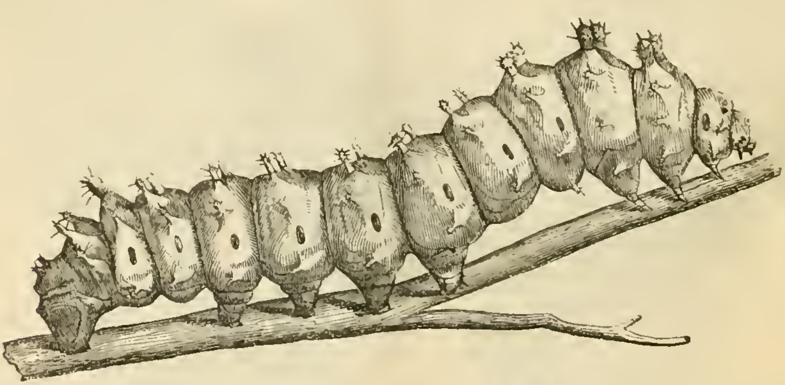
Fig. 32.

4. THE CECROPIA EMPEROR CATERPILLAR. (*Platysamia cecropia*, Linn.)

Order, Lepidoptera ; Family Bombycidæ.

This insect was fully described by the Rev. Mr. Bethune, in his treatise on insects injurious to the Apple, contained in the Commissioner's Report for 1870, to which we refer our readers for further details. As the caterpillar feeds also on maple leaves we have given a figure of it, No. 33.

Fig. 33.



Colours—Green, blue, yellow and red.

Mr. Bethune well describes it as a giant among caterpillars. It is about four inches long when full grown. The colour of the body is pale green, and it is covered with tubercles of green, blue, yellow and red colours. It spins a cocoon in a manner similar to *T. Polyphemus*, which it much resembles in its habits save that the cocoon remains attached to the trees. The larva is subject to the attacks of a parasitic *Tachina* fly. Mr. Bethune states that the most effective remedy is to go round the orchard or garden in the winter, and cut off the cocoons which are so large and conspicuous as to be at once seen.

5. THE MAPLE OWLET MOTH. (*Apatela Americana*, Harr.)

Order, LEPIDOPTERA ; Family, NOCTUIDÆ.

During the later portion of the summer months and early in the fall, the caterpillar of the owlet moth may often be met with. It is about three inches long at maturity, the upper side of the body is greenish-yellow, and covered with long soft yellow hairs, with four long slender erect tufts of black hairs, two on the fourth and two on the sixth segments, and a long single tuft on the eleventh segment; the head, last segment, and all the under side, including the feet, are black. During repose it remains curled up sidewise. Dr. Harris writes that "when about to make its cocoon, it creeps into chinks of the bark or into cracks of fences and spins a loose half-oval web of silk, intermixed with the hairs of its body; under this it then makes another and tougher pod of silk, thickened with fragments of bark and wood, and there when its work is done changes into a chrysalis, in which state it remains till the following summer." The perfect moth expands about three inches. The fore wings are light gray—near the outer margin there is a wavy scalloped whitish line, edged with black, and there are various black lines and streaks edged in the same way; as are also the reniform or kidney shaped spots in the middle of the wing. The outer edge of both fore and hinder wings is fringed with wavy black and white spots. The hind wings are of a rather darker shade of gray in the males, while those of the female are more dingy or reddish brown. All the wings are whitish and shining on the under side, with a black wavy curved band and a central semi-circular spot on each, the fringes are the same colour as on the upper side. The body is reddish brown above, and much lighter in colour on the under side. The four wings have the peculiar mark resembling the Greek letter "ψ," though not so distinctly as in "Acronycta Psi," whose history we related in the report for 1870, when treating of the plum. The Thorax is very thick, with prominent collar and shoulders.

The family name of this moth is given to it from its nocturnal habits, having been named by the great entomologist Linnæus from "*Noctua*," the Latin word for an owl. The maple owlet is the largest of our American species. It is very similar to, and has sometimes been mistaken for *Apatela Aceris*, the maple moth of Europe, although the larvæ do not bear any resemblance to each other.

6. THE BANDED MAPLE MOTH (*Ophiusa bistriaris*, Hubner.)

Order, LEPIDOPTERA; Family, NOCTUIDÆ.

It is somewhat hard to believe that this elegant little moth can be the cause of any mischief to our maples, but we must not be deceived by appearances, for it is a veritable enemy.

The moth expands about one inch and three-quarters. The wings are large, and clearly and neatly shapen. The colour of the forewings is a rich chocolate brown, with a broad lighter margin on the outer edge, with a wavy scalloped line dividing it lengthways; there are two whitish lines edged on the inner side with a deeper shade of chocolate brown, the outer of these two lines forms the inner side of the marginal broad border; the hind wings are of a uniform reddish brown, with two indistinct transverse lines and bordered with a whitish fringe, margined interiorly with a scalloped black line. The under side of all the wings is of a light brown colour, with a black wavy transverse line and a central black spot in each wing, and a broad whitish border with blackish scalloped margin, and a fringe; the body is the same colour above as the fore wings; the head is thickly clothed with deeper red collar; the feelers are erect and prominent.

The larva has been bred by Mr. William Saunders from the Silver Maple, *Acer* *dasycarpum*, and we give the following condensed description from his notes published in the *Canadian Entomologist*, vol. ii. p. 130.

A number of specimens were taken late in July. Their length was 1·40 inches; somewhat onisciform. The head was medium sized, flattened and bilobed; of a pale, ashen gray colour, a dark brown stripe on each side, and a few short grey hairs scattered on its surface.

The body above is brownish grey, with numerous streaks and dots of pale brown; a double irregular dorsal line widening here and there throughout its entire length. There are many other broken lines of the same character, composed chiefly of dots, but none of them continuous. On the hinder part of the twelfth segment is a raised crescent shaped line, edged behind with black, and on the terminal one two whitish dots, with a small patch of black at their base. The spiracles, or breathing pores, are pale, oval, and edged with black. The under surface is paler and bluish-green, with two round central blackish spots on the hinder part of the seventh and eighth segments. The feet are greenish, and semi-transparent. This larva is subject to considerable variation in its colour and markings. When about to go into chrysalis the larva cuts through a portion of a leaf of the tree on which it has fed, and turning it over constructs a snug little case, fastening it up closely and carefully with silken threads, and in this completes its transformations. After remaining in the pupa state about two weeks Mr. Saunders' specimens produced the perfect imago.

Although not appearing in any very great numbers the moth is tolerably common in the western part of the Province.

7. THE MAPLE LEAF CUTTER (*Ornix acerifoliella*, Fitch.)

Order, LEPIDOPTERA; Family, TINEIDÆ.

Many persons, we have no doubt, have often noticed a peculiar appearance of the maple leaves, resembling the effects of fire or frost, and giving a dingy brown look to the whole foliage. It is more or less common every year in this Province, but it has been unusually noticeable in the London district during the past season. It is caused by the larvæ of a pretty little moth, whose dark brilliant blue colour and bright orange yellow head may frequently attract the attention of an observer during the early part of the summer, as the moth flies about from tree to tree, or rests exposed upon the leaves.

This little creature belongs to a family that embraces the smallest in size of all our *Lepidoptera*, and many members of which are very familiar to us, as we know to our annoyance and discomfort when our furs and carpets and wearing apparel are attacked. Dr. Asa Fitch, the talented Entomologist of the State of Massachusetts, was the first to work out the life-history of this destructive little maple leaf cutter, and from his excellent treatise, published in 1856, we intend to make a few extracts. "The cause of this fading of the leaves was recently discovered upon examination. It was found that the green parenchyma or pulpy substance of the leaf was destroyed in spots and irregular patches, leaving only the fine net-work of veins and the transparent cuticle. These spots were commonly in rings or in segments of a circle, with the centres green and unaffected. In addition to these, holes of a nearly circular form appeared in the leaves, about a quarter of an inch in diameter, with others of a smaller size. A dozen or more of these holes were at that time found in almost every leaf; and some of the pieces which had been cut out of the leaf, forming these holes, might be observed adhering like round scales to the surface of the leaf, some on its upper, others on its under side. On elevating this scale from the surface of the leaf another smaller one was found beneath it, and beneath them was a small white worm, which was evidently the artizan by whom all this work had been done—cutting out these circular pieces from the leaf to form a cloak for himself, and when hungry feeding upon the pulpy substance of the leaf, thus forming the circular and irregular spots seen upon it. Occasionally one of these scales might be observed to move slightly along, the worm at such times protruding its head from under the edge of the scale, and with its feet pulling its unwieldy domicile to another part of the leaf."

"The worm within these cases is nearly a quarter of an inch in length when mature. It is slender, and of a flattened cylindrical form, soft and contractible, composed of thirteen segments marked by slight intervening constrictions. It is dull white, the head, which is strongly depressed, and the three thoracic segments pale rusty brown. An interrupted broad blackish stripe along the middle of the back is more or less distinct. Only the three pairs of legs upon the thoracic segments are distinctly developed."

"These worms, or many of them at least, are carried to the ground upon the leaves, when they fall from the trees in autumn. They remain in their cases and change to pupæ among the fallen leaves beneath the trees, in which situation they may be found early in the following spring."

Dr. Fitch mentions the fact that trees standing alone in fields or yards around houses were exempt from the attacks of the leaf-cutter. Our experience does not confirm this statement, for we found that several isolated trees were badly disfigured around the country house where we spent the past summer months. A small Ichneumon-fly, about one-tenth of an inch in length, and pale yellow, is parasitic upon the larvæ cases, and probably is of material service in checking the increase of the moth. Dr. Fitch suggests as a remedy that sheep or cattle be allowed to range the ground occupied by the sugar orchard, and if notwithstanding the trampling of the earth by cattle standing under or travelling around them, the leaves of particular trees show that they are preyed on by this moth, it will be well after the leaves have fallen in autumn to feed salt to the animals under such trees, that any insects among the leaves may be trampled upon and destroyed.

The holes made by these insects are nearly circular when first cut, bnt by the subsequent growth of the leaf they become oblong.

8. THE MAPLE MEASURING WORM (*Stegania pustularia*, Guenee).

Order, LEPIDOPTERA; Family, GEOMETRIDÆ.

We quote the following account from Mr. W. Saunders' notes, as published in the *Canadian Entomologist*, vol. iii. p. 325:

"The larvæ of this delicate looking little geometric moth feeds on the maple. It is common in the London neighbourhood, and may be readily got in season by striking the branches of the trees a sharp blow, when it drops at once part way to the ground, remaining suspended by a silken thread, by means of which, when danger passes, it can regain its position on the tree. It is found full grown about the middle of June, enters the chrysalis state within a few days afterwards, and produces the moth early in July.

"When full grown the larva measures about five-eighths of an inch in length; body cylindrical, head medium-sized, rather flat in front and slightly bilobed, and of a pale green colour, with a few very fine hairs, invisible without a magnifying glass, scattered over its surface; mandibles tipped with black."

"Body above bluish green, with thickly set longitudinal stripes of whitish and yellow; a double whitish dorsal line with bordering lines of yellowish white, neither of which are unbroken, but are formed of a succession of short lines and dots. Below these, on each side, are two or three imperfect white lines, made up of short streaks, and much fainter than those bordering the dorsal line; spaces between the segments yellowish. The skin all over the body is much wrinkled and folded."

"The under surface is green, with a tinge of yellowish between the segments; feet yellowish green, prolegs green, faintly tipped with brown."

"The moth is of a pure white colour, with three or four reddish brown spots on the costal margin of each of the fore wings, and with a faint curved line of the same, crossing them a little beyond the middle; it expands one inch."

The larva feeds on the young and tender leaflets and buds, and of course causes some injury. In all probability the same remedy would be of service as that suggested by Dr. Fitch in the case of the maple leaf cutter.

INSECTS AFFECTING THE PEACH.

By E. B. Reed, London, Ont.

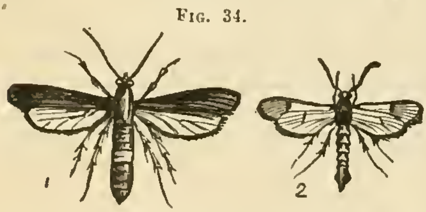
THE PEACH BORER (*Ægeria exitiosa*, Say.)

Order, Lepidoptera ; Family, Ægeridæ.

This notorious pest, which has been well termed "the silent and insidious destroyer of the peach tree," is so common, and its attacks are so universal wherever peach-culture is attempted, that we deem it matter of interest to our readers to lay before them the full details of its history. The laborious researches of those able American Entomologists, Mr. Thomas Say, of Philadelphia, Dr. Thaddeus Harris, of Massachusetts, and Dr. Asa Fitch, of New York, have caused the whole history of the peach borer to be well worked up, and it is from their writings that we propose to condense the following treatise for the benefit of our Canadian readers.

Mr. Say first described the insect in 1826, and gave it the name of *exitiosa*, a word signifying "destructive," in allusion to its powers of mischief. The perfect insect belongs to a group or family of moths, which, from their transparent wings and slender bodies with coloured bands, bear so strong a resemblance to certain bees, wasps, hornets and flies that various species have received the names of *apiformis*, the bee-shaped; *vespiformis*, the wasp-shaped ; *crabroniformis*, the hornet-shaped ; *tipuliformis*, the gnat-shaped, etc. So deceptive is this likeness that even the celebrated naturalist, DeGeer, in writing of one of the species observes, "the first time that I saw it I hesitated to take it with my naked hand, believing that I had found a wasp." The moths fly only in the day time, and they may be frequently seen basking in the sunshine. Their larvæ derive all their nourishment from the wood and pith of the various shrubs and trees which they affect, and in the stems or roots of which they lie concealed.

Fig. 34.



Colours Steel Blue and Yellow Band.

At figure 34 we give a representation of of the perfect or winged state of the peach borer, No. 1 showing the female and No. 2 the male, by which our readers will notice that the sexes differ so remarkably in appearance that it is difficult to believe that they both belong to the same species. The male, No. 2, is of a deep steel blue colour, with various pale yellow marks, and has a glossy satin-like lustre. The antennæ are black, and fringed on the inner side with numerous fine short hairs.. The palpi, or feelers, the shoulder-covers, the rings of the abdomen, and of the peculiar brush or fan on the tail are edged with pale yellow. The wings expand about one inch ; they are all transparent and glass-like, with a slight tinge of smoky yellow, their veins, margin and fringe are steel blue. The body is slender and cylindrical. The feet are black, with two rings of pale yellow on the shins.

The female, No. 1, has a very dark steel blue body, with a tinge of purple, and a broad band of a bright glossy orange-yellow colour, occupying the whole of the fourth and fifth segments. The abdomen is of a long oval form, nearly twice as broad as that of the male. The antennæ have no fringe along their inner sides. The fore wings are opaque, and of a steel blue colour, with the tips and fringes of a purplish tint. The hind wings are transparent like those of the male ; they are broadly margined upon both sides, and marked at the base with steel blue; they have five thick veins, and commonly there are traces of a straw-yellow stripe on the outer margin towards the tip. The wings expand about one inch and a half. Both sexes have several varieties, but the two above mentioned descriptions are those of the ordinary types.

The eggs are deposited by the moths in the course of the summer, upon the trunk of the tree near the root. Mr. Evan Thomas, as quoted by Mr. Say, says that "they leave from one to fifty, and in some instances nearly three hundred eggs in each tree, according to its size and capacity to support the future progeny. These soon appear, but it is difficult to detect them until they have acquired a growth of two or three weeks, when they are four or five lines in length. From this period their growth is accelerated or retarded in proportion to the quantity of nourishment afforded."

Dr. Fitch writes "that the worms when hatched work downwards, at first in the bark of the root, forming, a slender flexuous channel, which becomes filled with gum. At the distance of an inch or two below the surface the whole of the bark of the root becomes consumed in badly infested trees, and the soft sap wood is also extensively gnawed and eroded, so that frequently the root is nearly severed. The larger worms in the winter season repose with their heads upwards, in contact with the exterior surface of the root, commonly in smooth longitudinal grooves which they have excavated, their backs being covered over with the castings mingled with the gum and with cobweb-like threads, thus forming a kind of cell, the cavity of which is considerably larger than the body of the worm inhabiting it. The smaller worms have no such cell, but lie promiscuously in the gum, or between it and the root."

The presence of these borers may always be readily detected by the castings and gum which issue from the hole in the bark.

Dr. Harris tells us "that these borers, when nearly one year old, make their cocoons either under the bark of the trunk or root, or in the earth and gum contiguous to the base of the trees. Soon afterwards they are transformed to chrysalides, and finally come forth in the winged state, and lay the eggs for another generation of borers."

"The last transformation takes place from June to October, most frequently, however during the month of July in the State of Massachusetts. Here, although there are several broods produced by a succession of hatches, there is but one rotation of metamorphoses consummated within a year. Hence, borers of all sizes will be found in the trees throughout the year, although it seems necessary that all of them, whether more or less advanced, should pass through one winter before they appear in the winged state."

Dr. Fitch also confirms the statement that whoever examines infested roots will find worms upon them of all sizes, at all times of the year. From his report it appears that the pupa state lasts at least three weeks in the warmest part of the summer, and that in the State of New York the moths generally deposit their eggs about the end of July and the beginning of August. At fig. 35 we give a faithful representation of the full grown larva, and we quote its description as given by Mr. Saunders in the *Canadian Entomologist*, vol. iii.

Fig. 35.

The larva is a naked, soft cylindrical grub, slightly flattened on its under side, and measures when full grown over half an inch in length, and nearly a quarter of an inch in diameter. It is divided into fourteen nearly equal segments by broad transverse constrictions.

The head is of a medium size, with a depressed line down the centre, dividing it into two lobes. It has a triangular piece inserted in the middle, with its base towards the mouth and its apex terminating just under the anterior edge of the second segment. The head is also flattened, and of a reddish colour, becoming darker, almost black, on its anterior edge. The jaws are black and prominent. The body above is of a dull pale yellow, with the segments or rings of the body deeply cut. The second segment is of a pale reddish brown colour, smooth and horny looking. On each segment there are a few minute pale reddish dots, from which arise short reddish or brownish hairs—those along the sides and on the posterior extremity being somewhat larger. A faint line runs along each side through the stigmata or breathing pores of a paler shade on the rest of the body. The stigmata are small, nearly round, and of a dull reddish colour. The under surface is very similar in colour to the upper. The feet are tipped with reddish brown, and the prolegs are pale yellow, with the fringe of hooks crowning each, of a dark reddish brown.

From Dr. Fitch we learn that "when ready to enter the pupa state the worm crawls upwards to the surface of the ground, and there forms for itself a follicle or pod-like case of a leathery texture, made from its castings, held together by dry gum and cobweb-like threads. This follicle is of a brown colour, and oval in its form, with its ends rounded ; it is about three-fourths of an inch long, and over one fourth in diameter, but is variable in its size, being sometimes but half an inch long. Its inner surface is perfectly smooth, and of the colour of tanned leather, It is placed against the side of the root, often sunk in a groove, which the worm appears to have gnawed for this purpose, with its upper end slightly protruding above the surface of the ground. But if the earth has been stirred recently, so as to lie loose around the root, the worm will commonly form its follicle an inch or more below the surface."

A great variety of remedies have been proposed by the numerous writers who have treated upon this insect, but we think that the following extracts will give the results of those experiments that appear to have met with the best success.

Dr. Harris informs us "that the following plan, which was recommended by me in the year 1826, and has been tried with complete success by several persons in this vicinity, will effectually protect the neck or most vital part of the tree from injury. Remove the earth from the base of the tree, crush and destroy the cocoons and borers which may be found in it and under the bark, cover the wounded parts with the common clay composition, and surround the trunk with a strip of sheathing-paper eight or nine inches wide, which should extend two inches below the level of the soil, and be secured with strings of matting above. Fresh mortar should then be placed around the root, so as to confine the paper and prevent access beneath it, and the remaining cavity may be filled with new or unexhausted loam. This operation should be performed in the spring, or in the month of June. In the winter the string may be removed, and in the following spring the trees should again be examined for any borers that may have escaped search before, and the protecting application should be renewed."

Mr. James Worth, who is largely quoted by Mr. Thomas Say, writes : "The best plan of guarding against the ravages of this insect which I have found, is to examine the tree early in the month of July ; take a bricklayer's trowel, and opening the ground around the trunk the lodgment of the insect will at once be discovered by the appearance of gum, and it can be readily destroyed. One person can thus examine more than a hundred trees in less than half a day, and very few, if any, of the insects will escape."

Mr. C. V. Riley, the State Entomologist of Missouri, in his first annual report published in 1869, gives yet another remedy, and one which appears to be so successful that we cannot refrain from giving our readers the full extract. "I have had ample occasion," he writes, "to witness the effect of the mounding system during the summer in several different orchards, and am fully convinced that it is the best practical method of preventing the attacks of this insect, and that it matters little whether ashes or simple earth be used for the mound. True, there are parties who claim that the almost total exemption from borers in mounded peach-orchards is due, not to any special effect produced by the mound, but to the general rarity of the insect. But I have found no general rarity of the insect wherever I have been in our own State, but, on the contrary, have with difficulty found a single tree in any orchard that was in anywise neglected that did not contain borers ; while I have found mounded trees entirely exempt. The following paragragh communicated to the *Western Rural* by Mr. B. Pullen, of Centralia, Illinois, touches on this point, and I can bear witness to the thrift and vigour of Mr. P.'s trees :

"As spring will soon be upon us, I wish to add my testimony in favour of the "banking system," as a preventive against the attacks of the peach borer. As to its efficiency there can be no doubt, I have practised it for four years with complete success. I would not advise its adoption until after the trees are four years old. During most of this period the bark is tender and trees are liable to be entirely girdled by even a single worm. Safety lies only in personal examination and removal with the knife in fall and spring (September and April). In April of the fourth year bank up to the height of from ten to twelve inches, pressing the dirt firmly around the tree. A little dirt should be added each successive spring ; it is not only a preventive, but a great saving of labour."

As further testimony, and with a view of giving the method by which the trees may be mounded, I also insert the following communication from E. A. Thompson, of Hillside (near Cincinnati), Ohio, which appeared in the *Journal of Agriculture* of November 14th, 1868:

"The mounding system was first practised, so far as I know, by Isaac Bolmar, of Warren County, Ohio. I visited his orchards some years ago, acquainted myself with his system, and concluded to try it upon my orchard of 4,000 trees—then one year planted. I plant my trees in the fall, and in the spring following cut them back to six inches above the bud. The tree, then, instead of having one body has several—from three to six. The second summer I plough both ways, turning the furrows towards the trees. The men follow with shovels, throwing the loose soil around th trees to the height of about one foot. In the fall I cut the trees back, taking off about one-third of the year's growth. The next spring or summer I pursue the same method, raising the mound about one foot higher, cut back in the fall, and in the third summer repeat the process, raising the mound another foot, which finishes the job. The mound will then be about three feet high at its apex, and six feet in diameter at its base. The mounding need not be done in the summer or at any particular season; it is just as well done in the fall when the hurry is over. The dirt is never taken away from the trees; in fact it cannot be removed without injury to the tree, for the young rootlets each year keep climbing up through this mound. I had occasion to remove one of these mounds a few days since, and found it a mass of healthy roots."

"Now for the benefits. First, you have no trouble with the grub or borer; he must have light and air, and the mound is too much for him; he comes out, and that is the last of him. I have never wormed my trees or hunted for borers, and an orchard of healthier or thriftier trees cannot be found. It has been asserted that the borer will reappear again near the top of the mound—but I am satisfied this is not the case; I have never thus far been able to find one. Second, the system imparts longevity to the tree. I saw a tree in Warren County, treated in this manner, *thirty* years old, still healthy and bearing annual crops. Third, trees thus treated are not subject to disease. I have never had a case of *yellows* in my orchard. Fourth, the expense is trifling—one man can mound fifty trees per day. The system can be applied to old as well as young orchards; but if old trees are thus treated they should first be severely cut back, when they will make a growth of young wood."

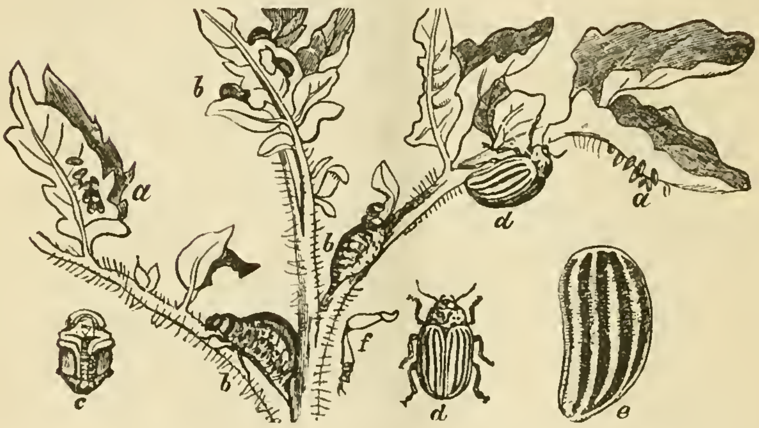
It is also stated that tobacco stems thrown round the stem of the trees have been productive of good, as they seem to have the effect of keeping away the moth.

INSECTS INJURIOUS TO THE POTATO.

By E. B. Reed, London, Ontario.

Addenda to the Report of 1870.

Fig. 36.



Colours—(a) deep orange; (b) and (c) venetian red, inclining to cream colour; (d) and (e) cream colour and black.

During the past year we looked forward with considerable anxiety to the effect that the Colorado Beetle would produce on the potato crop; we are glad to be able to report that on the whole, less mischief has been done than we anticipated. It is somewhat difficult, however, to arrive at an accurate estimate. The Bureau of Agriculture forwards every year to the Secretaries of the Electoral Division Agricultural Societies a printed circular requesting a detailed return of the crops in each district, if these returns were properly made they would afford much valuable information. It is to be regretted that they are not more universally attended to. So far as we can learn only 40 of these returns have been made for 1872, and it is on these partial details that we must base our analysis for the Potato crop. While, however, the ravages of the beetle have been somewhat less than we expected, its increase in numbers and onward progress have yet been such as to cause not only a material effect on the crop, but also to maintain a good deal of alarm amongst the farming community. A comparison of the crop returns for the two past years fully confirms the statement made in our former reports, that the second and third years of appearance of the beetle are worse than the first.

A few statistics may not be out of place here.

In 1871, 45 Agricultural Societies sent in returns shewing an average crop of 131 bushels per acre.

In the past year, 1872, only 40 Societies reported, with an average of 118 bushels per acre.

In 1871 only 14 Societies reported the presence of the beetle, while 33 were free from it, and none badly affected.

In 1872, 26 Societies report injury from the beetle, and 8 report very serious damage, in some cases almost total destruction, and only 14 appear to be free.

It is to be noticed that all the western places which in 1871 were the most badly affected, were in 1872 far more seriously attacked. In no one place do we find that the beetle after making its appearance one year, has not reappeared in the following season. The following list of Societies reporting the advent of the beetle for the first time, will shew what its onward progress is:—

Middlesex, N.	Hastings, E.	Perth, S.	Norfolk, N.
Durham, W.	Northumberland, W.	Simcoe, S.	Wellington, S.
Wellington, N.	Middlesex, W.	Niagara,	Grey, S.
Frontenac,	Peterborough,	Victoria,	Oxford, N.
Hastings, N.			

While the following were those receiving most injury :—

Bothwell,	Essex,	Middlesex, E.	Wellington, N.
Lambton,	Perth, S.	Elgin, E.	

We are quite aware of the inaccuracy of these statistics, as we know that in some of the new places the beetle appeared in 1871. We base the statements, however, upon the returns given to the Commissioner. It would be very desirable to obtain statistics of the various sorts of potatoes grown, as we are quite satisfied from our own experience that some varieties are much more subject to attack than others, and we would beg respectfully to suggest to the Commissioner of Agriculture the propriety of obtaining such information during the coming season.

From the monthly reports of the Agricultural Department published at Washington, we obtain some information respecting the ravages of the Colorado Potato Beetle in the United States.

The returns of their correspondents shew that the crop of 1872 was less than that of 1871 by about six millions of bushels. This, however, comprehends "sweet potatoes" as well. The western States, in which the potato crop had suffered for several years past from the ravages of the Colorado beetle, reported diminishing losses from that cause, and were the only States, North Carolina and Texas excepted, reporting increased production.

In the following twelve Western States, viz., Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Nebraska, Missouri, Kansas, California, and Oregon, the average yield was only 98 bushels to the acre, while the average price on December 1, 1872, was 50 cents per bushel.

Harding County, Iowa, is reported exempt, after several years' visitation of the beetle "Tyck's Seedling" Potato is claimed to be "bug proof"

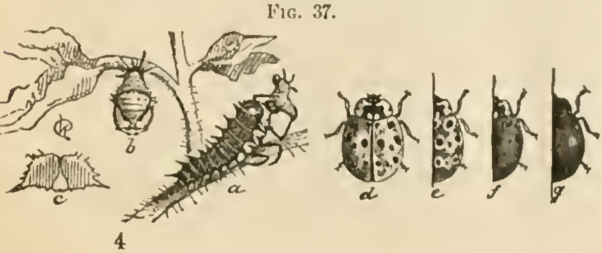
We give these statistics as it is from the Western States that the Colorado Beetle has worked its way, and they shew to some extent what effect has been produced by its ravages for some years past.

In our immediate neighbourhood at London the beetles literally swarmed, and thousands were daily trodden down on the sidewalks and streets, and we look for a still further increase next year. We may mention as a curious fact, that although we had previously seen many hundreds of thousands of the perfect beetle, it was only last season that we for the first time saw even one in actual flight; but perhaps the numbers we saw this year on the wing fully compensated for the "masterly inactivity" of those formerly observed by us.

Our natural allies the insect enemies of the Colorado Beetle appear to be slightly on the increase, thus furnishing further evidence, if any is required, that Dame Nature still maintains the "balance of power," and that for every natural evil that arises, some natural remedy is sure to be found; and although the remedy perhaps may not, in our estimation, work quite so rapidly as we could desire, yet it is none the less sure and effectual in the end.

Especially have we noticed the more frequent presence of the Fifteen Spotted Ladybird

Fig. 37.



(*Mysia* 15 *punctata*, Oliv.)—see Fig. 37—and several friends have brought us in specimens of *Perillus circumcinctus*, Say—see Fig. 38—which they detected in the act of attacking the larvæ of the Colorado beetle.

We still continue to recommend Paris Green as the chief remedy. Wherever it has been properly used, good results have invariably been obtained. It is, of course, of the utmost importance that the quality should be good. As a marketable commodity, the quality of Paris Green is exceedingly variable. It is an arsenite of copper, and the best qualities contain about 60 per cent. of arsenic, on which its activity depends, but the inferior grades contain a much smaller percentage, and are consequently much less effective, and in some cases almost worthless for this purpose. We are satisfied that every reported case of failure in the use of Paris Green as a remedy for the Colorado potato beetle, may be traced directly to the inferior quality of the poison used. We have been informed by Mr. W. Saunders, of London, Ont., that he has found Plaster of Paris a most excellent substitute for flour to mix the poison with. It should, most certainly, be very useful as a fertilizer, and where available, would doubtless be found to obtain success. Its cheapness also is a very important point in its favour. Its proportions for mixture are somewhat more, owing to the difference between the weight of the plaster and that of flour, for while the latter works well in the ratio of from 15 to 20 parts to 1 of Paris Green, the Plaster will require at least 30 to 40. Flour, however, we consider for several reasons to be still a capital material for this purpose.

Fig. 38.

There is a mixture prepared at Strathroy, Ont., which it is claimed is a very good remedy for the beetle. We tried some on a small scale, but not enough to justify us in recommending it as a substitute for the Paris Green. We purpose testing it more extensively this next season.

In the State of Illinois we are told that the following plan has been tried and found to succeed, *i.e.*, to plough a small furrow between the rows of potatoes, knock off with a stick all the larvæ into the furrows, and then by running the plough up the row again cover them with earth.

We can hardly imagine that in our climate this would answer at all, for as the larvæ when full grown seek the earth in which to undergo their transformation into the pupal and perfect states, it would seem that this plan would only kill a few of the tenderest and youngest of the brood, and would not interfere with the older and more mature ones.

From the general returns, the early crops appear to escape the more easily, and in several instances the late crops seem to have been saved by a plentiful supply of rain, even after the bugs had attacked and finally left them.

The chief thing, however, seems to be not to grow too large a crop, and to exercise a vigilant watch over what is grown; this, with hand picking and the use of Paris Green will, we think, ensure success in most instances.

We have not heard of a single case of poisoning from the bite or handling of the beetle. As to our opinion on this point, we refer our readers to our Report for 1871.

We would beg here to record our thanks to our esteemed friend, Professor Geo. Buckland, the able and well-known Secretary of the Ontario Bureau of Agriculture, for his courtesy in furnishing us with statistics of the past year's crop; the Entomologists of Ontario indeed owe a great deal to the Professor for his invariable kindness and attention to their wants, and the promptitude with which he always seeks to assist them in carrying out their attempts at Practical Entomology. We feel sure that we express the feeling of all the members of the Entomological Society of Ontario, in offering to our friend all the kindly wishes of this Christmas season, and trusting that he may long be spared to superintend the working of the Bureau with which he has been so long and so honourably associated.

ON SOME INNOXIOUS INSECTS

By W. Saunders, London, Ontario.

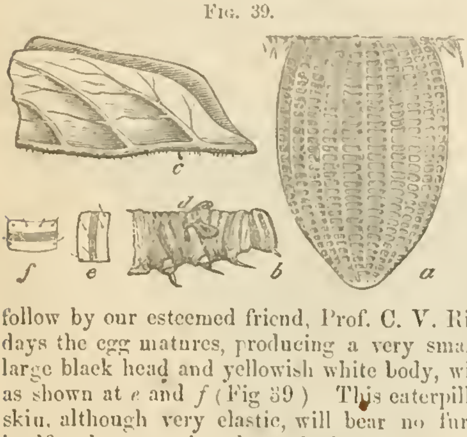
Under the above heading it is proposed to give our readers the life history of several of our more common insects, which are neither injurious nor beneficial to the farmer or fruit gorower, but which from their great abundance, or else from some peculiarity in their appearance, habits or size, excite curiosity and claim our attention.

The Archippus Butterfly (*Danais Archippus*, Fabr.)

The first insect of which we propose to treat is one of our commonest butterflies, known as the Archippus Butterfly (*Danais Archippus.*) Its first appearance on the wing is usually about the middle of May, but it is not very common until later in the season. It is said that it passes the winter in a state of torpidity, hidden in some sheltered spot where it sleeps securely till awakened by the warmth of spring. The few individuals which thus early appear, lay their eggs on the tender leaves of the young milkweed plants *(Asclepias cornuti)* and other species of Asclepias, and also on the bitter root *(apocynum Androsæmefolium)*; this takes place during the latter part of May or the beginning of June.

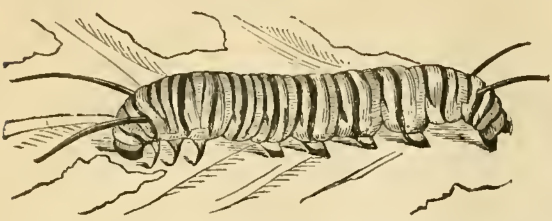
The eggs when first laid are white, but in two or three days they become yellow, and hen dull grey just before the time of hatching. They are $\frac{1}{25}$th of an inch long, conical in form, flattened at the base. When viewed with a magnifying glass they appear very beautiful, (see figure 39) where *a* represents the egg much enlarged, while at *c* it is shown of the natural size, and in its usual position on the under side of the leaf. On each egg there are about twenty-five raised longitudinale lines or ribs, and about the same number of pross-lines between each, so that the whole apwears covered with a regular and beautiful network as shown in the figure, which has been drawn from nature, as those also have which are to follow by our esteemed friend, Prof. C. V. Riley, of St. Louis, Mo. In about six or seven days the egg matures, producing a very smal caterpillar, one tenth of an inch long, with a large black head and yellowish white body, with a few black hairs on each segment or ring, as shown at *e* and *f* (Fig 39) This caterpillar grows very rapidly, and soon finds that its skin, although very elastic, will bear no further stretching, when it conveniently disrobes itself and appears in colours fresh and gay, by simply crawling out of its skin through a rent down the back, which takes place just at the proper time. This process, which is called moulting, is repeated three times during the growth of the larva, and requires no other preparation for its accomplishment than that of a short fast. Any abstemiousness shown at these critical periods in the creature's history is however soon compensated for by the enormous appetite with which it is furnished as soon as the crisis is past. At *b* (Fig. 39) the head and anterior segments of the larva just before its last moult, is figured for the purpose

Fig. 39.



of showing how the long fleshy horns with which the mature caterpillar is furnished are conveniently coiled up while lying buried beneath the old skin.

Fig. 40.



Colours—White, Black and Yellow.

The full grown larva (Fig. 40) is about one and three quarter inches long. Its head is yellowish, with a triangular black stripe in front below, and another of a similar shape above.

The upper surface of the body is beautifully ornamented with transverse stripes of black, yellow and white, the white covering the greater part of each segment, and having a wide black stripe down the centre, while the yellow occupies the spaces between. On the third segment (reckoning the head as first) are two long black fleshy horns, and on the twelfth two others of a similar character, but shorter, and not quite so stout.

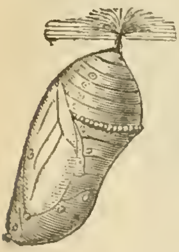
The underside is black, with a greenish flesh-colour between most of the segments.

The next change which comes over this caterpillar is that which transforms it to a pupa or chrysalis, a most astonishing transformation, when the voracious larva becomes for a time torpid, senseless, and almost motionless, while preparing for that change when it is to appear in brilliant plumage and gracefully float and flutter through the air, enjoying the summer's sunshine and sipping the nectar of flowers. Kirby in his "Introduction to Entomology" says, "were a naturalist to announce to the world the discovery of an animal which for the first five years of its life existed in the form of a serpent, which then penetrating into the earth and weaving a shroud of pure silk of the finest texture, contracted itself within this covering into a body without external mouth or limbs, and resembling more than anything else an Egyptian mummy; and which, lastly, after remaining in this state without food and without motion for three years longer, should at the end of that period burst its silken cerements, struggle through its earthly covering, and start into day a winged bird—what think you would be the sensation excited by this strange piece of intelligence? After the first doubts of its truth were dispelled, what astonishment would succeed! Amongst the learned what surmises! what investigations! Amongst the vulgar what eager curiosity and amazement! All would be interested in the history of such an unheard-of phenomenon." Yet the changes which the insect we are referring to undergoes in common with many others, is scarcely less wonderful or startling.

Fig 41.

In Fig. 41 the larva is represented as it appears at different periods during its transition to the state of chrysalis. At *a* it hangs suspended from a silken web in which its hind legs are entangled, and which has been previously attached by the caterpillar to the underside of a leaf, or fence rail, or some other secure place of retreat; and here, while hanging for about a day, the larva contracts its length and increases its bulk, especially on the anterior segments. By and by a rent takes place in the skin down the back, and the chrysalis begins to appear, and after long and persevering efforts in stretching, contracting, and wriggling the body, the skin is crowded backwards and worked nearly up to the hinder extremity, as shown at *b*; and now a difficulty presents itself, and a feat has to be performed to imitate which would puzzle the most daring acrobat, for without hands or feet to hold on by, it has to withdraw itself from the remnants of its larva skin, and hang itself up by a black protuberance crowned with a bunch of hooks at the extremity of the chrysalis. Although this feat is so wonderfully difficult, it is very seldom indeed that a failure occurs in its accomplishment. A ready explanation of the means by which this is done is given at *c*, (Fig. 41.) The joints of the abdomen being freely moveable, are first stretched against a portion of the larva skin, and by a sudden jerk backwards the skin is grasped and firmly held while the terminal segments are withdrawn and the process of suspension completed. Soon after this the chrysalis begins a series of wriggling and jerking movements with the view of dislodging the empty larva skiln after the removal of which it remains motionless unless disturbed, and becomes gradualy, harder and more contracted until it assumes the appearance represented by Fig. 42.

Fig. 42.



Colours Green and Gold.

The chrysalis is about an inch long, and of a beautiful pale green colour spotted with gold, and with a band of golden dots extending more than half way round the body above the middle; this band is shaded with black. There is also a patch of black around the base of the black protuberance by which it is suspended, and several dots of the same on other portions of the surface. The chrysalis state seldom lasts more than ten or twelve days, and towards the expiration of this period the handsome green and gold colours begin to fade, and the chrysalis grows gradually darker until the diminutive wings of the future butterfly show plainly through the semi-transparent enclosure. The escape of the imprisoned insect, now nearly ready for flight, is usually made quite early in the morning. We have several times watched for their deliverance, and have usually found it to take place soon after daybreak. A sudden crackling and slight tearing sound is heard, which arises from a splitting of the chrysalis case part way down the back; the fore legs, head and antennæ are first withdrawn, and in a very short time the entire insect is liberated. Strange looking creatures they are when they first present themselves to view, with bodies so large as to be out of all proportion to the tiny wings. When fully developed their wings measure about four inches across but when fresh from the chrysalis they are about the size of those of a large bee. The first necessity now for the welfare of the individual is to find a suitable location where the wings may be held in a good position for expanding, for without such favourable circumstance they would never attain a serviceable size. It is necessary that a position should be secured where the wings can hang down as they are expanding, for which reason the underside of a twig is often selected; and here, securely suspended by the sharp claws with which the feet are furnished, the wings undergo in a short time the most marvellous growth it is possible to imagine. We have seen the wings double their size by actual measurement within three minutes, and the whole process, from the time of the escape of the butterfly to that of the full development of the the wings, seldom occupies more than from fifteen to twenty minutes, and ere the sun is high in the heavens, on the morning of its birth, the soft flabby wings have dried and become rigid, and the butterfly is ready for flight.

A wing clipped from the insect immediately after its escape, and examined under the microscope, reveals the fact that the thousands and tens of thousands of scales with which the wings are covered, and which afterwards assume such beautiful feather-like forms, are now

Fig. 43.

Colours—Bright Orange, Red, Black and White.

nearly all linear or thread-like, not folded up or wrinkled, but undeveloped. Impressed with this thought, one is fairly astonished at the almost incredible change wrought in so limited a time, for the growth embraces not only the extension of the membraneous surface of the wing, but the enlargement and maturity of every scale or feather on it, the individuals of which appear but as particles of dust to the naked eye. What a wonderful and intricate system of circulation and power of nutrition must be possessed to accomplish this marvellous result.

The Archippus Butterfly (see Fig. 43) is so well known that it needs but little description to recall its appearance, especially where so good a figure is given. The ground colour of the wings when fresh is a beautifully bright orange red, the veins are heavy and black, and the margins are spotted with white, the latter being more or less covered or encroached upon by the general colour. Near the middle of the hind wings there appears in the figure, on one of the veins, an enlarged black streak or blotch, which, when closely examined, is found to be a small excrescence: as this is found only on the wings of the male, the sexes may be readily distinguished by this peculiarity.

We have frequently seen these butterflies in great numbers on pine trees which have been infested with aphis, attracted there no doubt by the sweet exudations which flow from the bodies of the aphis, thus interfering with the rights and privileges which have always been accorded to the industrious ant. They also have a fashion of congregating at times usually late in the season, in prodigious swarms, consisting of tens of thousands or hundreds of thousands of individuals. In September, 1871, we met with a swarm of this character, the particulars of which were communicated to the *Canadian Entomologist*, Volume 3, Page 156, as follows:—"On the first day of September while driving along the Lake Shore Road on the borders of Lake Erie, I was favoured with a sight which will not soon be forgotten. For several days previous *archippus* butterflies had been unusually abundant, and early in the morning on the day in question, some groups—numbering probably hundreds of individuals—which had rested during the night on trees adjoining the hotel at Port Stanley, were gyrating in a wild manner at all heights, some so high up that they appeared but as moving specks in the sky; others floating lower, over the tops of the trees in an apparently aimless manner. This was, however, as a mere skirmishing party when compared with the vast hosts seen a little later.

"It was about nine o'clock in the morning, when, passing a group of trees forming a rude semi-circle on the edge of a wood facing the lake, the leaves attracted attention, they seemed possessed of unusual motion and displayed all over fitful patches of brilliant red. On alighting, a nearer approach revealed the presence of vast numbers—I might safely say millions—of these butterflies, and they were clustering everywhere. I counted those on a small space, about the size of my two hands, on one of the trees, and there were thirty-two butterflies suspended on it, and the whole group of trees was hung in a similar manner. When disturbed they flew up in immense numbers filling the air, and after floating about a short time gradually settled again. There appeared to be nothing on the trees to attract them, yet when undisturbed they seemed to prefer resting in quiet, as if enjoying the presence of congenial society. I regretted not having a net with me, as I should like to have captured a number of them, to have seen in what proportion the sexes were represented in the company. Their food plants—the various species of *Asclepias*—did not appear to be unusually common in that section. I apprehended that many of the individuals must have travelled some distance to be present at this gathering" No satisfactory reason has yet been assigned for such gatherings. The fact that the larvæ of the *archippus* is but seldom affected with parasites may partially account for their occasional abundance; we only know of one small ichneumon infesting them, and have but rarely met with this.

The Disippus Butterfly. (*Limenitis disippus*, Godt.)

This butterfly is also common, but not nearly so abundant as the species last described. In the perfect, or winged state, it resembles the *archippus* butterfly very closely in colour, but it is smaller in size and may always be distinguished by the black band which crosses the hind wings, which is altogether wanting in the *archippus*.

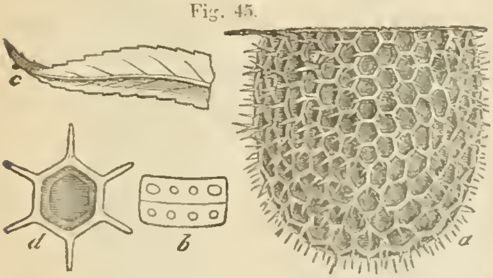
The *disippus* butterfly is represented by Fig. 44. The ground colour of the wings is of the same warm orange red as the *archippus*; the veins also are heavy and black, and the wings along their margins spotted with white. In the figure the left wings represent the upper surface, while those of the right, which are slightly detached from the body, show the under surface. The two surfaces differ but very little in colour and markings. It appears on the wing a little later in the summer than *archippus*, and deposits its eggs on the willow, which is its favourite food plant. Mr. Riley says that it feeds on the poplar and also on the plum. Although the *disippus* butterfly resembles the *archippus* so closely in the winged state, in the earlier periods of its history it is very dissimilar.

Fig. 44.

Colours, Orange, Red, Black and White.

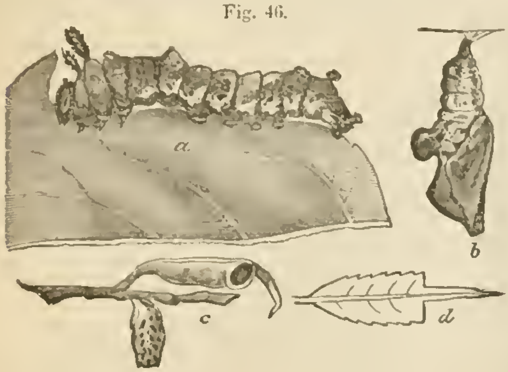
The egg is well represented by Fig. 45, and is a very beautiful and interesting object: *a* shows it highly magnified, while at *c* it is shown of natural size and in its natural position on the willow leaf. At *d* is represented one of the minute cells of the egg, very highly magnified, showing the little threadlike processes which proceed from each angle. Mr. Riley, who was the first to observe this egg, thus describes it in his "Third Annual Report," page 154. Length 0·38 inch. Diameter at base about the same. Globular, with top often slightly depressed Hexagonally reticulate, the cells more or less regular, sunken so as to give the egg a thimble-like pitted appearance, and about ten of them in the longitudinal row, and thirty in the circumference. Covered with translucent filamentouss pines, one arising from every reticulate angle and giving the egg a pubescent appearance. Each spine about as long as the cell is wide, those on the top being longest." He also says that the colour of the egg is at first pale yellow, but it soon becomes grey as the young larva within develops. These eggs are usually deposited singly near the tip of the leaf, generally on the underside, but sometimes on the upper side, and occasionally two or even three together.

Fig. 45.



The newly-hatched larva is nearly one-tenth of an inch long, with a large yellowish brown head. The body is pale yellowish brown with darker streaks, and with a few pale dots and warts, from which latter arise pale spines or bristles. In about a month from the time of hatching the larva becomes full grown, and appears as shown at *a*, Fig. 46, the following description of the mature larva was published by us in the *Can. Entomologist*, vol. 1, p. 94. Found feeding on willow, July 24th. Length one inch and a quarter. Head rather large, flattened in front, strongly bi-lobed, pale green, with two dull white lines down the front, and roughened with a number of small green and greenish-white tubercles. Each lobe is tipped with a green tubercle, or short horn.

Fig. 46.



The body above is dark rich green, with patches and streaks of dull white; the second segment is smaller than the head, and its surface covered with many whitish tubercles: the third segment dull whitish green, raised considerably above the second, with a flat ridge above, having a long brownish horn on each side of it, thickly covered with very short white and brown spines; fourth segment about the same as third, with the same kind of ridge above, with a small tubercle on each side, tipped with a bunch of short whitish spines; between the ridges on third and fourth segments are two small black dots above. Each segment from fifth to thirteenth inclusive, has two tubercles, one on each side, and in a line with the long horns on third segment, each crowned with a cluster of whitish spines; the tubercles on sixth and twelfth segments are much larger than the others those on the eleventh and terminal segments next in size, those on the ninth smallest. The tubercles on the seventh, eighth, tenth and eleventh segments have a streak of white at their base, and each segment behind fourth, excepting ninth, has several smaller tubercles of a bright blue colour. A large whitish patch covers nearly the whole of the ninth and parts of the eighth and tenth segments, and another of a similar character covers the second, third and part of the fourth. A white stripe extends along each side, close to the under surface, from the fifth segment to the end of the body, and in which is set a small cluster of whitish spines about the middle of each segment, from sixth to tenth inclusive. On each side of seventh, eighth and tenth segments is an elongated blackish spot, just above and behind the spiracles; the terminal segment has two dark greenish brown spots above in front of the tubercles. The spiracles are rather large, oval and brownish-black.

The under side is whitish-green, with a central dull white stripe on the hinder segments; the feet are brown, ringed with brownish-black; the prolegs pale greenish, faintly tipped with brown.

This caterpillar varies somewhat in colour, some specimens being of a paler green than that just described.

The chrysalis, Fig. 46, *b*, Mr. Riley describes as "marked with burnt umber, brown, ash grey, flesh colour and silvery white, and is characterized, like that of the other species of the genus, by a curious, thin, almost circular projection, which has been likened to a Roman nose, growing out of the middle of its back."

There are two broods of this insect during the year; the larvæ resulting from the eggs deposited by the second brood usually attain to less than half their full growth before winter, when they hybernate and complete their growth the following spring. The interesting preparations made by these caterpillars in the construction of little cases, in which they rest tolerably secure from harm while in this state of torpor, is thus described by Mr. Riley "First and foremost—with wise forethought, and being well aware through its natural instincts that the leaf which it has selected for its house will fall to the ground when the cold weather sets in, unless it takes measures to prevent this—the larva fastens the stem of the leaf with silken cables securely to the twig from which it grows. It then gnaws off the blade of the leaf at its tip end, leaving little else but the mid-rib, as shown in Fig. 46, *d*. Finally, it rolls the remaining part of the blade of the leaf into a cylinder, sewing the edges together with silk. The basal portion of the cylinder is, of course, tapered to a point, as the edges of the leaf are merely drawn together, not overlapped; and invariably the lower side of the leaf forms the outside of the house, so as to have its projecting mid-rib out of the way of the larva, as it reposes snugly in the inside. The whole when finished (see Fig. 46, *c*,) has somewhat the appearance of the leaf of a miniature pitcher plant. These curious little cases may be commonly found upon our willows or poplars in winter time.

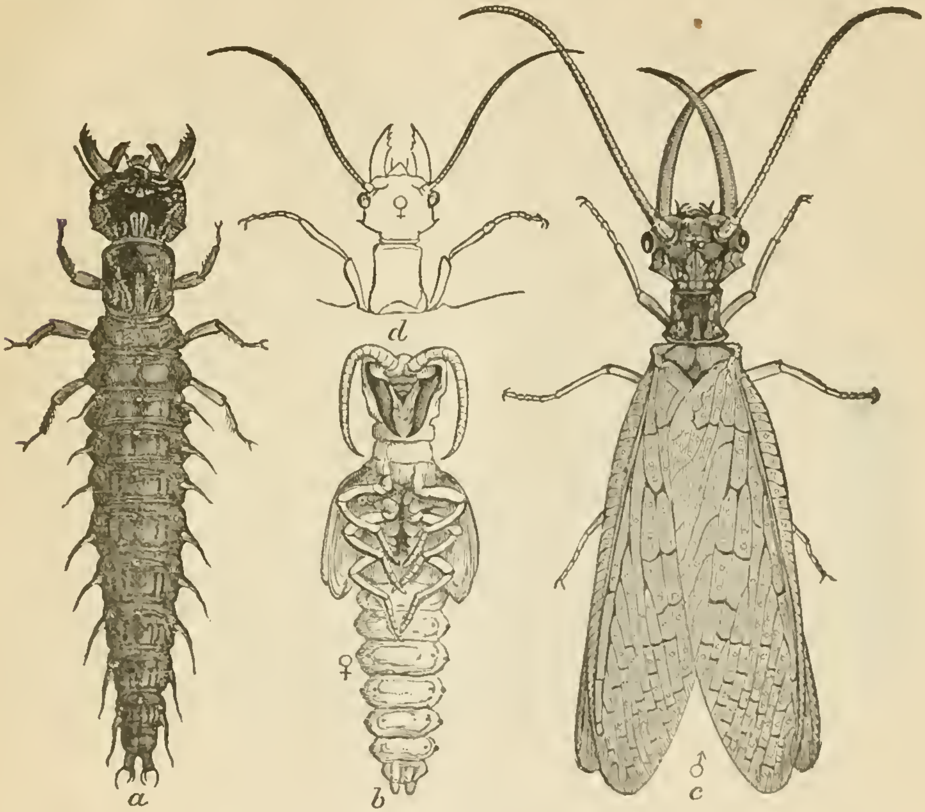
This insect is liable to the attacks of several parasites, which effectually prevent its increase beyond certain limits. One of these parasites is a tiny dark four-winged fly, which infests the eggs of the *disippus* butterfly; another is a very small black four-winged fly; and a third a larger two-winged fly, both of which attack the insect in its caterpillar state.

The Hellgrammite Fly (*Corydalis cornutus*—Linn.).

This is an insect which is not uncommon throughout Ontario, and whenever and wherever found, either in the larval or perfect state excites much surprise and curiosity from its large size and formidable appearance; it is not, however, in any way poisonous, as some people imagine it to be. In Fig. 47 this insect is represented in its several stages, while the expanded female is shown in Fig. 48. The larva—a most diabolical looking creature, *a*, Fig. 47—spends the earlier portion of its life in the water, crawling and swimming about upon the bottoms of rivers and streams, feeding upon the larvæ of various other insects which also inhabit the water. Mr. Riley has published a very interesting account of this insect in the first vol. of the American Entomologist, from which most of the following remarks are condensed.

Most aquatic larvæ spend the period of their chrysalis state in the water, and only emerge therefrom when ready to pass into the perfect or winged state; but the insects form ing the group to which this larva belongs, leave the water while they are still in the larval state and do not usually become pupæ for several days or even weeks thereafter. Hence the Creator

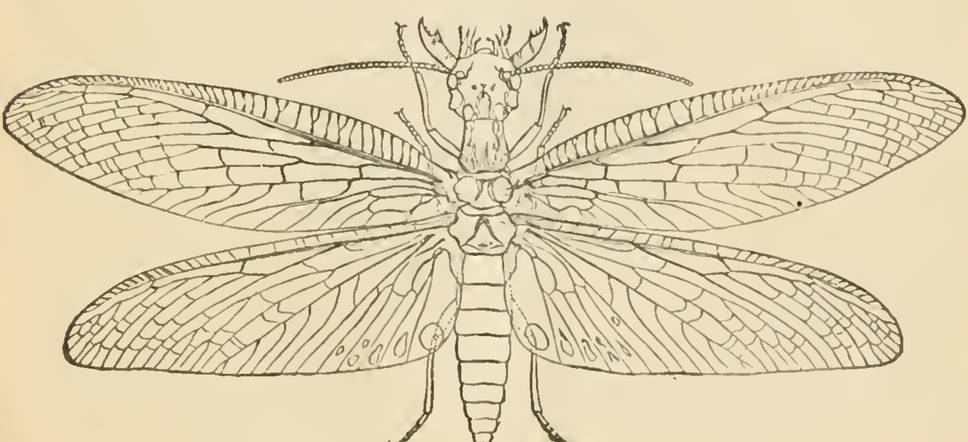
Fig. 47.



Colours—(*a*) rk brown, (*b*) whitish, (*c*) and (*d*) light brown.

to meet their necessities has given them a double system of respiration— a set of gills to breathe with in the water, and a set of breathing holes, or spiracles, to breathe with upon

Fig. 48.



land. In this larva the gills assume the form of paddle-like appendages, and are placed one-pair upon each of the seven front segments of the abdomen, while the spiracles are arranged in the usual manner along the sides of the body. After leaving the water the larva crawls rapidly about, chiefly in the night time, in search of a safe and suitable place in which to spend the chrysalis stage of its existence, usually selecting the under surface of a flat board or log, or burrowing under some large stone. Before attaining its object it sometimes wanders as much as a hundred feet from the water's edge, and an instance is given of one which crawled up the wall to the roof of a one-story building, and then tumbled accidentally down the chimney, to the great dismay of the good woman of the house. At this stage of their existence they are sometimes used by fishermen for bait, and having a very tough skin, one larva often suffices to catch several fish. They can pinch pretty sharply with their strong jaws, and they use the processes at their tail to assist them in climbing.

After a suitable hiding place has been selected, the larva forms a rude cell in the earth, and here changes to an inactive chrysalis (see Fig. 47, *b*). In this figure the wing cases are slightly spread apart from the body to show their shape and structure, whereas in nature they are closely appressed to the sides of the body. The larva leaves the water usually about the beginning of June, and by the end of that month, or the beginning of July, the perfect insect bursts its bonds and appears in the winged state.

Fig. 49.

In this form it measures, when its wings are spread, from four and a half to five inches; these, as shown in the figure, are gauze-like and covered with an intricate network of veins. The forewings are streaked with dark brown and sprinkled with whitish dots, of which latter there are also a few on the hind wings. The male—Fig. 47, *e*—is remarkable for its enormous jaws, which are very long and hook-like, while the female—Fig. 47, *d* and Fig. 48—has short jaws. The flies hide themselves in obscure holes and corners during the day and become active as the shades of evening gather. They frequently fly into houses situated near running water, soon after dusk, attracted probably by the light.

The eggs of the Hellgramite Fly—Fig. 49—are oval, about the size of a radish seed, and of a pale colour, with some dark markings. They are usually deposited in patches, upon reeds or other aquatic plants overhanging the water, where, when hatched, the young larvæ may find ready access to that element which is destined to be its home until the end of the following spring.

BENEFICIAL INSECTS.

By the Rev. C. J. S. Bethune, M. A.

Introductory (General Account of Insects).

Introductory.

Hitherto, in our Annual Reports, we have devoted ourselves to the consideration of those numerous species of insects that inflict damage upon our crops, fruits and vegetables, while we have only incidentally drawn attention to those other species that are useful to us as destroyers of their noxious fellows. We now propose to treat more especially of the latter class—our Insect Friends. We shall include amongst the number of these friends not merely those parasitic tribes whose special duty it is to keep in check the vegetable-feeding insects that would otherwise sweep everything away before them, but also those various other families that are directly useful to us from their products, or indirectly beneficial by acting as scavengers, removing nuisances, fertilizing plants, and performing other valuable offices. This is, indeed, a vast field of nature—one that we cannot traverse in a few pages or in a limited space of time; we must content ourselves, then, with taking one portion of it at a time and considering it somewhat in detail, in order to afford information that may be of use to the reader. Where to begin, and what mode of division to select is not an easy matter to decide; we think, however, that it will tend to simplicity, if we follow the natural orders into which insects are distributed, taking one at a time and selecting for consideration those families or tribes which are especially serviceable in their different ways. We shall thus not be confined to one form of service fulfilled by insects, but be presented with a variety in turn, and at the same time we shall be able to touch slightly upon a few of the leading distinctions upon which classification is based.

In order to render our arrangement intelligible to the ordinary non-Entomological reader it is advisable that we should give a brief account of the principal structural differences upon which the classification into Orders depends. In the first place, then, an Insect as the name implies (Latin :—*in* and *seco* I cut), is an animal whose body is divided into segments or rings, which are sometimes—as in wasps and hornets—almost entirely detached from each other, and cause the creature to appear as if cut in two. It thus belongs to that portion of the Animal Kingdom called the *Articulata*, the members of which have their bodies composed of short cylinders or annulations, jointed or articulated together. Insects may be distinguished from the Articulata by several characteristics. They breathe, for instance, not through their mouths, like the larger animals, nor yet through gills, like fish, but by means of spiracles or breathing holes in their sides, through which the air is drawn in and taken to all parts of the body. This mode of breathing distinguishes true insects from many kinds of animals that are sometimes included in the same class with them, such as crabs, lobsters, shrimps, etc., which breathe through gills, and spiders. scorpions, etc., which have breathing sacs in the abdomen. The head of insects is distinct and more or less plainly separated from the rest of the body, thus differing again from crabs, scorpions and spiders. In their larval or grub state insects have, in many cases, a large number of legs, even as many as twenty-two in the caterpillars of some saw-flies, but in their perfect or winged state they never have more than six; this limitation separates them from spiders, which have eight; Centipedes which have from thirty to forty or more, and Millipedes or thousand-legged worms, which have in some species as many as two hundred. Another marked characteristic of insects is their wonderful system of metamorphoses or changes of state (for instance, from egg to caterpillar, caterpillar to chrysalis, and chrysalis to butterfly), ending, in the great majority of cases, in the acquisition of wings. A few other classes of animals undergo some metamorphoses,— in fact, if we include the embryo state, all do so,— but none of these attain to a winged form. Again, insects in their perfect or imago condition uniformly possess a pair of those very singular organs which we call feelers or Antennæ (from the Latin *Antenna*, the yard of a ship's mast), and which are not possessed by any of the numerous members of the spider family. Furthermore insects have their six legs, referred to above, very highly organized, with numerous joints and applications to fit them for all manner of purposes, and very different from the mere bristle like appendages of many worms.

To recapitulate, the distinguishing marks of an insect are briefly these:—1st. They have their bodies divided into *segments*; 2nd. They breathe through openings in their sides *(spiracles)* from which proceeds *tracheæ* or windpipes; 3rd. They have distinct heads, with jointed *antennæ*; 4th. When adult they have *six articulated legs*; 5th. They go through a number of metamorphoses, ending in a *winged state.*

These are the five grand characteristics of an insect proper; any members of the animal kingdom that do not possess them we exclude from the class, and omit from our consideration in these Reports. Many authors, we are aware, take a somewhat different view of the limits of the class of insects, and—regarding Spiders, Scorpions, Mites, Centipedes, Millipedes, etc., as degraded forms of insects—include them in their Entomological systems. As we all agree, however, pretty much in our definition of an insect proper, it becomes merely a question of technicalities rather than one of practical moment, whether we include or exclude these lower and closely allied forms. For the sake of simplicity and of greater ease in imparting information, we prefer to adhere to the limitations that we have laid down. Any of our readers who desire to look further into the matter—and we trust there may be many—we would refer to Dr. Packard's *Guide to the Study of Insects* as a convenient repertory of information gathered from the works of all the leading authorities upon the subject.

In the higher orders of animals—to quote an account that we wrote some years ago,—* while the internal anatomy is wonderfully complicated, the outward appearance is comparatively simple and plain; all the works of the intricately constructed machine are concealed from view, a few primary organs only being apparent to the sight. In insects the case is just the reverse. The internal organs are few in number and simple in construction; while the external parts are particularly numerous, and marvellously varied to suit the special ends of the almost infinite number of differing species. To the student of Entomology this is a manifest advantage, as with the aid of a magnifier he is enabled to observe and note most of the various parts, or trace out their special uses, without having to resort to the dissection of the object. The great majority are on the surface, and if we give them a little careful examination and patient study we shall soon learn a great deal about them. The most obvious parts of an insect, when closely examined are: 1st: the *Head* and its appendages; 2nd: the *Thorax* to which are attached the wings and feet; and 3rd. the *Abdomen*, which is composed of several joints or segments and which is usually terminated by the organs of generation, or a sting or other instrument.

When we look at the head of a quadruped, we see that it is very small compared with the rest of the body, and that it exhibits only a pair of eyes and nostrils, a mouth, ears, and sometimes horns or tusks. A bird's head, again, displays still less, little more being seen than a pair of eyes and a beak. But take up an insect and examine its head with a lens, or, if it be a large specimen, even with the naked eye, and what a complicated structure do you

* *Canada Farmer*, April 15th, 1868, p. 126.

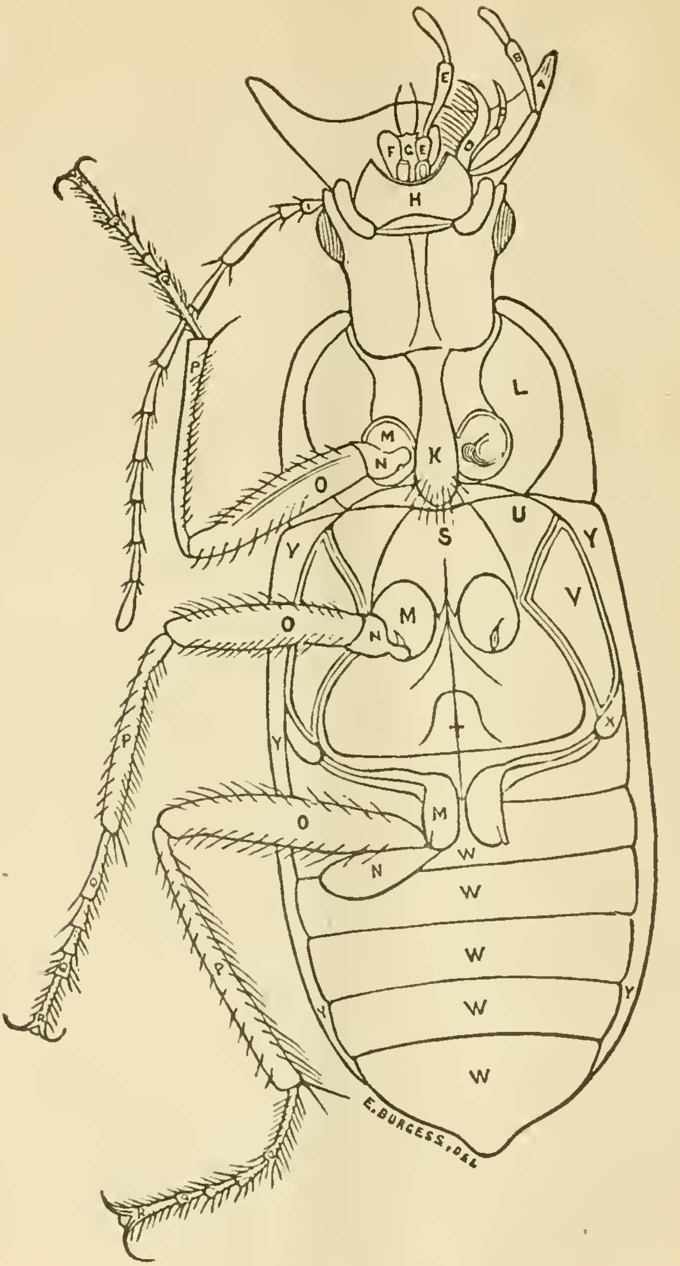
behold! Eyes there are, big and little, antennæ or horns; mouth with jaws above and jaws below, pairs of feelers or palpi, perhaps a sucker, or possibly a set of lancets; instruments for observation, instruments of defence, instruments for taking food, all grouped together in a very small space, and constructed in the most wonderful variety of ways. Compare a few insects of different orders together, and the wonder is still greater. Look at the head of the large Pine-borer beetle, with its powerful jaws and antennæ twice the length of its body, then at the Dragon-fly with its scarcely perceptible antennæ, but with eyes that almost surround it; look again at a large Hawk-moth, with its beautiful feather-like antennæ, and its coiled up sucker that will unroll to more than the length of its great body; now turn to a grasshopper, a fly, or a bug and see what a change—what a variation of organs is to be seen! To recount all these differences of form, structure, size, colour, clothing, etc., would occupy volumes, without even saying a word about their objects and offices. We must be content, then, with considering the organs as they are common to all, and only observe, for the present, the variations that distinguish the several grand orders of insects, leaving out of sight the minor differences that are peculiar to species, genera, or even families.

The *Head* of an insect—to come to particulars—is a hard, somewhat rounded skull; having an opening in front for the mouth and its group of organs, On each side it has a fixed, immoveable eye, of large size and complex structure, between which are sometimes two, or often three, tiny little eyes, each consisting of a single lens. Close to the large eyes are two moveable jointed organs, called antennæ, of endless variety of form, size and structure, whose exact uses have long been a puzzle to naturalists. The front part of the head is often separated by a seam from the rest of the skull (especially in Beetles), and is then called the *Clypeus* or shield; this part often bears a horn or knobs. The under surface of the head is called the throat, and is divided into various parts, each with its particular name, in the different orders of insects. The head is connected behind with the thorax, sometimes by a very slender neck, sometimes by a barely perceptible division.

The *organs of the mouth*, though varying very much in form, are yet constructed on one principle. They consist of six principal organs, two on each side of the opening, one above, and one below. The upper one is the upper lip (*labrum*); the lower the under lip: the upper pair of side organs are the upper jaws or *mandibles;* the lower pair the *maxillæ* or lower jaws: Each of the lower jaws has attached to it one, or two, jointed organs or feelers, called *palpi*, and the under lip has also a pair of these feelers. The jaws, it should be noticed, move sideways, not up and down. There are two principal modes in which the food obtaining organs are employed, the operation of which is vastly different, and causes an enormous change in form and structure. When the side pieces of the mouth are short, apart from each other, and have a horizontal motion, the action produced is *biting*, as in a beetle; but when these side pieces are elongated, pressed close to each other, and have a longitudinal motion, the action produced is *sucking*, as in a butterfly. According to these modes of action, insects are divided into two grand classes, called in English, *Biting Insects* and *Suctorial Insects*; any classification based upon this difference, must, however, be confined to insects in their perfect form since caterpillars, for instance, have jaws for biting, which are transformed into a spiral sucking-tube when the insect becomes a moth or butterfly.

In *Biting Insects* the upper lip is a flat plate closing the mouth above; the upper pair of jaws or mandibles are of a hard, horny consistency, and are furnished with teeth for biting and gnawing the food; these teeth are portions of the jaw itself, not separate in any way. The lower pair of jaws or maxillæ, are modified in many ways which it would be tedious to particularize here; and the lower lip is still more complicated, and subject to great variations. In bees, the lower jaws and lip form together a sucking apparatus, while the form of the upper biting jaws causes them to be included among the biting insects. The accompanying large wood-cut, (Fig. 50) of a highly magnified beetle, exhibits all the various parts of the mouth of a biting insect, as well as the legs, abdomen and other parts of the under surface. The clearness of the illustration renders much description superfluous.

Fig. 50.



HARPALUS CALIGINOSUS, Say.

PARTS OF CUT.

Ventra Surface of *Harpalus Caliginosus.*

A Mandible.
B Maxillary palpus.
C Outer lobe of maxilla.
D Inner lobe of maxilla.
E Labial palpus.
F Paraglossæ.
G Ligula.
H Mentum.
I Antenna.
K Prosternum.
L Episternum of prothorax.
M Coxæ.
N Trochanter.
O Femora.
P Tibiæ.
Q Tarsi.
R Ungues.
S Mesosternum.
T Metasternum.
U Episternum of mesothorax.
V Episternum of metathorax.
W Ventral segments.
X Epimeron of metathorax
Y Epipleura.

In *Suctorial Insects* there is a wonderful diversity of structure. Bugs, for instance, have the two pairs of side-pieces lengthened out into slender lancet-like organs for piercing, the whole being enclosed in the fleshy elongated lower lip, which acts as a sucker. (Fig. 51 *a*.) In Flies, also, the five

Fig. 51.

a b

upper organs are turned into lancets sheathed in the fleshy sucker of the lower lip; this structure is especially seen in the fierce, blood-thirsty Horse-fly (*Tabanus*); in the common House-flies the lancets are wanting. In Butterflies and Moths the lower jaws are greatly elongated into a delicate instrument for sucking, which is coiled up and hidden from sight when the insect is at rest, but is thrust out and extended to the bottom of long-throated flowers when in action. (Fig. 52.) In all these cases the palpi, or mouth-feelers, also are variously modified. The other organs of the mouth about which we need not now speak in particular are the antennæ, and the different kinds of eyes.

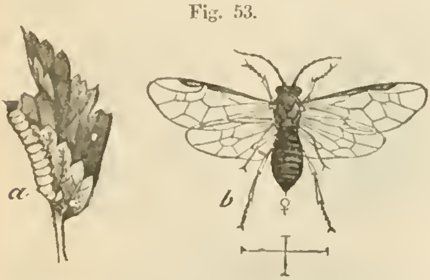
Fig. 52.

We have just now spoken of insects as being divided into two great sections according to the structure of the mouth in the perfect insects, viz; Suctorial (*Haustellata*) and Biting (*Mandibulata*). These sections are further subdivided into seven Orders, depending upon the structure of the wings. We shall briefly recount the special characteristics of each Order, and then turn from what we fear are dry, even though necessary, details to the consideration of our proper subject—Beneficial Insects.

There is an immense difference of opinion among Naturalists with regard to the arrangement of these Orders, but as this is a question that does not concern us in these Reports we shall not enter into it, but merely content ourselves with following here the series adopted by Dr. Packard.

Order 1. HYMENOPTERA. (Greek: *Hymen* a membrane, and *Pteron*, a wing). Includes Bees, Wasps, Sawflies, Ants, Ichneumons, etc. Four membranous wings, with few veins or nervules; the hind pair usually the smaller. Fig. 53 represents a Saw-fly and its larva; Fig. 54 a magnified Ichneumon.

Fig. 53.



a b ♀

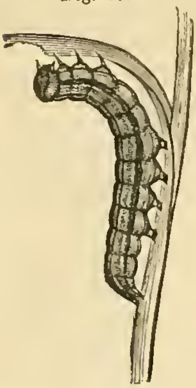
Fig. 54.

Order 2. LEPIDOPTERA. (Greek: *Lepis* a scale, and *Pteron* a wing). Includes Butterflies (Fig. 55.) and Moths. (Fig 56.) Membranous wings, generally four, entirely covered with scales, antennæ almost always composed of numerous minute joints. Butterflies may be distinguished from moths by their club-shaped antennæ; the latter have these organs of very various forms, but never clubbed or thickened at the extremity. The larvæ are usually called caterpillars (Fig. 57),

Fig. 55.

Fig. 56.

Fig. 57.



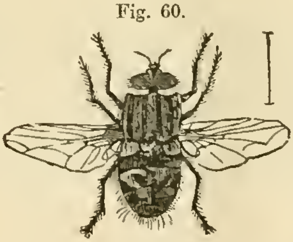
and are so familiar to every one that we need not enter into any description of them; they may be distinguished from the false caterpillars of Saw-flies by never having more than eight pairs of legs. The pupa is usually termed a chrysalis (Fig. 58), and sometimes is protected by a cocoon.

Fig. 58.

Order 3. DIPTERA. (Greek: *Dis* twice; *Pteron* a wing). Includes the common Horse and Flesh-flies, Gnats, Mosquitoes, Crane-flies, etc. Two wings only apparent, the hinder pair being in a rudimentary condition, and represented by what are termed 'halteres,' poisers or balancers (Figs. 59 and 60). The larvæ are usually destitute of feet, and are called 'Maggots;' some, however, as the mosquitoes are aquatic and actively locomotive. This order, as well as the two preceding, belongs to the Suctorial or Haustellate section of Insects.

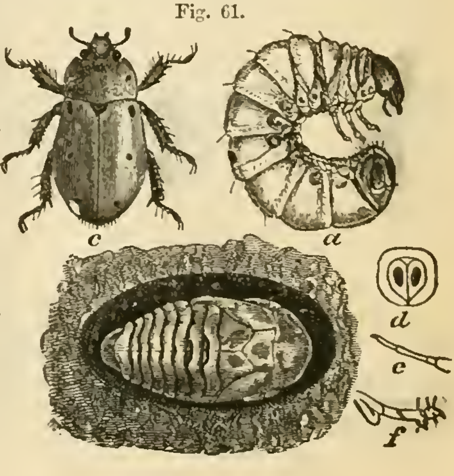
Fig. 59.

Fig. 60.



Order 4. COLEOPTERA. (Greek: *Coleos* a sheath, and *Pteron* a wing). Includes all the various tribes of beetles. Four wings usually present, the anteri r pair of which are hardened and thickened so as to resemble the substance of the head and thorax, and are n t adapted for flight, but form protecting cases (called *elytra*) for the ample hind wings, concealed beneath them. Fig. 61 represents a perfect beetle (*c*), the larva (*a*) and pupa (*b*). The mouth is always furnished with jaws for biting.

Fig. 61.



Order 5. HEMIPTERA. (Greek: *Hemi* half, and *Pteron* a wing.) Includes Bugs, Plant lice, Boat-flies, Cicadas, Cochineal Insects, &c., Four wings, the anterior pair of which are stiff and hard like those of the beetles, for about half their length, while the remainder is thin and membranous; the hinder pair are also membranous. The mouth is furnished with a sucker or beak, through which they imbibe the fluids, animal or vegetable, upon which they live. (Figs. 62 and 63).

Fig. 62.

Order 6. ORTHOPTERA. (Greek: *Orthos* straight, and *Pteron* a wing.) Includes Grasshoppers, Locusts, Crickets, Cockroaches, &c. Four wings, the anterior pair of which are somewhat thickened to protect the broad net-veined hinder pair, which fold up like a fan upon the abdomen, in long straight folds. The hind legs are large and thick, and adapted for leaping. Mouth furnished with strong jaws for biting and masticating.

Fig. 63.

Order 7. NEUROPTERA. (Greek: *Neuron* a nerve, and *Pteron* a wing). Includes Dragon-flies (Fig. 64), May-flies, Caddis-flies, Termites, Lace winged flies, etc., Four thin, glassy wings, very finely reticulated, or covered with a fine net-work of veins or nerves. The mouth is usually furnished with biting jaws.

Fig. 64.

1. TIGER BEETLES (*Cicindelidæ*).

Having now enumerated the various Orders into which Insects are divided, and their chief characteristics, it remains for us to select one for our consideration here, in respect to those of its members who may be deemed directly or indirectly beneficial to mankind. We have decided upon beginning with the Beetles (*Coleoptera*), partly because they are very favourite objects of study with Entomologists, and partly because they present strongly marked peculiarities both in structure and habits, and are very abundantly distributed everywhere. The first family of Beetles is the *Cicindelidæ*, of which we have only one genus, *Cicindela*, in Canada. This name, derived from the Latin, signifies a Glow-worm or bright shining insect, and is applied to them on account of their bright metallic colours, which sparkle in the sunshine. In English they are commonly called Tiger-beetles from their fierce disposition and habit of leaping upon their prey. They feed entirely upon other insects, both in the larval or grub state, and when they attain to the winged or beetle condition. Their favourite haunts are warm sunny banks, sandy roads, railway tracks, or other spots exposed to the full glare of the sun, and free from vegetation, which would impede their movements. Some species, however, frequent grassy places on the borders of woods and among scattered trees. At the approach of the passer-by they suddenly take wing, and fly with great rapidity for a few yards before him, alighting again as suddenly as they rose, but always with their heads turned in the direction of the approaching danger. The same individual may be started up again and again, but after a few alarms, when he begins to find himself the object of a particular pursuit, he craftily eludes further persecution by making a long and circuitous flight back to his former station. By carefully marking where he goes, and going quietly back, we have often succeeded in finding the desired specimen careless and off his guard, and captured him even without the aid of a net. In cloudy or stormy weather they hide themselves in some convenient retreat, but they soon re-appear with the returning sunshine.

The eggs are laid in the earth, where the grubs that are hatched from them also spend their lives. These grubs or larvæ are very curious creatures, and well repay a little observation. It would be difficult to describe their form so as to render them easily recognizable to the reader, but the accompanying cut (Fig. 65.) will afford a sufficiently good idea of their appearance.

Fig. 65.

It will be seen that they have a pair of tremendous, curved jaws, three pairs of legs, and a pair of very curious recurved hooks or spines on the eighth segment towards the tail. They are of a yellowish white colour with a brownish horny head. They live in deep round holes, about the diameter of a lead pencil, the orifice which they usually close with their heads. No sooner does any unsuspecting insect approach sufficiently near than it is seized by a sudden effort, and carried off to the bottom of the hole, there to be devoured at leisure. The larva lives in this manner throughout the summer, and is supposed to pass through its pupa state in the ground during the winter, appearing in the beetle form early in the following spring.

The beetles, of which over one hundred different species are known to inhabit North America, and about a dozen have been found in Canada, are provided with sharp cutting jaws, three pairs of long slender legs, which enable them to run with great rapidity, and a pair of membraneous wings, concealed beneath the handsome wing-covers when not in use. They feed upon small insects of every description, and must destroy incalculable numbers. The accompanying figures of some of our commonest species will enable the reader to recognize them without difficulty.

Fig. 66.

Fig. 66 represents the common Tiger-beetle (*Cicindela vulgaris*, Say), which is found in great numbers all over Canada and the United States. It is a little over half an inch long, and about half as broad, of a dull purplish colour above, and a bright brassy green beneath. On each wing cover above are three whitish lines of irregular shape, as seen in the figure. It is very common on roads and sandy banks throughout the summer.

Fig. 67 represents the purple Tiger-beetle (*C. purpurea*, Riv.), a very handsome metallic purple beetle, nearly the same size as the preceding, in company with which it is often found. Sometimes it is greenish instead of purple. This is one of the first beetles to come out in the spring. We have taken it in numbers in April, and once as early as the 17th of March, before the snow had all gone.

Fig. 67

Fig 68.

Fig. 68. The hairy-necked Tiger-beetle, (*C. hirticollis*, Say) is another common species that bears a general resemblance to *C. vulgaris* though smaller, and with the neck covered with whitish hair, as the name implies.

A most beautiful species is the Six-spotted Tiger-beetle, (*C. sex-guttata*, Fabr.), a most brilliant metallic green insect, with six tiny white spots on its wing-covers. It is sometimes found in gardens, but more usually in partially shaded places, where it chooses as its post of observation some projecting stone or log. It is rather difficult to capture, being exceedingly active in its habits, and is not nearly so common as the preceding species.

Fig. 69.

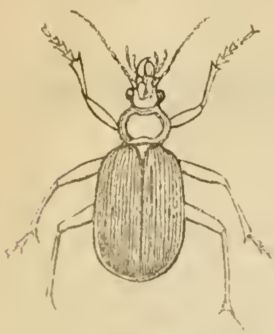
Fig. 69 represents another very handsome and rather larger species which is occasionally found in Canada. As all these beetles live upon other insects, and devour enormous numbers of those that are injurious to us, we beg that our readers, one and all, will abstain from ruthlessly trampling them under foot in the future, and will rather encourage them about their farms and gardens.*

2. Carnivorous Ground Beetles. (*Carabidæ*).

Next of the Tiger-beetles comes the family of the Carnivorous Ground Beetles (*Carabidæ*). Under this general name are included a very large number of different genera and species, which are found all over the world and in all sorts of situations. In Canada we have over forty genera and an immense variety of species already known to our Entomologists, and more are added to the list every year. Some of the species are the most difficult to determine of all our beetles, and afford an intricate puzzle to the student; the general features of the whole family can, however, be easily learnt from a few specimens, descriptions and illustrations of which we now proceed to place before the reader.

* To avoid misapprehension we would state that in this account of the Tiger Beetle, and in those that follow, we have quoted freely from our own contributions to the *Canada Farmer*. As our articles are scattered over a number of volumes and have not been published in consecutive form, we think no apology is needed for their partial reproduction here.

Fig. 70.



Colours, Metallic Green, Purple and Copper.

The largest and handsomest member of the family is the green Caterpillar-hunter (*Calosoma scrutator*, Fab.—'The Beautiful-bodied Searcher'). Fig. 70. It is of the same general shape as the following species, but no wood-cut can convey an idea of its exceeding beauty and brilliance of colour. The head and thorax are dark purplish black, the latter with a greenish coppery margin; the wing covers (elytra) are bright and shining green, with fine longitudinal lines and scattered punctures, and a broad, coppery red margin; the under-side is deep shining green varied with coppery markings: the legs are blackish-brown, in some lights deep purple. This magnificent beetle, as its name implies, feeds upon caterpillars, especially the obnoxious canker-worm of the United States, sometimes even ascending trees for the purpose; its larva (or grub) has also the same useful propensities. It is rather a rare insect in Canada, though found occasionally in most parts of Ontario; collectors of insects can often find specimens in summer after a southerly gale, on the outer shore of Toronto Island, which is a famous place for obtaining rare beetles that have been drowned in the lake and washed ashore by the waves.

Fig. 71.

Another caterpillar-hunter, (Fig. 71), belonging to the same genus as the preceding, is quite a common insect in Canada, and can be found in May and June under logs or stones, as long as the ground is moist; in the hot dry weather it is not so readily met with. It is called the hot, or glowing Calosoma (*C. Calidum*, Fabr,) from the appearance of the wing-covers, which are black with six rows of bright coppery impressed spots, thus bearing a fanciful resemblance to a vessel of coals with a perforated cover. Its general colour is shining black, unrelieved except by the spots just mentioned; still it is a handsome beetle, though not to be compared to the preceding species. Like its congener, it devours caterpillars with avidity, both in its larval and perfect states, and is a capital hand at reducing the numbers of those horrid pests, the cut-worms; we usually transport a number of these big beetles into our garden every spring to keep down these cutters-off of our young cabbage plants.

Fig. 72.

The next large beetle of this family to which we would draw attention, is the murky ground beetle (*Harpalus Caliginosus*, Say); it is entirely of a dull black colour, and may be readily recognized from Fig. 72. We beg our readers to take particular notice of this figure, as there are a very large number of beetles of the same general shape and structure, though usually smaller, that prey upon other insects and are consequently useful to man. Any dark-brown, black, green or metallic coloured beetles of this shape, that are found under chips, or stones in damp places, or running in grass, may be safely considered as belonging to this family, and therefore be treated with kindness and consideration; it always gives us a pang of regret to find the crushed body of one of these beetles lying by the way side, where it has been ruthlessly trampled under foot by some ignorant "lord of creation." The particular species here referred to is stated by Mr. Riley to be a formidable enemy of that western plague, the Colorado potato beetle; it is also satisfactory to learn that an allied species (*H. Pensylvanicus*, De Geer ?) a very common insect in Canada, is a merciless devourer of the plum curculio. Fig. 73 represents the perfect insect, and Fig. 74 the larva.

Fig. 73.

A much smaller but very peculiar genus of beetles, is called the Bombardier (*Brachinus*,) from its extraordinary power of discharging from its tail end a very pungent fluid, accompanied by a report (resembling the sound *phut*) and some smoke-like vapour; this fluid, which resembles nitric acid in its effects, and makes a stain on the fingers that will last for several days, is no doubt intended for its defence against more powerful beetles. Fig. 75 represents one of these beetles (*B fumans* Linn.); its head, thorax, and legs are yellowish-red, and its wing-covers dark blue. Like other ground beetles, it may be found under sticks and stones in the spring, and in similar hiding-places on the damp margin of rivers during the hot summer months. There are quite a number of different species of this genus in Canada, but all are very much alike.

Fig. 74.

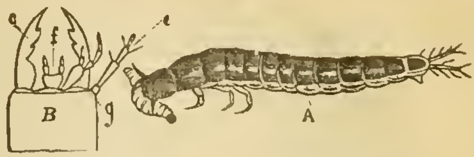


Fig. 75.

It would be almost an endless task to go through the list of species of this family, but we trust that the examples now given will be sufficient to enable our readers to recognize these friendly beetles, and save them from being doomed to a pitiless destruction, that knows no difference between friend and foe.

3. Water Beetles (*Dytiscidæ, Gyrinidæ &c.*)

After the carnivorous Ground Beetles, we come, in the ordinary classification of insects to a large group that live almost entirely in or upon the water. Some of them live on the surface of lakes, ponds and pools; others prefer clear running streams; others, again, the muddy bottoms of half stagnant pools.

This group is divided into two principal families, the "diving-beetles" (*Dytiscidæ*). and the "whirligigs" (*Gyrinidæ*). They are all more or less insectivorous, both in their larval and perfect state, and hence beneficial. As their food, however, consists mainly of insects that inhabit the water, and which are either similar in their food and habits to their destroyers, or live upon water plants of no particular value, it can hardly be said that they are beneficial to the farmer or fruit-grower; still, as they are not noxious and are certainly useful in their own sphere, we shall go on to describe them, and implore that their lives may be spaied from the destruction so universally dealt out to the poor insects.

The Diving-beetles (*Dytiscidæ*) are mostly large-sized insects of an oval flattened shape, generally of a dark brown, olive, or blackish colour, and often with a margin and other markings of yellowish. Their legs are specially adapted for swimming, being large and oar-like, and covered with long hairs; the hinder pair are very much flattened, also, so as to give a propelling stroke. When they rise to the surface to take in a fresh supply of air—a silver-like bubble of which may generally be seen attached to their hinder extremities—they appear to come up merely from being specifically lighter than the water; but when they dive or swim through the liquid, which they do with great swiftness, they move by means of regular and successive strokes of their oar-like legs. When at rest upon the surface they extend these legs at right angles with the body, generally with the head under water and the tip of the abdomen above, enabling them to draw in air to the spiracles beneath the wing-covers. They inhabit stagnant pools in preference to running water, and are very voracious in their habits, attacking and devouring other denizens of the water, even occasionally preying upon very young fish. We have kept a specimen for many weeks in a glass jar of water, and watched its graceful movements and curious habits with much interest; it fed greedily upon house-flies, aphides, etc., with which we supplied it.

Their larvæ are called "water tigers" from their ferocity; they are long and cylindrical, with large flattened heads, armed with scissors-like jaws, by means of which they seize other insects, and, it is said, "snip off the tails of the tadpoles!" Their body terminates in a pair of long tubes through which they inhale the needful supply of air. When about to transform they creep into the earth near by, and make a round cell, inside of which they assume the pupa state, the perfect beetle appearing in two or three weeks, if in summer, but not till the following spring if in the autumn. We have sometimes seen little pools of water in the spring perfectly swarming with these and other larvæ.

The whirligigs (*Gyrinidæ*) must be familiar to every one. They are those litttle black beetles that one sees so often in groups on the surface of water, whirling and circling about in every direction with great rapidity. "When thus occupied their motions are so exceedingly quick that the eye is perplexed in following them, and dazzled by the brilliancy of their wing-cases, which glitter like bits of polished silver or burnished pearl. On approaching them they instantly take alarm and dive beneath the surface, carrying with them a little bubble of air, which glitters like a drop of quicksilver, and is attached to the posterior portion of their bodies. Sometimes they may be taken flying, their large wings enabling them to change their abode without difficulty, when the drying up of their native pool compels them to migrate. This enables us to account for the occasional discovery of these insects in small puddles of newly-fallen rain water. The structure of the short hind legs, and especially of the curious branched tarsi, must be examined in endeavouring to account for the singular motions of these insects; the assembling together of which has been regarded by some writers as resulting purely from a strong social influence, and by others as indicating no closer bond than that of animals congregating round their common food. That the food of the Gyrinidæ consists of small dead floating insects, I have ascertained; but I would further suggest that, being produced on the same spot, as is the case with the swarms of midges, they are influenced in some degree by the common desire of continuing their species. I have often observed that, in their gyrations, they hit against one another. In dull and inclement weather they betake themselves to quiet places, under bridges, or beneath the roots of trees growing at the water's edge. When touched they emit a disagreeable odour, arising from a milky fluid, which is discharged from the pores of different parts of the body. The remarkable structure of the eyes, which, unlike those of most insects, consist of two distinct pairs, one on the upper and the other on the lower surface of the head, must be greatly serviceable to the insect in the peculiar situation in which it is generally observed, and whereby it is enabled to see objects beneath it in the water, and above it in the air." (Westwood). They are all of a broad, oval form, generally of polished black colour, with broad oar-like hind tarsi, and long slender fore-feet, used in seizing their prey. They vary in size from about one-fifth to half an inch in length.

Besides the Diving-beetles and the Whirligigs, there is yet another great family of aquatic beetles, which belong to a different sub-tribe of this order of insects; its members are termed "Water Lovers," (*Hydrophilidæ*) from their habits.

The members of this family live either in the water, or on the damp margins and shores of streams and ponds; they are carnivorous in the larval state, but as beetles they feed upon refuse and decaying vegetable matter, thus uniting the qualities of the two families already noticed, and those of the scavenger beetles, which we purpose bringing before the reader by and by. A considerable number of these "Water Lovers" are found in Canada; some of the species attain a very large size, while others are quite minute, and not to be discerned without close observation. As these creatures are not of any very general interest, we may dismiss them from our notice and pass on to the more conspicuous and note-worthy Carrion Beetles.

4. Burying and Carrion Beetles. (*Silphidæ*).

These curious and interesting creatures belong to the family *Silphidæ*; they are distinguished by the flattened form of their bodies, their knobbed antennæ, their habits, and the black nauseous fluid they discharge when handled. Their grand duty is to remove from the surface of the earth all dead or putrefying animal matter, which would otherwise become noxious and offensive. They are usually found in or close to carrion of all sorts, though sometimes they devour putrid fungus; occasionally we have taken them on the wing, and have even found them attracted by light into our rooms in summer. The *Silphidæ* are divided into several genera, the chief of which are *Necrophorus*, including the Sexton or Burying Beetles, and *Silpha*, the Carrion Beetles; both of these genera are well represented in Canada.

The Sexton Beetles (*Necrophorus*), in spite of their loathsome occupation, are decidedly handsome insects. Their usual colour is deep shining black, variegated with rich orange-red spots; beneath they are frequently ornamented with yellowish silken hair like that of a Humble-bee; their antennæ are very remarkable, consisting of a jointed stem terminated by a rose-coloured or orange knob composed of four little cups or plates piled one above the other. The largest species we have is called the American Sexton (*N. Americanus*, Oliv.) ; it is nearly an inch and a half long, deep black, ornamented above with large orange-red spots on the head, thorax, and wing-covers, and beneath with light yellow hairs on the breast.

These insects are wonderfully powerful for their size, their flight is vigorous, and they are able to run with rapidity. We have at least ten species of these grave-digging beetles in Canada, differing from each other in size and ornamentation, but all possessing the same habits and instincts. They are not at all uncommon during the summer months ; no sooner, indeed, is any small dead animal or piece of flesh left in a decomposing state on the surface of the ground, than they assemble in troops to bury it. After a careful examination of the object, as if to take its dimensions, and ascertain how many labourers would be required for the job, several of them commence operations by creeping beneath the carcass and digging away the earth with their fore-legs ; they continue their labours till they succeed in sinking it several inches, sometimes nearly a foot, beneath the surface ; and at the end of twenty-four hours the object is generally out of sight, unless it be particularly large, or the ground difficult to work in. In this labour the males assist, and as soon as it is accomplished, the females deposit their eggs in the carcass.

Many curious and interesting accounts have been published respecting the habits and instincts of these creatures—two interesting narratives of the kind are given in the *Canada Farmer* for July 15th, 1868, page 214. A German Entomologist relates that he confined four beetles of this genus in a small space, and supplied them with the following quantity of materials : four frogs, three small birds, two fishes, one mole, two grasshoppers, the entrails of a fish, and two pieces of ox's liver ; they succeeded in interring the whole in fifty days. Of course this quantity was much more than sufficient for the nourishment of their future progeny, for whose benefit the burying takes place, and it was probably only because these carcasses were placed within their reach that they continued their burying propensities, (Westwood). As a further instance of their powers, we may mention the following case, related in the *American Entomologist* :—

"On one particular occasion, having deposited a full-grown rat upon newly-moved earth in a particular spot, as a trap for these Burying-Beetles, we found that in twelve hour's time the carcass had been completely buried, all but the tip of the tail, by a single individual of our largest and handsomest species,(*N. Americanus*, Oliv.) a beetle which is only one inch and a half long. It would puzzle an Irish labourer to bury a full-grown whale in the same length of time ; yet proportionately this would be a task of precisely the same magnitude."

The Carrion Beetles (*Silpha*, etc.,) differ from the foregoing in their more flattened shape, and dulness of colour, as well as in their habits and minor peculiarities of structure. Our largest and commonest species is the Surinam Silpha (*S. Surinamensis*, Fab.) Its colour is uniformly black, with a transverse irregular, reddish coloured band or series of spots, near the end of the wing-covers. It is found abundantly in carrion during the summer, and may certainly be considered from its fetid odour and repulsive appearance an exceedingly disgusting, even though highly useful creature. It does not bury its food, like the Sexton Beetle, but may be found swarming in and over exposed carcasses during the summer months, evidently revelling in filth. The handsomest species of this genus is the Shield-bearing Silpha (*S*, *peltata*, Catesby,) which is remarkable for the broad, thin expansion of its thorax in the form of an ancient semi-circular shield, of a creamy-white colour, ornamented in the middle with a device somewhat in the form of a cross. We have occasionally taken it in numbers about the body of a dead fish. The larvæ of this genus, unlike those of the preceding one, are obliged to seek their own food, which is of the same character as that of their parents, and consequently have strong legs, and a crustaceous flattened body.

5. Scavenger Beetles (*Staphylinidæ*).

The preceding group of insects follow the useful occupation of sextons for the smaller animals, or employ themselves in other ways for the removal of carrion. The next tribes of beetles that come within the scope of our present observation, discharge a somewhat similar office in the domain of nature, and busy themselves in the removal of nuisances from the surface of the earth.

To quote the words of Kirby and Spence (*Introduction*, Letter ix.),—"How disgusting to the eye, how offensive to the smell, would be the whole face of nature, were the vast quantity of excrement daily falling to the earth from the various animals which inhabit it, suffered to remain until gradually dissolved by the rain, or decomposed by the elements! That it does not thus offend us, we are indebted to an inconceivable host of insects which attack it the moment it falls; some immediately begin to devour it, others depositing in it eggs from which are soon hatched larvæ that concur in the same office with tenfold voracity; and thus every particle of dung, at least of the most offensive kinds, speedily swarms with inhabitants which consume all the liquid and noisome particles, leaving nothing but the undigested remains, that soon dry and are scattered by the winds, while the grass upon which it rested, no longer smothered by an impenetrable mass, springs up with increased vigour." The insects that engage in this work belong to many different tribes, chiefly pertaining to the orders of beetles and flies (*Diptera*). A large proportion of the former come in natural sequence almost immediately after the Carrion Beetles already described, and may, therefore, be fitly reviewed here. To give a complete account of all the different families of beetles that belong to the hordes of scavengers, would be a long, and —to the general reader—by no means an interesting proceeding; we shall, therefore, content ourselves with describing the peculiarities in structure and habits of the common sorts.

The first and most numerous family that we come to, includes all those species of beetles, called in England "Rove-beetles" or "Cock-tails" (*Staphylinidæ*). They are readily distinguished from all the other families by their peculiarly long and narrow bodies, flattened form and very short wing-covers, (*elytra*) which only cover one or two segments of the abdomen, instead of almost the whole of it, as is the general rule with beetles. These short wing-covers give the insect somewhat the appearance of wearing a boy's short jacket, instead of a long coat; notwithstanding their brevity, however, they completely conceal and keep out of the way the ample membranous wings. which, when not in use for flight, are beautifully tucked away beneath them. The long uncovered abdomen is capable of being moved in different directions, and is employed by the creature in folding and unfolding its wings. When irritated or alarmed it cocks its tail over its back, and assumes a ludicrously threatening aspect: it also possesses the power, probably for defence, of protruding at will two vesicles from the extremity of the abdomen, which emit a very unpleasant, and sometimes indescribably fetid odour.

The chief food of these insects, both in the larval and perfect states, consists of decaying animal and vegetable matters; in early summer every piece of dung that falls to the earth speedily swarms with them, and in the autumn they are equally numerous in fungi, agarics, etc. Some species are also carnivorous, feeding upon other insects; in England a large species, commonly called the Devil's Coach Horse, (*Georius olens*) devours large numbers of the destructive Ear-wig (*Forficula*). "On the least approach of danger," Westwood relates, "this insect, like the rest of the group, immediately puts itself into a most ferocious-looking posture of defence, throwing the tail over the head like a scorpion, protruding the anal vesicles, elevating its head and widely opening its long and powerful jaws."

Upwards of four hundred species of this family of beetles are found in North America, and of these, one hundred and five species have been taken in Canada. Many more undoubtedly remain to be found and described when collectors pay more attention to the minuter forms of insect life. Eight hundred species have been described as found in England alone. In tropical climates they are very rare; their places as insect-scavengers being supplied by the excessively abundant ants and termites.

6. Dung Beetles (*Scarabæidæ*, etc).

The members of the family to which we have now come, and to which we have given the title of "Dung-beetles," for want of a better, have been objects of peculiar interest to mankind for many thousand years, and will, no doubt, continue to attract the attention of all observers of nature as long as the world lasts. Were it not for their extraordinary habits and for the reverence which was accorded to some of them in ancient times, these creatures—like the preceding family—would be simply disgusting to us, even though of great value in the economy of nature.

Every one has, no doubt, heard of the Sacred Beetle of the Egyptians, which was worshipped by them as a god, and reverenced in various ways. It was called the Scarabæus, and belongs to the tribe we are now considering. "Hor-apollon"—according to Louis Figuier—"the learned commentator on Egyptian hieroglyphics, thinks that this people, in adopting the Scarabæus as a religious symbol, wished to represent at once *an unique birth—a father—the world—a man.* The *unique birth* means that the Scarabæus has no mother. A male wishing to procreate, said the Egyptians, takes the dung of an ox, works it up into a ball and gives it the shape of the world, rolls it with its hind legs from the east to the west, and places it in the ground, where it remains twenty-eight days. The twenty-ninth day it throws its ball, now open, into the water, and there comes forth a male Scarabæus. This explanation shows also why the Scarabæus was employed to represent at the same time *a father*, *a man* and *the world.* There were, however, according to the same author, three sorts of Scarabæi; one was in the shape of a cat, and threw out brightly shining rays (probably the Golden Scarabæus), the others had two horns (Copris)."

There is a colossal granite figure of a Scarabæus brought from Egypt in the British Museum, and other smaller representations that we have seen appear to have been worn as amulets, suspended from necklaces or bracelets. It is supposed by some that the plague of "flies" inflicted upon this people in the days of Moses consisted of swarms of this beetle, thus rendering the object of their superstitious worship a means of punishment; but we can hardly think that so innocent and harmless a creature, in other respects, would have been chosen by the Almighty for such a purpose; we do not, however, insist upon any particular view of the subject, as so little is told us in the pages of holy writ.

In Canada we have one species (*Canthon lævis*, Drury,) which bears a strong resemblance to the Egyptian Scarabæus in appearance and habits, it is not very common, but is, however, generally distributed throughout the Province of Ontario. There are also several species of another genus (*Copris*), which possess similar habits but differ in their striated wing-covers, and in the extraordinary curved horn with which the head of the males is armed. A remarkable peculiarity of these insects exists in the structure and situation of the hind legs, which are placed so near the extremity of the body and so far from each other, as to give the insect a most extraordinary appearance whilst walking. This peculiar formation is, however, particularly serviceable to its possessors in rolling the balls of excrementitious matter in which they enclose their eggs. These balls are at first irregular and soft, but by degrees, and by continued rolling, they become rounded and harder; they are propelled by means of the hind legs, and the insects occasionally mount on the top, when they find a difficulty in urging them along; probably in order to destroy the equilibrium. Sometimes these balls are an inch and a half in diameter; and in rolling them along the beetles stand almost upon their heads, with their heads turned away from the balls. These manœuvres have for their object the burying of the balls in holes, which the insects have previously dug for their reception; and it is upon the dung thus deposited that the larvæ feed when hatched (MacLeay). These rhinoceros or unicorn beetles—as they may be termed—frequently fly into houses through open windows, when attracted by light in the warm summer evenings. They are especially abundant on sandy soils.

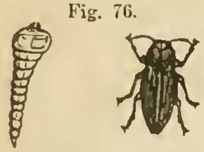
Another family of Dung-beetles (*Geotrupidæ*) performs a similar important part in the economy of nature, by feeding upon and burrowing under newly fallen dung. Its species, however, do not make up pellets and roll them along the ground, as those above mentioned, but content themselves with sinking shafts immediately under the mass of excrement, and there hoarding up the supply of food for their young. They are much more common in this country than the preceding, and may often be observed on a warm summer's evening, when the shadows are growing long, hovering about the droppings of some horse or cow, and preparing to do their part in the removal of a nuisance, and the fertilization of the earth.

Yet another family (*Aphodiidæ*) must be briefly noticed, before we leave these useful creatures. One species is almost the first beetle to greet us in early spring, as it flies about the manure of the hot-bed, and expands its coral-red wing-covers to the sun. It is the *Aphonius fimetarius*, Linn., and is common in England as well as in Canada. Another tiny species (*A. inquinatus*, Fab.,) swarms in the spring along the highways, resembling a fly as it hovers in the air, but easily distinguished when captured in the hand, or otherwise arrested in its flight; both of them feed upon horse-dung. The species of this family are especially numerous in the temperate regions of the northern hemisphere, and devote them selves entirely to the consumption and removal of the excrement of the larger herbivorous animals. Need we say that they should, on no account, be destroyed ?

7. Luminous Insects (*Lampyridæ*).

In the regular order of families of beetles, according to the generally received classification of Coleoptera, we come to a number of decidedly noxious insects after the Dung-beetles just described ; such for instance as the May-beetles and other leaf-eaters, (*Melolonthidæ*), the Buprestis Borers that perforate the wood of a majority of our trees, (Fig. 76), and the Spring-back Beetles, (*Elateridæ*), parents of the justly dreaded Wire-worms. The first family of common insects that we come to after these, are the Fire-flies—luminous insects of the family *Lampyridæ.*

Fig. 76.



In tropical countries the fire-flies belong to two very different families of beetles, the Elateridæ and the Lampyridæ, but in Canada luminous examples of the former are very rare indeed, though we have myriads of the latter. Our fire-fies, in the perfect state, are soft flattened beetles, with the head almost entirely concealed under the projecting hood formed by the thorax; they are generally of pale colours, though sometimes black. They are voracious in their habits ; feeding in the larval state, upon earth-worms and soft-bodied insects. The light which they emit proceeds from the extremity of the abdomen, and appears, from its fitfulness, to be under the control of the insects. Its origin and composition have long been a matter of doubt. According to Siebold, " the luminous organs of these insects consist of a mass of spherical cells, filled with a fine granular substance, and surrounded by numerous trachean branches. This substance appears, by daylight, of a yellow, sulphur-like aspect. The light produced from these organs, so remarkably rich in tracheæ, is undoubtedly the result of a combustion kept up by the air of these vessels. This combustion explains the intermission of the phosphorescence observed with the brilliant fire-flies, and which coincides, not with the movements of the heart, but with those of inspiration and expiration."

All our readers are, no doubt, perfectly familiar with the sparkling intermittent light exhibited by fire flies on damp summer evenings. They appear to take especial delight in moisture, frequenting low marshy grounds and river bottoms in myriads, while they but occasionally visit the drier air of high ground. We have sometimes seen them in tens of thousands, nay millions, when driving at night along some sequestered country road bordered by wet, swampy ground, or when taking a nocturnal ramble in search of insects up the valley of the Credit. Brilliant and numerous though our Canadian fire-flies are, they cannot be compared—judging from the accounts of naturalists—with the glories of the tropical species. There, besides species similar to ours, they have the huge lantern flies, said to be two or three inches long, and emitting a most brilliant light and also the large spring-back beetle (Elater Noctilucus) that gives forth a bright glow from spots on the thorax. Southey thus describes the appearance of these creatures in tropical America :—

> "Soon did night display
> More wonders than it veiled ; innumerous tribes
> From the wood cover swarm'd and darkness made
> Their beauties visible ; one while they stream'd
> A bright blue radiance upon flowers that closed
> Their gorgeous colours from the eye of day ;
> Now motionless and dark, eluded search,
> Self-shrouded ; and anon, starring the sky,
> Rise like a shower of fire."

In England they have but one species of luminous insect, well known under the name of 'glow-worm." The females of this insect are long, flat, soft wormlike creatures, quite destitute of wings ; emitting usually a pale steady light from the extremity of the abdomen. The males, on the other hand possess complete wings and wing covers, and are but feebly luminous. We have taken them in early summer in the long damp grass beside hedge-rows in Lancashire, where their tiny light attracted us from some little distance. They did not, however, appear to be at all common.

In this country both sexes of the fire-flies are fully winged, and both appear to be equally luminous. The larvæ also of several species possess the property of emitting light; but of these we have rarely obtained specimens. In 1868 we obtained a remarkable larva which in all probability belonged to the genus "Melanactes" of the Elater family. "Its general colour, (as we described at the time in the *Canadian Entomologist*, vol. 1. page 2) was a dark drab, the posterior angles of each segment, the softer connecting portion between the segments and the under side of the body being very much paler, and of a somewhat dirty yellow hue ; on each side there is a deeply impressed line in which the spiracles are situated. When seen in the dark, the insect presented a very beautiful appearance, being apparently ringed and dotted with greenish fire. Each spiracle appeared to be a point of bright greenish light, and the division between each segment a line of the same colour ; it looked indeed as is if the whole insect were filled with fire, which shone out wherever it was not concealed by the dark shelly integument. When coiled up on its side it looked like a lovely Ammonite whose striæ emitted green light, and with a point of green fire in each interspace."

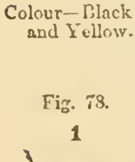
All the insects of the Lampyris family, whether luminous or not, may be classed among our friends, as they do not feed upon our crops or fruits, but upon various worms, snails and insects. One species (*Chauliognathus Pennsylvanicus*), a pretty yellow soft winged beetle, with a black oval spot towards the tip of each wing cover, is especially useful from its commendable habit of devouring the larvæ of the dreaded Plum Curculio, when in the larval state itself. The perfect insect we have sometimes taken in great numbers upon thistle blossoms, towards the close of summer.

8. Lady Birds (*Cocinellidæ.*)

From Luminous Insects to Lady-birds is a long leap to take in our description of neutral and beneficial insects. The intervening families of beetles, however, are so addicted to the destruction of our property in one form or another, and the exceptions are so few and inconspicuous, that we must pass them all over, and go on to the consideration of the pretty little creatures—as useful too, as they are pretty—that are generally known by the name of "Lady-birds," (vulgarly called *Lady-bugs*). They belong to the family *Coccinellidæ* of Coleoptera.

After the Luminous insects (*Lampyridæ*) which we just now brought before the reader, there come, according to the generally received classification, a large number of most destructive insects. Of these we may mention the *Ptinidæ*, the species of which "are found in old houses, in furniture, in rotten palings, stumps of trees, etc., which they and their larvæ perforate with round holes in every direction, which are filled with a very fine powder formed of gnawed wood and excrementa ; some species feed upon collections of dried plants, skins of insects, etc; whilst others bore into our chairs, tables, and other woodwork, books, etc. ; other species feed upon almost every substance, devouring ginger, rhubarb, cayenne pepper, etc : and rendering ship-biscuit often unfit for use ; others again feed upon woollen clothes, wheat in granaries, and other stores,"—a most noxious family certainly. After them come the *Scolytidæ*, the members of which are very destructive to trees and timber ; the *Cantharidæ*, (Fig. 77,) useful for blistering purposes, as 'Spanish flies,' but very injurious to vegetation ; the *Curculionidæ*, (Fig. 78,) one or two well-known species of which are enough to condemn the whole family, e. g. the Plum Curculio and the Pea-weevil ; the *Cerambycidæ*, or Capricorn Beetles, (Fig. 79,) the larvæ of which are wood-borers, and attack trees of every kind ; and the *Chrysomelidæ*, beautiful golden insects many of them, but including such noxious creatures as the Three-lined potato beetle, (Fig. 80,) the Turnip-fly or Flea beetle, the Colorado Beetle, the newly imported Asparagus Beetle, etc,

Fig. 77.



Colour—Black and Yellow.

Fig. 78.

Fig. 79.

Fig. 80.

Colours, Pale Yellow and Black.

The "Lady-birds" belong to the last family of all of the orders of beetles. They are so common and so well known to every child that it is hardly necessary to give any description of them. The accompanying wood-cuts will suffice to remind the reader of their appearance.

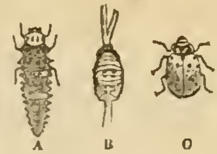
(Figs. 81, 82, 83, 84.)

Fig. 81.

Fig. 82.

Fig. 83.

Fig. 84.



Who is there, indeed, that has not set one on outstretched finger and sung to it in childish glee, "Lady-bird, Lady-bird, fly away home, your house is on fire and your children all burned!"? In France they are much regarded also, and called by children "Bêtes à bon Dieu," "Vaches de la Vierge," etc.; and in England they are termed Lady-cows as well as Lady-birds.

The general colours of these insects are yellow, red or orange, with black spots; and black, with red, white, or yellow spots; their shape is hemispherical, and though they vary somewhat in size, an average specimen bears a considerable resemblance in size and figure to an ordinary split pea; they have but very short legs and therefore creep but slowly; their powers of flight, however, are considerable. When alarmed they fold up their legs under the body and drop to the ground, and if handled they emit a yellowish fluid from the joints of the limbs which has rather a strong and disagreeable smell. In old times this fluid was considered to be an admirable specific for toothache! We have never, however, possessed sufficient courage to test its qualities in this respect ourselves!

As every one knows—or certainly ought to know by this time—the Lady-birds, both in their larval and perfect states, feed upon the obnoxious plant lice (*Aphides*), and are thus of the utmost service to the gardener, orchardist and hop-grower. Some species also prey very successfully upon the dreaded Colorado beetle, and assist beneficially in reducing the numbers of this new insect plague.*

More than thirty species of this family of beetles are known to inhabit Canada. Attention has so frequently been drawn to them in the course of these reports, that we need do no more than say—spare their lives and encourage their propagation by all means; they are the most useful class of insects that we have.

We have now enumerated all the leading varieties of beetles that are in their several modes serviceable to mankind. If any of our readers are now enabled to distinguish between insect friends or foes of this order, we shall feel well repaid for any trouble that these descriptions may have cost us. Our limited time and space preclude us from going on to other orders in this report; when another year comes round we hope, however, to have something further to say upon the subject.

---

* Vide *Second Annual Report*, p. 72.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

FOR THE YEAR 1874.

INCLUDING REPORTS ON SOME OF THE NOXIOUS AND BENEFICIAL INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario;

WILLIAM SAUNDERS,

Editor of the Entomologist;

EDMUND BAYNES REED,

Vice-President of the Entomological Society of Ontario.

Printed by Order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 86 & 88 KING STREET WEST.

1875.

CONTENTS.

A.

B.

C.

D.

E.

F.

G.

H.

I.

K.

L.

M.

N

O.

P.

R.

S.

T.

W.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

FOR THE YEAR 1874.

INCLUDING REPORTS ON SOME OF THE NOXIOUS AND BENEFICIAL INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.

Head-Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario;

WILLIAM SAUNDERS,

Editor of the Entomologist;

EDMUND BAYNES REED,

Vice-President of the Entomological Society of Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE YEAR 1874.

To the Honourable the Commissioner of Agriculture,—

Sir,—I have the honour to submit for your consideration the Report of the Entomological Society of Ontario for the year 1874, embracing a detailed statement of receipts and expenditures during the year, which accounts have been duly audited, also a list of the office-bearers elected for the year 1875.

The annual meeting of the Society was held at the City of Toronto, at the same time as the Exhibition of the Agricultural and Arts Association in accordance with the provisions of the statute, when the various reports were then presented and approved of.

I have also the pleasure of submitting herewith a Report on some of the Noxious, Benefical and Other Insects of this Province, which has been prepared on behalf of the Society by the Rev. C. J. S. Bethune, M.A., Mr. Wm. Saunders and Mr E. B. Reed.

THE CANADIAN ENTOMOLOGIST, the organ of the Society is still issued monthly, and has now nearly reached the completion of its sixth volume, the regular issue of our journal for the past six years has enabled us with the help of our esteemed contributors to disseminate a vast amount of practical, as well as scientific knoweledge relating to Entomology which has done much towards increasing the interest felt in this branch of Natural History so important to the agriculturist.

In order to illustrate the pages of this Report, we have procured as large a number of new wood cuts and electrotypes as the limited means at our disposal would admit of, we can only regret that it is not more profusely illustrated as we feel sure that such illustrations add greatly to the interest and usefulness of our report.

I have the honour to remain, sir,
Your obedient servant,

J. H. MCMECHAN,
Secretary-Treasurer Entomological Society of Ontario.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The fourth annual meeting of the above Society was held (by the kind permission of the Provost) in the library of Trinity College, Toronto, on the 23rd of September, at 3.30, P.M. The report of the Secretary-Treasurer was presented, showing a slight increase of membership and a satisfactory condition of the finances, after which the President read his annual address, which was by request of those present, kindly placed at the disposal of the Printing Committee for publication.

The following Officers were then elected :—

President.—Rev. C. J. S. Bethune, M.A., Port Hope.

Vice-President.—R. V. Rogers, Kingston.

Secretary-Treasurer.—J. H. McMechan, London.

Council.– E. Baynes Reed, W. Saunders, Rev. G. M. Innes, J. M. Denton, London, G. J. Bowles, Montreal.

Editor of Entomologist—W. Saunders.

Editing Committee.—Rev. C. J. S. Bethune, M.A., E. Baynes Reed, J. G. Bowles.

Library Committee.—W. Saunders, E. Baynes Reed, J. H. McMechan.

Auditors.—Chas. Chapman and J. H. Griffiths, London.

FINANCIAL STATEMENT OF THE SECRETARY-TREASURER.

Receipts.

To Balance from previous year	$177 62
" Government Grant additional for 1873	500 00
" " " " " 1874	750 00
" Members' fees	137 52
" Sales cork, pins, labels, &c	195 02
	1760 16

Disbursements.

By CANADIAN ENTOMOLOGIST, printing	518 75
" Pins, cork, &c	91 02
" Engravings	118 10

By Library	$58 95
" Editor's salary for 1872	100 00
" " " " 1874	100 00
" Secretary's salary for 1873	50 00
" " " " 1874	50 00
" Expenses, sundry small	120 18
" Rent	80 00
" Expenses of Report	51 00
" Balance, cash in bank	422 16
	1760 16

We certify the above as a correct statement of accounts for the year ending September 23, 1874, as shown by Treasurer's books and with vouchers for the same.

J. H. GRIFFITHS,
CHAS. CHAPMAN, } *Auditors.*

REPORT OF THE COUNCIL.

It is gratifying, at the expiration of this the fourth year of the existence of our Society, to be able to report its continued well-being and progress, and to know that its efforts are being more and more recognized as an aid to those agricultural interests which constitute the chief source of the wealth of our Province.

The *Entomologist* is still regularly published, and has now nearly reached the close of its sixth volume. By its regular issue there has been placed before our members much useful and practical information relating to many of the commoner insect pests, with instructions as to the use of the best remedies to check their ravages. Besides this it has formed, and still forms, a valuable medium for the publication of such scientific matter in relation to the life history of our insects, which, while of immediate interest to only a limited number of our readers, is of great importance to those engaged in the study of the science of Entomology. We feel that our journal has done and is still doing a good work in this respect ; and it is pleasing to know that our efforts in this direction are warmly appreciated by scientific men in the adjoining Republic and in Europe, as well as in our own country.

As mentioned in the Report of the last Annual Meeting, a cordial invitation was extended by the "American Association for the Advancement of Science," at the meeting held in Portland, in 1873, to the members of our Society to be present at the meeting in 1874, in Hartford. A deputation was appointed by your Council to attend this meeting on behalf of our Society, in reference to which the following report appeared in the September number of the *Entomologist* :—

THE AMERICAN ASSOCIATION.

At the recent gathering of this scientific body in Hartford, Conn., there were brought together an unusual number of Entomologists. This was owing partly, no doubt, to the kind invitation extended by the Association to the American and Canadian Entomological Societies to appoint special meetings of their members to be held at that time and place, with the view of having these important Societies fully represented. In response to this invitation, a number of members of the American Entomological Society were present, while our Canadian Entomologists were represented by the worthy President of our Society, Rev. C. J. S. Bethune, M.A., and the Editor of the *Entomologist*. Several evenings were occupied by these "brethren of the net" in interesting and profitable discussions on the habits and peculiarities of various insects, the time passing so pleasantly that the midnight hours were reached ere separation could be effected. After mature deliberation it was resolved to organize under the name of "The Entomological Club of the A. A. A. S.," and the following constitution was adopted : —

TITLE.

I. The name of the association shall be "The Entomological Club of the American Association for the Advancement of Science."

OBJECTS.

II. The annual re-union of the Entomologists of America, the advancement of entomology, and the consideration of all general questions relating to the science that may from time to time arise.

MEMBERSHIP.

III. All members of the American Association for the Advancement of Science who are interested in entomology, shall *ipso facto* be members of the club.

OFFICERS.

IV. The officers of the club shall be a President, a Vice-President, and a Secretary, to be elected annually by vote of the members.

DUTIES OF THE OFFICERS.

V. The President, or in his absence the Vice-President, shall preside at all meetings; the Secretary shall perform all the usual duties of a recording and corresponding Secretary.

MEETINGS.

VI. A meeting shall be held in each year at the place of meeting appointed by the American Association for the advancement of Science; it shall commence at 2.30 p.m., on the day before the meeting of the American Association for the advancement of Science, and be continued throughout that evening; further meetings may be held as time will permit during the week following.

The following resolutions were also unanimously passed:

Resolved, That the members of the American Entomological Society and the Entomological Society of Ontario, together with all other persons interested in entomological science, be cordially invited to attend and take part in the proceedings.

Resolved, That the Secretary be requested to publish notices of the meeting in such periodicals devoted to natural history, and especially in those devoted to entomology as are published on the continent; and further that the members be requested to bring with them at the annual re-unions specimens for exchange and exhibition, and especially types of species that they may have described during the year.

At a subsequent meeting of the Club, the following officers were elected: President, Dr. John L. Leconte, Philadelphia, Pa.; Vice President, Samuel H. Scudder, Cambridge, Mass.; Secretary, Chas. V. Riley, St. Louis, Mo. We feel sure that under such able direction, the Entomological Club of the A. A. A. S. will prosper, and be the means of stimulating many to increased effort, and thus greatly advance the interests of our favourite study.

As it may interest many to know who were present at these meetings, we furnish the following list: Dr. John L. LeConte, Philadelphia, Pa.; Dr. J. G. Morris, Baltimore, Md.; Prof. S. S. Haldeman, Chickis, Pa.; Dr. H. A. Hagen, Cambridge, Mass.; S. H. Scudder, Cambridge, Mass.; A. R. Grote, Buffalo, N. Y.; Dr. G. M. Levette, Indianapolis, Ind.; C. V. Riley, St. Louis, Mo.; O. S. Westcott, Chicago, Ill.; J. A. Lintner, Albany, N. Y.; H. F. Bassett, Waterbury, Conn.; George Dimmock, Springfield, Mass.; B. Pickman Mann, Cambridge, Mass.; E. P. Austin, Cambridge, Mass.; Dr. R. King, Kalamazoo, Mich.; Chas. P. Dodge, Washington, D. C.; Mr. Patton, Waterbury, Conn.; Rev. C. J. S. Bethune, M.A., Port Hope, Ont.; W. Saunders, London, Ont. During the meetings of the Association several interesting and valuable papers on Entomological subjects were read by Dr. LeConte and Messrs. Scudder, Riley and Grote.

The branches of our Society organized at London, Montreal and Kingston, continue to thrive, and by their frequent meetings and social intercourse stimulate the members resident in these cities to greater application in the service of entomology. We trust that such of our members as can, will aid the editor of the ENTOMOLOGIST by sending him from time to time, memoranda of their observations, on the habits and life history of our insects with any other notes they may deem of interest to the lovers of our favourite science.

Submitted on behalf of the Council by
J. H. McMECHAN,
Secretary-Treasurer.

ANNUAL MEETING OF THE LONDON BRANCH.

The annual meeting of the London Branch of the Entomological Society of Ontario was held at the residence of Mr. W. Saunders, on the 17th of February.

A goodly number of members were present, and the following officers were elected for 1874: President, A. Puddicombe; Vice-President. H. P. Bock; Secretary-Treasurer, J. G. Geddes; Curator, J. Williams; Auditors Messrs. C. Chapman and J. Griffiths.

A box of Lepidoptera from Miss Carey, of Amherstburg. was shown by Mr E. B. Reed, containing some interesting specimens taken in that locality; among others there were fine examples of *Papilio thoas* and *Philampelus satellitia.*

W. Saunders exhibited a box of Coleoptera, embracing a large number of species kindly donated by Theodore L. Mead, Esq., of New York. Also, several boxes of European insects, presented by Francis Walker. Esq., of the British Museum. The Secretary was instructed to tender to Mr. Walker the sincere thanks of the Society for his continued liberality in this matter—the cabinets of the Society and those of the members also having been repeatedly enriched with valuable specimens through his kindness.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The first annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 6th, 1874, when the following officers were elected for the ensuing year:

W. Couper, President; G. J. Bowles, Vice-President; F. B. Caulfield, Secretary-Treasurer; G. B. Pearson, Curator; Council—W. Hibbins, sen., C. W. Pearson, P. Knetzing.

The reports of the Council and Secretary Treasurer were read, and, on motion, adopted. The Branch, although young, is in a prosperous condition, the expenses of the past year having been met, leaving a small balance on hand, and the list of members is gradually increasing. Owing to the lateness of the season but little field work has been done, but some rare captures have been made already. The Branch meets as usual at the residence of the President, No. 67, Bonaventure Street, Montreal, P. Q. All business communications to be addressed to the Secretary-Treasurer, F. B. Caulfield, 254, St. Martin Street, Montreal, P. Q.

FIRST ANNUAL REPORT OF THE COUNCIL OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

During the summer of 1873 a fortunate circumstance occurred to which this Branch owes its origin. The following gentlemen, viz., Wm. Couper, F. B. Caulfield, Wm. Hibbins, C. W. Pearson and G. B. Pearson. met by chance on the Montreal Mountain, where the subject was discussed. and it was then decided to hold a meeting at the residence of Mr. Caulfield, in order to make further arrangements for its formation. This meeting was held on the 30th of August, when it was resolved to form a branch in connection with the Entomological Society of Ontario, and the Secretary *pro. tem.* was instructed to write to the parent society, asking permission to form a Branch Society in this city. This proposition was at once accepted by the parent Society.

On the 16th of October the following officers were elected for the ensuing year:—William Couper, President; M. Kollmar, Vice-President; F. B. Caulfield, Secretary-Treasurer; Council—G. J. Bowles, P. Knetzing and C. W. Pearson; Curator, William Hibbins.

By-Laws were framed for the guidance of the Branch, which were approved by the parent Society. Our monthly meetings have been regularly held and well attended, and your Council congratulate the Society on benefits derived. During the eight meetings which have been held, independent of the production of original communications on Entomology, there were remarkably good exhibitions of insects, which also tended to give additional information to members.

The first meeting of the Branch in August, 1873, consisted of seven members, and since then five additional members have been elected.

The following papers were read during the winter months:—

"A Dissertation on Northern Butterflies," by William Couper; "On the Cicindelidæ Occurring on the Island of Montreal," by F. B. Caulfield; "On Some of the Benefits Derived from Insects," by F. B. Caulfield.

The following works have been donated during the year:—

"On Some Remarkable Forms of Animal Life from the Great Deeps of the Norwegian Coast," by G. O. Sars, 1 Vol.; "On Norwegian Crustaceans," by G. O. Sars, 2 Vol.; "Synopsis of the Acrididæ of North America," by Cyrus Thomas, 1 Vol.

Your Council would suggest that the Curator procure store boxes for the preservation of the specimens obtained for the Society during the approaching season. In this way the nucleus of a collection can be formed prior to the purchase of a cabinet, which your Council trusts the Society will be possessed of before next winter.

Your Council would also suggest that members carry note-books wherein to record Entomological observations, especially relative to insects injurious to the crops; also, of such species as are considered beneficial in checking the progress of destructive insects. As this is one of the principal objects of the Society, field notes of this nature are always valuable, and should form subjects of investigation and discussion at our meetings. Attention should be given to the larval forms of insects, as this is a specialty of Entomology from which much knowledge is yet to be obtained.

Your Council strongly impress on the members to use their influence in promoting a knowledge of the importance of the study of Entomology, more especially with Agriculturists and horticulturists, in order to enable them to check the ravages of the numerous insects injurious to vegetation.

All of which is respectfully submitted.

C. W. Pearson,
Geo. Jno. Bowles.

Wm. Couper, Chairman.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1874.

To the Members of the Entomological Society of Ontario:—

Gentlemen,—I beg to offer you again, after the lapse of a year, my hearty congratulations upon the continued prosperity of our Society. As you have already learnt from the Report of our Secretary-Treasurer, we have been favoured with a slight increase in our list of membership—as large, indeed, as can fairly be expected in a Society which confines itself to the study of a particular branch of Natural Science, and which cannot therefore attract into its ranks many who are not specially engaged, to some extent at least, in this limited field of investigation.

It is especially pleasing to find that our number of branches continues to increase—a highly successful one, with its headquarters in Montreal, having been organized since our last annual meeting. Its first annual report has been already presented to us in the pages of our journal.

The Canadian Entomologist, upon whose success the well-being and fair fame of our Society so largely depends, has—I am sure you will agree with me—been more ably sustained than ever before. The thanks of the whole Society are assuredly due to the energetic and talented Editor, Mr. Saunders, who has been, indeed, its mainstay from the issue of its first number till now. It would be well if all our members would aid him, not only by contributions, but also by increasing the circulation, and thereby improving the means of support of the publication.

When I applied just now the term "limited" to our field of enquiry, I only did so when considering Entomology as one amongst a large number of sections of the great circle of natural sciences, which includes within its area the study of all things material which come within the range of man's intellectual powers. If we look, however, at Entomology and its objects alone, we cannot fail to see at once that it is practically without limit—that there is work enough for thousands of investigators for almost innumerable generations to come. And when we couple with Entomology other kindred sciences, such as Botany, Geology and Physical Geography, which are so closely allied that no student can safely overlook them, we begin almost to be overwhelmed with the vast extent of this field of knowledge that we seek to explore. So vast, indeed, is the field that no one now ventures to survey the whole of it, except in a very general way ; each explorer finds himself compelled—if he would do any effective work—to confine his labour to some one or two of its sections or subsections. By this division of labour, all departments of the Science will by degrees be taken up, and much that is now a '*terra incognita*' will become familiar to the patient explorer.

In our own country—within the bounds of this great Dominion—there is need of many more students and explorers. Even in this Province of Ontario, the headquarters of our Society, where more has been done than in any other part of Canada, there is yet room for a great increase to our band of collectors and investigators. How incomplete, for instance, is even yet our list of Diurnal Lepidoptera, and how many pages are still blank in the life history of some of our commonest butterflies? Our able Editor, my excellent friend, Mr. Saunders, has done much to fill up these blank pages, and his work is everywhere recognized as thorough and authoritative ; but yet there remains much more to be done, that we hope our members will before long accomplish. If we turn to Crepuscular and Nocturnal Lepidoptera, we must feel almost appalled at the extent of our ignorance. For those who have the time and the ability, I can think of no more interesting or attractive field of enquiry—none that will sooner or better repay the pains-taking student, whether he looks for fame or pleasure, whether he sighs for fresh fields to conquer, or desires to set his foot where man has not trodden before. In a department where so much remains to be done, we all, I am sure, offer a most cordial welcome to one who has recently cast in his lot among us, and has traversed the broad Atlantic in order to study the Noctuidæ of this country. I allude to Mr. George Norman, of St Catharines, late of Forres, in Scotland.

In another order of insects, the Coleoptera, much, no doubt, has been accomplished. Through the pains-taking labours of a Billings and a Pettit, not to mention other good workers, and by the aid of the great authorities in the neighbouring States, Dr. Leconte and Dr. Horn in particular, we have been able to increase our list of Canadian beetles from a few hundreds at the birth of the Society, to more than as many thousands now. But still how very much more remains to be done? What a field of labour there is before both student and collector in the Carabidæ, the Staphylinidæ, the Curculionidæ and other numerous families of beetles! May we not hope that during the coming winter our present scattered stores of knowledge will be utilized and made available for the good of all, by the compilation and publication of a large addition to our old and valuable list of Canadian Coleoptera?

If there remains so much to be done in these two favourite orders, what shall I say of the remainder, that are so generally neglected? It is surely time that some of our members should devote themselves to the working up of such interesting orders as the Neuroptera, the Hymenoptera, the Orthoptera, the Hemiptera, even if no one can be found at present to take up the study of the more difficult Diptera.

In all these orders there is the nucleus of a collection in the cabinets of our Society, while no doubt much additional material would be furnished by individuals to any member who will take up in earnest the study of any one of them. It would be a great contribution to our knowledge of Canadian insects if there could be published by the Society carefully prepared lists of as many species as possible in each of these orders. Such lists would, of course, be very incomplete at first, but they could easily be so arranged in publication that additions might be made to them at any time, as our stores of knowledge increase.

Such, gentlemen, are some of the modes in which, I think, we should endeavour to extend the operations of our Society. If each year, when we assemble together for our annual meeting, we can point to some such work done in the previous twelvemonth, we shall have good reason to congratulate ourselves upon real permanent progress—upon building up the foundation of an Entomological structure that will prove enduring and substantial in time to come.

Thus far I have referred to Entomology as a purely scientific pursuit; there is another aspect in which we cannot refrain from regarding it, viz., as a subject of very great economic importance to every inhabitant of our land. This view of Entomology has been especially brought before us of late by the havoc that has been produced in our farms and gardens by hordes of destructive insects.

The dreaded Colorado Potato Beetle (*Doryphora decem-lineata*) has spread eastward with great rapidity, and has now reached the Atlantic coast in some parts of the United States. I have been informed by friends who reside in various parts of the Union, that while little, if any, diminution in the numbers of the pest is to be observed in the west, it is becoming very destructive where it has attained to its second year of colonization. During the first year of its invasion of a particular locality, no appreciable damage is done by it, but as its armies increase in geometrical progression, the potato crops of the following season generally suffer to a terrible extent. It has now covered the whole of the Province of Ontario, and is very destructive throughout the western half of it, though we are happy to say that our intelligent farmers and gardeners are effectually using the remedies suggested by our colleagues, Messrs. Saunders and Reed, in their Report to the Legislature a few years ago. In Quebec it is but beginning to be observed; no doubt it will be found there in myriads next year. Across the border, it has penetrated to the western portion of Vermont, into New Jersey, down to the sea coast in Pennsylvania, and in Maryland; at Baltimore, Md., it is very abundant, while straggling outposts have been found as far south as Washington. The whole of New York and Ohio have been pretty well covered with the insect, while in Missouri it is as abundant as ever. In Indiana and Michigan there is a local diminution in the numbers of the pest, but no where are there as yet any signs of its cessation. The people of Europe are now beginning —and with good reason—to feel alarmed at the prospect of its crossing the Atlantic. The English and French scientific and agricultural publications are commencing to publish notices of the insect and to talk of restrictive measures, while in Germany, we are told that stringent regulations will probably soon be put in force by the Government to prevent the invasion of the country. Unless some regulations of this kind are put in general force throughout the whole of Western Europe, I believe that—judging from the spread of noxious European insects on this side of the Atlantic— the Colorado Beetle will soon become there as familiar an object and as destructive a pest as it is here.

While the Colorado Beetle from the Rocky Mountains has been overspreading the whole northern continent eastward, there has been moving southward and westward in a similar manner another insect—the Cabbage Butterfly (*Pieris rapæ*)—that is almost as injurious as the other. This insect, an European importation, as of course you all know, starting from Quebec some few years ago—there first noticed by our friends Messrs. Couper and Bowles has now spread westward over almost the whole of Ontario. At Port Hope it has been this year by far the most common of all butterflies; thousands were to be seen throughout the whole season, from early summer to the present time, flitting about along every road, and hundreds hovering over or alighting in every garden. There is hardly a cabbage or cauliflower fit to be eaten anywhere in the neighbourhood, while stocks and mignonette have been ruthlessly demolished in all the flower gardens. Its spread westward, however, has hardly been as rapid as its movements to the south. The two maritime provinces of New Brunswick and Nova Scotia and all the New England States, have for some time been occupied, and now I am told that this year it is most plentiful as far south as Washington, and that it is by no means rare in Virginia.

While referring to the wonderful spread of noxious insects during the past few years, and to their excessive prevalence now, I must not omit to mention the affliction caused to our north-west Province of Manitoba and to many of the western States by the swarms of locusts, or grasshoppers as they are termed (*Caloptenus spretus*). The accounts of the sufferings caused by this terrible plague are perfectly appalling, and rival anything that we have read of the ravages of the Eastern locusts. Happily for us they do not seem to extend much further to the east than the Missouri River, though, occasionally they penetrate to some of the broad prairies beyond. As a detailed account of this insect will probably be afforded you in the forthcoming Annual Report of our Society, I need not detain you with any further remarks upon it.

The only other insect to which I need now call your attention for a moment, is the Grape Vine *Phylloxera*. I am glad to learn that its ravages in the vineyards to the south of us have been comparatively trifling this year, and that in all probability the summer droughts to which we are so liable, will prevent its ever being as formidable a foe as it was at one time apprehended.

To turn from this not very cheerful subject, I may mention, before concluding, that Mr. Saunders and myself duly attended the recent meeting at Hartford, Conn., of the American Association for the Advancement of Science. There we had the pleasure of meeting a large number of Entomologists from all parts of the United States, and we had the further gratification also, of being presided over, in general session, by the ablest of American Entomologists, Dr. Leconte, and in the Zoological Section, by another great worker in our department, Mr. S. H. Scudder. Informal meetings of Entomologists were frequently held, and finally it was agreed upon to form an Entomological Club of members of the A.A.A.S., who should assemble annually a day before the meeting of the Association in the place that may be from time to time selected for its sessions. In this way we trust that much may be done for the furtherance of our favourite branch of science, and that Entomologists generally, from all parts of the continent, will bring together their types of new species and the surplus of their collections for mutual information and benefit.

Without further trespassing upon your time and attention, I beg to thank you, gentlemen, for the kind consideration you have shown to my colleagues and myself during our term of office, and with hearty wishes for the continued prosperity of our Society,

I have the honour to be, gentlemen,

Your obedient servant,

CHARLES J. S. BETHUNE,
President E. S. of O.

Trinity College School,
Port Hope, September 22nd, 1874.

INTRODUCTORY.

ONCE again at the close of another year, a few of the members of the Entomological So-iety of Ontario have undertaken the task of endeavouring to lay before the public, some in-ɔrmation respecting the habits and lives of the insect world, and more especially those mem-ers of it which have a direct or indirect influence upon the growth or well-being of the produce f field or forest.

It is a satisfaction to know that these annual reports are read and appreciated, and that ıany of our practical Fruit-Growers and Agriculturists are desirous of obtaining some know-ədge of the transformations of the various and beautiful members of the insect world, of those eautiful atoms of God's creation, each in its appointed sphere fulfilling the purpose for vhich it was created, drawing forth our wonder, our admiration and our praise; for "He who vondereth at nothing hath no capabilities of bliss, but he that scrutinizeth trifles hath a store f pleasure to his hand, and happy and wise is the man to whose mind a trifle existeth not."

"He prayeth best who loveth best
All things both great and small,
For the dear God that loveth us,
He made and loveth all."

ENTOMOLOGICAL CONTRIBUTIONS.

By E. B. Reed, London, Ont.

1. The Io Moth (*Saturnia Io*).
2. The Flat-headed Apple-tree Borer (*Chrysobothris femorata*).
3. The Locust Tree Borer (*Clytus pictus*).

1. The Io Moth *Saturnia* (*Hyperchiria*) *Io.* [Fabr].

Order, Lepidoptera ; Family, Bombycidæ.

This lovely moth is well worthy a place in the cabinet of the collector, and from its brilliant colouring and conspicuous markings is always sure to attract notice and admiration.

The moth belongs to a family which has received the name of "Bombyces" from *Bombyx* the ancient name of the silk worm. As, however, it is in the larval or Caterpillar state that this insect more frequently meets our eye, we will begin by a description of it in that stage. The full grown larva of which, fig. 1 is an admirable representation, is of a most delicate apple or pea-green colour with a broad dusky white stripe at each side bordered with lilac on the lower edge. The body is covered with spreading clusters of green bristles tipped with black. These bristles are exceedingly sharp, and when the insect is handled will produce a very irritating sting similar to but much sharper than that of the nettle, and the effect of which causes a reddening of the flesh and the immediate appearance of raised white blotches which last for a considerable time. Fig. No. 2 shews the appearance of these bristles, some of them as *b*, being stouter and more acute than the others and able to inflict a sharper and more penetrating sting. This stinging property is very curious and is not very easily explained ; Mr. C. V. Riley writing of a very similar insect, the *Saturnia Maia*, says, " that the sting is caused by the prick of the spines, and not by their getting broken in the flesh. From the fact that the spines appear hollow, one would naturally attribute their irritating power to some poisonous fluid which they eject into the puncture. But I have been unable to resolve any apical aperture, nor was Mr. Lintner more successful. Hence I infer that the irritating property belongs to the substance of which the spines are formed, and this opinion is strengthened by the fact that those of a dead larva, or of a cast-off skin which has been in my cabinet for several years, still retain the irritating power, though so brittle that it is not easy to insert them."

Fig. 1.

Fig.

In the earlier stages the caterpillars are gregarious, feeding together side by side and in going to and returning from their place of shelter, moving in regular files after the manner of the processionary caterpillars of Europe (*Cneocampa processionea*). This marching habit is so very peculiar that it is well worth describing. Though the insects move without beat of drum they maintain as much regularity in their steps as a file of soldiers. The celebrated naturalist Reaumur, writing of the European Procession Moth says, "I kept some for a little time in my house in the country, I brought an oak branch which was covered with them into my study, where I could much better follow the order and regularity of their march than I could have done in the woods. I was very much amused and pleased at watching them for many days. I hung the branch on which I had brought them against one of my window shutters. When the leaves were dried up, when they had become too hard for the jaws of the caterpillars, they tried to go and seek better food elsewhere. One set himself in motion, a second followed at his tail, a third followed this one, and so one. They began to defile and march up the shutter, but being so near to each other that the head of the second touched the tail of the first. The single file was throughout continuous; it formed a perfect string of caterpillars of about two feet in length, after which the line was doubled. Then two caterpillars marched abreast, but as near the one which preceded them, as those who were marching in single file were to each other. After a few rows of our processionists who were two abreast, came the rows of three abreast; after a few of these came those who were four abreast; then there were those of five, others of six, others of seven and others of eight caterpillars. This troop so well marshalled was led by the first. Did it halt, all the others halted; did it begin again to march, all the others set themselves in motion and followed it with the greatest precision. That which went on in my study goes on every day in the woods where these caterpillars live. When it is near sunset you may see coming out of any of their nests by the opening which is at its top, which would hardly afford space for two to come out abreast, one caterpillar, as soon as it has emerged from the nest, it is followed by many others in single file; when it has got about two feet from the nest, it makes a pause during which those who are still in the nest continue to come out; they fall into their ranks, the battalion is formed; at last the leader sets off marching again, and all the others follow him. That which goes on in this nest passes in all the neighbouring nests; all are evacuated at the same time."

According to "Harris," the caterpillars of the Io Moth do not spin a common web, but when not eating they creep under a leaf where they cluster side by side. When about half grown the caterpillars disperse, each seeking a location for itself. They moult five times, the larvae devouring their cast off spinous skins. After being in the larval state about eight weeks, they arrive at maturity, and are then about two and a half inches long, and present the appearance of Fig. No. 1.

Their food plants are very numerous. They have been found on Black Locust, Indian Corn, Willows, Sassafrass, Wild Cherry, Elm, Hop Vine, Balsam, Balm of Gilead, Dogwood, Choke Cherry, Currant, Cotton and Clover. I this year found two larvæ on the English Filbert, and bred them to maturity on that plant. I have, however, more commonly found them on the Choke Cherry. The larvæ when full grown ceases eating, and crawls to the ground, where, amongst the loose leaves and rubbish, it forms a rough outer covering, within which it makes a slight cocoon of tough, gummy, brown silk. In this retreat a transformation is soon effected to the pupal or chrysalis state, from which, having remained therein during the winter and spring months, the moth emerges in the perfect winged condition about the month of June.

The moths are remarkable for the difference between the sexes both in size and colour.

Fig. 3.

The male (Fig. 3), which is much the smallest, is of a deep Indian or maize yellow colour.

On the forewings are two oblique, wavy lines near the hind margin and a zig-zag line near the base. There is also a large, dark, reddish, central reniform spot or blotch; this is very marked in all the Canadian specimens I have seen, although in the cut, which is drawn by Mr. Riley, probably from a specimen taken in the Western States, the spot is not so distinct. The hind wings are broadly shaded with purple next to the body; near the hinder margin is a curved purplish band, and within this again is a smaller one of a dark purple or violet colour. In the centre of this last band and the middle of the wing is a large round blue spot, with a whitish centre and a broad border, almost black. It is from these prominent eye-spots that the moth derives its name, in allusion to the classical Grecian fable of the beautiful Io who, having incurred the displeasure of the jealous Juno, was placed by her under the watchful vigilance of the hundred-eyed Argus.

The under side of the wings is of the same deep yellow—the forewings having the inner margin broadly shaded with purple and shewing the reniform eyed spot very distinctly; the hinder wings are more uniform in colour, with a transverse purple line, and a very small distinct white spot representing the centre of the large spot on the upper side. The body is also deep yellow—somewhat darker on the thorax. The antennæ, as usual in the males of the bombyces, are beautifully pectinated, presenting a double comb-like appearance The male varies slightly in size, from two and a half to two and three-quarter inches in width.

Fig. 4.

The female (Fig. No. 4) is considerably larger, ranging from three to three and a half inches. The specimens vary much in colour, from a dark purplish brown to a warm ochreous red. The fore wings have similar wavy zig-zag lines, the reniform blotch being less distinct than that in the male; the inner margin is of a deeper colour, and with the head and thorax is thickly coated with a short, woooly, pilose covering. The hind wings are marked in a similar manner to those of the male. The undersides of the wings have the same uniform colour, and are marked much like those of the male.

The body is ochreous yellow, a little lighter above, and each segment is bordered with a narrow, reddish band.

" The moths have a fashion of sitting with their wings closed, and covering the body like a low roof, the front edge of the underwings extending a little beyond that of the upper wings, and curving upwards."

The eggs are deposited on the under side of the leaf, and are described by Mr. Riley as being compressed on both sides and flattened at the apex, the attached end smallest. Their colour is cream white with a small black spot on the apical end and a larger orange one on the sides. A cluster found on Sassafrass by a western lady contained about thirty eggs. The moths are nocturnal, flying only by night.

The Flat-Headed Apple-Tree Borer.

Chrysobothris femorata, (Fabr).

Order, Coleoptera; Family, Buprestidæ

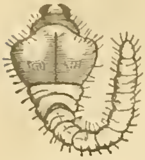
Among apple-growers there has been during the past year or two a great complaint of some borer infesting their trees, and investigation has shown that it is to this little beetle that the injuries may be traced.

Fig. 5.

Although insignificant in size, yet its larva is capable of doing immense mischief in our orchards. The beetle belongs to a family of insects which is especially remarkable for their rich and varied colouring, many having most brilliant tints. The one we are describing, fig. 5, is of a greenish brassy black colour above, the under side having a bright coppery hue. It is about half an inch in length. It is of an oblong oval shape, blunt round head, and tapering towards the tail. It flies by day and is very swift on the wing. It may often be seen during the summer months running up and down the trunk and limbs of trees or resting itself, basking in the sunshine.

The larva, fig. 6., is a pale yellow, footless grub, its anterior end being enormously enlarged, round and flattened. Dr. Fitch worked up the history of this little pest some years ago. According to his account " the parent beetle deposits its egg on the bark from which a worm hatches and passes through the bark, and during the earlier stages of its life, consumes the soft sap wood immediately under the bark. But when the worm

Fig. 6.



approaches maturity and has become stronger and more robust, it gnaws into the more solid heart-wood, forming a flattish and not a cylindrical hole such as is formed by most other borers, the burrow which it excavates being twice as broad as it is high, the height measuring the tenth of an inch or slightly over. Within this hole the larva may be almost always found with its tail curled round completely towards the head, in a manner peculiar to the larvæ of beetles belonging to the family *Buprestidæ*. It remains in the tree about a year. It is in the latter end of the summer, that the larva penetrates into the hardwood of the tree; its burrow extending upwards from the spot under the bark where it had previously entered. On laying open one of the burrows Dr. Fitch found it more than an inch in length, and all its lower part filled and blocked up with the fine sawdust like castings of the larva. With regard to remedies, Dr. Fitch advises three: "First, coating or impregnating the bark with some subtance, repulsive to the insect. Second, destroying the beetle by hand-picking; and Third, destroying the larva by cutting into and extracting it from its burrow."

His advice is so plain and comprehensive than I cannot do better than quote it at length. "As it is during the month of June and forepart of July that the beetle frequents the trees for the purpose of depositing its eggs in the bark, it is probable that whitewashing the trunk and large limbs, or rubbing them over with soft soap early in June, will secure them from molestation from this enemy. And in districts where this borer is known to infest the apple trees the trees should be repeatedly inspected during this part of the year, and any of these beetles, that are found upon them should be captured and destroyed. It is at mid-day of warm sunshiny days that the search for them will be most successful, as they are then most active, and shew themselves abroad. The larvæ, when young, appear to have the same habit with most other borers, of keeping their burrow clean by throwing their castings out of it through a small orifice in the bark. They can therefore be discovered, probably, by the new, sawdust like powder, which will be found adhering to the outer surface of the bark. In August or September, whilst the worms are yet young, and before they have penetrated the heart-wood, the trees should be carefully examined for these worms. Whenever, from any particles of the sawdust-like powder appearing externally upon the bark, one of these worms is suspected, it will be easy, at least in young trees, where the bark is thin and smooth, to ascertain by puncturing it with a stiff pin, whether there is any hollow cavity beneath, and if one is discovered, the bark should be cut away with a knife until the worm is found and destroyed. After it has penetrated the solid wood, it ceases to eject its castings and consequently, we are then left without any clue by which to discover it. Hence the importance of searching for it seasonably."

The natural food of this insect is believed to be the white oak, but it is found also on many other trees. such as apple, peach and plum, and, according to Mr. C. V. Riley has most seriously affected the soft maples in the valley of the Mississippi. The beetle when caught contracts all its limbs and feigns death.

THE LOCUST-TREE BORER. [*Clytus Pictus.*—FABR.]

Order, COLEOPTERA ; Family, CERAMBYCIDÆ.

This active little beetle belongs to the same family as the *Clytus Speciosus,* of Say, whose attacks on the maple tree I described in my report for 1872.

This is a very common insect, and a most fatal obstacle to the cultivation of the locust tree in Ontario.

In 1866, at the meeting of the Entomological Society of Canada, Prof. Croft, of Toronto, drew the attention of the members to the ravages during the past summer, of this beetle, and stated that many of the acacia trees of Toronto and the vicinity, had fallen victims to the larvæ. Since that date the writer has watched with interest the steady westward progress of this destructive pest. Indeed, so rapid has been its spread, that there is hardly a locality in Ontario now, where it has not made its appearance, and we may almost give up any attempt to check its ravages, or to successfully procure the cultivation of the locust tree.

These beetles are so common now that they will be readily recognized without any engraving. They are from three quarters to half an inch in length. Colour, velvet black, with transverse lemon-yellow bands, of which there are three on the head, four on the thorax and six on the elytra or wing covers, making thirteen in all ; the tips of the elytra are also edged with yellow. The third band on the body is very noticeable, as it forms a very distinct representation of the letter W. The thorax is very globular. The antennæ are dark brown. The underside of the body has the outer edges of the segments, bordered with yellow stripes. The legs are rust-red.

"In the month of September," writes Dr. Harris, "these beetles gather on the locust trees, where they may be seen glittering in the sunbeams, with their gorgeous livery of black velvet and gold, coursing up and down the trunks in pursuit of their mates, or to drive away their rivals, and stopping every now and then to salute those they meet with a rapid bowing of the shoulders, accompanied by a creaking sound, indicative of recognition or defiance. Having paired, the female, attended by her partner, creeps over the bark, searching the crevices with her antennæ, and dropping therein her snow-white eggs, in clusters of seven or eight together, and at intervals of five or six minutes, until her whole stock is safely stored. The eggs are soon hatched, and the grubs immediately burrow into the bark, devouring the soft inner substance that suffices for their nourishment till the approach of winter. During winter they remain at rest in a torpid state. In the spring they bore through the sap-wood, more or less deeply into the trunk, the general course of their winding and irregular passages being in an upward direction from the place of their entrance. For a time they cast their chips out of their holes as fast as they are made, but after a while the passage becomes clogged, and the burrow more or less filled with the coarse and fibrous fragments of wood, to get rid of which the grubs are often obliged to open new holes through the bark. The seat of their operations is known by the oozing of the sap, and the dropping of the sawdust from the holes. The bark around the part attacked begins to swell, and in a few years the trunks and limbs will become disfigured and weakened by large porous tumours caused by the efforts of the trees to repair the injuries they have suffered." The habits of this insect seem to have been known for a long time, for we find a description of them made in 1771, by Dr. J. R. Forster, and Dr. Fitch records that Petivera gave a figure and description of it in his "Gazophylacium," published in London in 1702.

The beetle is, undoubtedly, a native species, it never having been found in any other country. In remarking on their destructive powers, Dr. Fitch states, "that one of the principal thoroughfares leading east from the city of Utica was formerly planted on its south side with locust trees, these had become so large and ornamental as to render this one of the most admired avenues in the suburbs of that city. When some thirty (now 40), years since, these trees were invaded by this insect, to such an extent, that in the course of two or three seasons, they were totally ruined, many of them being killed outright, and the remainder having their limbs and branches so lopped off, that they could never recover from the deformity." Micheaux also reported that fifty years ago this insect had become so destructive, that many people in different parts of the States were discouraged from planting the locust.

In my own experience, three or four seasons have completely killed the largest trees, and about half that time for many of those of smaller size. The numbers and fecundity of the beetle are very great. I well remember in the early fall of 1873, on passing a small clump of locusts growing in St. Paul's Churchyard, London, Ont., my attention being arrested by the breaking off of a branch of considerable size from one of these trees, and my curiosity being excited, I made an examination, and found that the branch had been eaten almost through by the larvæ, and on looking up at the trunk of the tree, I counted over fifty beetles running up and down ; that tree was completely killed that season. I had occasion to pass these trees going up and down to my office, and I am satisfied I must have killed fully one hundred that year, merely treading on them as I found them on the sidewalk beneath, or in the neighbourhood of these trees.

These beetles may often be found feeding on the pollen of the Golden Rod (*Solidago*). Dr. Fitch suggests, "as a feasible plan of checking the multiplication and destructiveness of these borers, to plant a small patch of the Golden Rod where locust trees are grown, that the beetles when they issue from the tree may resort to the flowers as is their habit. They can readily be found thereon, and captured and destroyed. It will be a pastime to the children of the household, whose sharp eyes qualify them well for this employment, to search their flowers."

The gathering should be begun as soon as the beetles begin to appear, and should be continued for several successive seasons ; if none of the Golden Rod can be conveniently grown, numbers of the beetles may still be caught while pairing on the trunk of the trees ; if too high to reach, a sharp rap against the tree will cause them to drop to the ground. when with a little activity they can be secured.

The grub remains in the tree about a year ; the beetle when handled, makes a peculiar sharp creaking noise.

NOTES OF THE PAST SEASON.

BY W. SAUNDERS.

THE CURRANT WORM (*Nematus ventricosus*, KLUG).

This troublesome pest has been in most localities as abundant as ever during the past summer. Whatever checks nature may have provided to prevent its excessive increase, they seem, as yet, to avail but little, for the larvæ continue to swarm in hundreds and thousands on currant and gooseberry bushes throughout the summer, demanding constant vigilance and liberal supplies of hellebore if the foliage is to be preserved.

For the benefit of those who may not possess copies of our previous reports we have introduced again figures of this insect with such additional notes on this species in its various stages as we have been able to gather during the summer.

FIG. 7.

Fig. 7 shows the eggs as they are laid on the under side of the leaves. These eggs (described from specimens found on the 28th June) are when first laid about $\frac{31}{100}$ths of an inch long, nearly cylindrical, rounded at the ends, white, glossy and semi-transparent. Eggs found on the same bushes, the same day, but probably laid some days before, measured $\frac{41}{100}$ths of an inch in length with a corresponding increase in diameter. From this it is reasonable to infer that the eggs increase in size before hatching, the elastic membrane which forms their covering expanding with the development of the enclosed larvæ. The eggs, of which we have examined large numbers, we have never found embedded in the substance of the leaf (as some have stated they are) to any perceptible extent; careful examination under a powerful microscope has failed to reveal any abrasion of the surface after the egg has been forcibly removed.

FIG. 8.

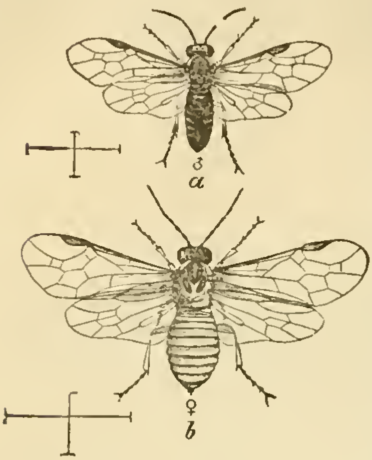
c

Fig. 8 represents the larvæ nearly full grown, and Fig. 9 the perfect insects, the smaller one being the male, the larger one the female.

On the 19th of June, on going into the garden about 7 A.M., we noticed these perfect insects flying about in scores in sunny spots, around and under gooseberry bushes; in about an hour afterwards when visiting the same spot for the purpose of capturing some, only one here and there could be found, and these had settled on the bushes. A male and female were captured and enclosed in a gauze bag, which was tied so as to enclose a small branch of a gooseberry bush, with several leaves on it, all quite free from eggs. When examined in the evening of the same day, the female was seen laying her eggs; the next morning, on opening the bag, it was found that 48 eggs had been deposited during the interval, the female being still very active. On the

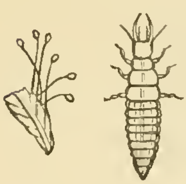
24th of June, this branch was examined again, when quite a number of the young larvæ were found just hatched from the eggs which had then only been laid between four and five days ; many of the eggs, however, were found dried up, for which no cause could be discovered.

Fig. 9.



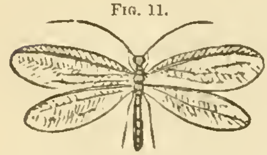
On the 30th of June, the larvæ of a lace wing fly *Chrysopa* was observed sucking the juices from the young larvæ of *N. ventricosus.* This friendly helper was a little more than a quarter of an inch long, and had placed itself in the midst of a colony of the young currant worms and had already consumed several before it was taken in the act, Fig. 10 *b* represents one of their larvæ about half-grown, the fly is shown in Fig. 11. The female lace wing fly lays her eggs on long slender stalks, fig. 10 *a*, placing quite a group of them together ; they are very pretty objects. It is supposed that these long stalks serve the purpose of keeping the unhatched eggs at a safe distance from the young larvæ first hatched who would, otherwise, probably eat them up. The perfect insect deposits these eggs quite rapidly. On the 18th of June, when out collecting with some friends, one of them captured a lace wing fly and shut it up in a small box. In a few moments after, having occasion to look at it, he found one egg deposited; after walking a few yards with it to show it to us, which could not have occupied him more than three or four minutes, the box was opened again when it was found that three more eggs had been deposited, we had no opportunity of watching the further deposition or maturing of these eggs. The lace wing fly larvæ are very voracious, and if sufficiently numerous would prove formidable foes to the currant worm.

Fig. 10.



a b

Fig. 11.



From about the 12th of May to the end of the season, the currant worms were very abundant. The earlier broods seem to confine their operations almost entirely to the gooseberry bushes, but after two or three weeks they attack the currant bushes with equal vigour. On the 16th of June, we noted the fact that the full grown larvæ in great numbers, others half grown or more and young colonies of the newly hatched larvæ were all to be found at that date on the same bushes. About the last of July, many colonies of these newly hatched larvæ were found almost entirely destroyed by some undiscovered foe ; probably some beneficial insect. Many leaves were found with the rows of empty egg shells on them and with a few holes eaten in them, but with the greater part of their substance uninjured, and with but little or no injury to the leaves surrounding ; here evidently the greater portion of the larvæ had been destroyed soon after hatching.

On the 10th of July, while emptying out a number of the perfect flies from a box, searching for the empty pupa case of an ichneumon fly found dead in the box, two pupæ of ventricosus were found. They were very pretty objects, about one quarter of an inch long, of a very pale and delicate whitish green colour, becoming yellowish green at each extremity ; remarkably transparent and delicate looking. The eyes were black and prominent ; the feet, antennæ and mouth parts all separately cased, with the same glossy transparent covering almost crystal-like. The wing cases were similar in appearance, but of a little deeper green, bent under and reaching to the first abdominal segment. The pupa seems to be incapable of movement, a slight quivering only of the limbs could be detected under the microscope when pressed on. The feet all terminated in rounded knobs with no visible claws.

The Currant Measuring Worm *Ellopia* (*Abraxis*), *ribearia*, Fitch.

This insect has also been very abundant during the past summer. As early as the third week in May, the young larvæ were found quite common on red currant, gooseberry and black currant, and by the first of June many of them had grown to an inch in length ; judging-from the numbers infesting the bushes, they appeared to prefer the black currant to either the red or the gooseberry. By the 15th of the month they were well grown, and appeared as shown in fig. 12, (after Riley). They are then nearly an inch and a quarter long, of a whitish colour with a number of black spots on each ring or segment ; a wide yellow stripe down the back, and another of the same character along each side, the latter somewhat broken. The underside is white with a slight tinge of pink, also spotted with black, and with a wide yellow stripe down the middle.

Fig. 12.

The length of the chrysalis see fig. 1 , is about half an inch ; it is of a dark reddish brown colour, paler between the segments, appearing under a magnifying glass roughened with minute punctures and irregularities of surface ; the abdominal segments are dotted with round punctures of varying sizes, while the terminal one is armed with two short sharp brown spines. By the 2nd or 3rd of July, fresh specimens of the moth fig. 13, were on the wing becoming much more abundant about the 6th, when they were observed flying in almost every direction about the bushes. The moth when its wings are expanded measures an inch or more across ; the wings are of a pale yellowish colour with several dusky spots, varying in size and form, and more distinct in some specimens than in others ; sometimes these spots are so arranged as to form one or two irregular bands across the wings. About the middle of July, some of these active specimens were captured, and one of the females, confined in a box by itself, laid a large number of eggs, 140 in all, between the 22nd and 23rd of July. These were laid loose in the box excepting 24 of them which were slightly attached to the sides. The egg when viewed through a microscope is a very beautiful object ; its length is nearly $\frac{3}{100}$ths of an inch, width nearly $\frac{2}{100}$ths : in form it is an elongated oval, rather blunt at each end. Colour dull yellowish grey, sometimes with a bluish tinge with the surface honeycombed with regular depressions, the ridges bordering each cell having several bright minute whitish dots, which give the egg a very pretty and brilliant appearance when brought under the strong light of the condenser of the microscope. At the present date, December 1st, these eggs are still unchanged, excepting slightly in colour, owing to the developing larvæ showing through the semi-transparent shell in spots, the larvæ in all probability will not emerge until early spring. As there is only one brood of this insect with us during the year, it is never likely to prove very troublsome ; a seasonable application of hellebore will in any case keep it within bounds.

Fig. 13

THE WHITE-MARKED TUSSOCK CATERPILLAR, *Orgyia leucostigma.*

The orgyia caterpillar is always common in our section of Ontario. The clusters of eggs from which the larvæ are produced are quite numerous in winter on our fruit trees especially those of the apple, pear and plum, they are securely fastened to the tree along with a dead leaf or two by threads of silk.

Fig. 14.

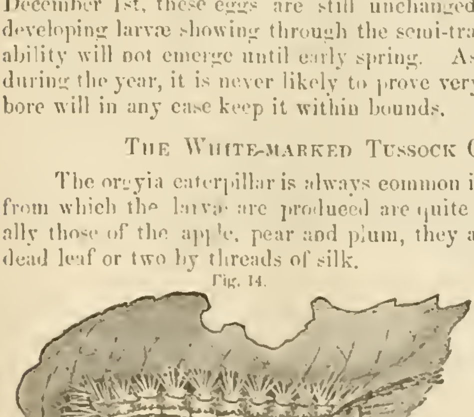
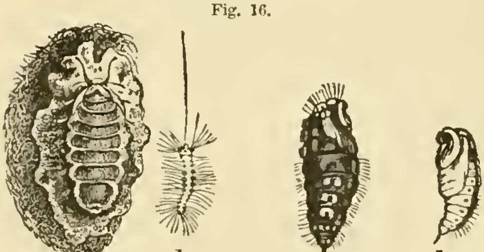


Fig 14, (after Riley), represents the full-grown caterpillar which, when about to change to a chrysalis,selects a leaf on which to undergo this important transformation, and this leaf in such a position that while the chrysalis is firmly attached to it on the one side, *it* is firmly secured by silken threads to the under side of a branch on the other, thus securing the leaf from falling to the ground in the Autumn. In about a fortnight after the change to chrysalis takes place, the moths begin to make their appearance. The male which comes forth from a chrysalis not more than about half the size of that which produces the female, (*d* fig. 16 shows the chrysalis of the male, *c* that of the female), is a very pretty winged moth, see fig. 15, (after Riley). Its antennae are beautifully feathered or pectinate, and its wings are dark brown, with a white spot on each front wing near the inner hind angle. When at rest its outline is heart-shaped, and its long front feet heavily clothed with hairs and scales are thrust forward to their full length. Very different indeed in appearance is his mate; the female is wingless or furnished with but the merest rudiments of wings which no one would observe without the closest inspection, she is represented at fig 16 resting on the cocoon from which she rarely moves more than a few inches. There she waits the attendance of the male after which the process of egg depositing begins. Dr. Fitch says that the eggs are extruded in a continuous string which is folded and matted together so as to form an irregular mass which is glued to the top of the cocoon; on removing this mass of eggs from its place of attachment, the surface of the cocoon appears covered with fragments of a transparent gelatinous-looking substance, which has evidently been applied in a fluid state. The bottom layer of eggs will usually number one hundred or more, and their interstices are well filled with this same gelatinous material, which adheres so strongly to the eggs that when the nest is torn open, they cannot be separated without bringing away portions of this substance firmly attached. Another irregular layer of eggs is placed on this, then a third, and sometimes a fourth before the total number is exhausted, and through the whole of these the gelatinous matter is so placed as to secure every egg, not by its being imbedded in a solid mass, but surrounded by the material worked into a spongy or frothy state. Over all is a heavy layer of the same, with a nearly smooth greyish white surface, the whole number of eggs being so placed as to present a convex surface to the weather which effectually prevents the lodgment of any water on it.

Fig. 15.

Fig. 16.



a *b* *c* *d*

Colours Yellow and Black.

Within this enclosure from 375 to 500 eggs are securely placed. We have counted the contents of several and 375 is the lowest and 500 the highest number we have found. The egg is nearly globular, flattened at the upper side, not perceptibly hollowed, with a dark point on the centre of the flattened portion surrounded by a dusky halo. Its surface is smooth under a magnifying power of 45 diameters, but when submitted to a higher power, appears lightly punctured with minute dots. Its colour is uniformly white to the unaided vision, but the microscope reveals a ring of dusky yellow surrounding it immediately below the flattened portion. Its diameter is $\frac{1}{25}$ of an inch.

A careless observer seeing a dead leaf here and there upon his trees might readily conceive that they were blown into the position they occupied by accident, and retained there by threads of spiders' webs or something of that sort, but a closer examination will furnish food for thought, in the wise arrangements made by the parent moth, in providing for the safety of her future offspring, and at the same time may well excite alarm in the mind of the fruit grower when he perceives promise of the approaching birth of such a horde of hungry caterpillars as even one of these egg masses will produce.

Early in June these eggs begin to hatch and continue to hatch on different trees for several weeks. During the past season we found the larvæ about half an inch long on the 3rd of July, and by the 22nd, some specimens were nearly full grown. There must, however, have been earlier larvæ than these which escaped notice, for on the 29th of July we found a freshly hatched cluster of young larvæ belonging to the second brood. The cocoon had been made and the eggs laid between two young green leaves of a pear tree, the following description was taken the day after.

Length one eighth of an inch. Head, reddish brown slightly bilobed, dotted with black on the sides. Body above, yellowish green, semi-transparent, dotted and spotted with dark brown. Each segment or ring is provided with a transverse row of tubercles from which arise clusters of long spreading hairs, one pair of tubercles on the sides of the second segment much larger than any of the others and with a larger cluster of hairs; in each cluster there is one or more hairs, very long, longer in some instances than the entire body of the larva, there is a dark brown broken stripe along each side. Hairs mixed, brown and whitish. Changes take place in its appearance at each successive moult until finally it presents the appearance given in fig. 14, and is in adornment one of the most beautiful caterpillars we know of with its vermillion red head and collar, the graceful pencils of long black hairs at each extremity, and the cream coloured brushes or tufts along its back.

Nine different parasites have been found infesting this larvæ. These friendly helpers must do much towards keeping this destructive creature within reasonable limits. Of 34 cocoons lately taken at random from different trees, only ten were found with eggs attached and quite a large proportion of the remainder were infested with parasites. Hence when collecting these cocoons in winter none should be taken or destroyed, but those which have egg masses on them, as all the others will contain either useful parasites or else the empty, harmless male chrysalis. As the female never travels beyond her cocoon, it is clear that this insect can only spread by the wanderings of the caterpillar or the careless introduction of eggs on young trees, no doubt the latter has been the most prolific source of evil.

THE APPLE-TREE BLIGHT.

This strange disease, affecting the tips of the branches of apple and quince trees, has been very common during the past summer, and has extended over a large portion of the western part of Ontario. The first specimens we received this year were from Mr. James Dougall, of Windsor. He writes, on the 27th of June, as follows—"I send you to day, by express, some twigs and shoots of apple and quince trees, affected by what I presume is the twig borer. I have never been able to discover any insects or larvæ in the shoots, but possibly I may have been late in looking for them. The year before last this pest was very bad down the lake shore, about Ruthven, the orchards were browned with it. Last year it attacked my larger apple trees badly, and in the nursery rows some Alexander trees, which were five years old, suffered, while the younger ones were not touched; this year it is worse than last. My quinces have been badly injured for the past three years."

On the same day we received another package from C. F. Treffry, of Hawtry, Ontario, with the following note—"I herewith enclose for your inspection some small branches from some of my apple trees. In passing through my orchard I was surprised to find three of my finest young trees affected as enclosed. I have watched closely for the insect which must have caused such damage, but without success; neither can I find anything in the Society's Report for 1873 which will give me any information respecting it."

This same disease affected the trees very much on the grounds of Mr. Charles Arnold, of Paris, and many orchards in that section of country were similarly injured. In our own location we observed it in one instance only, affecting a few fruit-bearing twigs on a quince tree. About Hamilton, and between that city and Dundas, we saw, in July, many trees which had been badly injured, and, on returning from New York, a few weeks later saw evidences of the same trouble in some of the apple orchards in the western portion of that state. Thus it will be seen that this disease has affected many trees in widely distant portions of our country, and probably has extended much further than we are at present aware of. We shall be glad to hear from our fruit-growing friends in reference to this matter.

The advent of this disease is shown by a sudden withering of the twigs and extremities of the branches, particularly the fruit bearing portions, and embracing the whole of the new growth. Soon the leaves appear as if scorched, and the wood of the affected portions becomes black. Here the trouble seems to end, and later in the season the tree partially recovers its vigour and throws out new shoots from below the base of the affected portion. The fact of the fruit branches being principally involved tells heavily on the crop for the year, and makes this disease a much more serious matter than it would otherwise be. The effects produced are so similar in appearance to the damage done, in some instances by the twig borers that we do not wonder at the prevailing opinion that the injury is in some way caused by insects. The most careful examination, however, fails to reveal the slightest evidence of insect work, and, like the mysterious pear tree blight, its origin and progress are at present involved in obscurity. From the fact of its affecting only the new and tender growth we should infer that some atmospheric agency is probably concerned in the production and propogation of this disease. At present we have no remedy to suggest.

ON SOME OF OUR COMMON INSECTS.

By W. Saunders.

The Cecropia Moth (*Attacus Cecropia*, Linn.)

Among the many beautiful and wonderful insects native to this country, there is none which excites yearly more wonder and astonishment than the cecropia moth. Its size is enormous, measuring when its wings are spread from five and a half to six and a half inches across, and sometimes even more while its beauty is proportionate to its size. The accompanying figure 17 (after Riley) is a faithful representation of this magnificent creature. Both front and hind wings are of a rich brown, the anterior pair greyish, shaded with red,

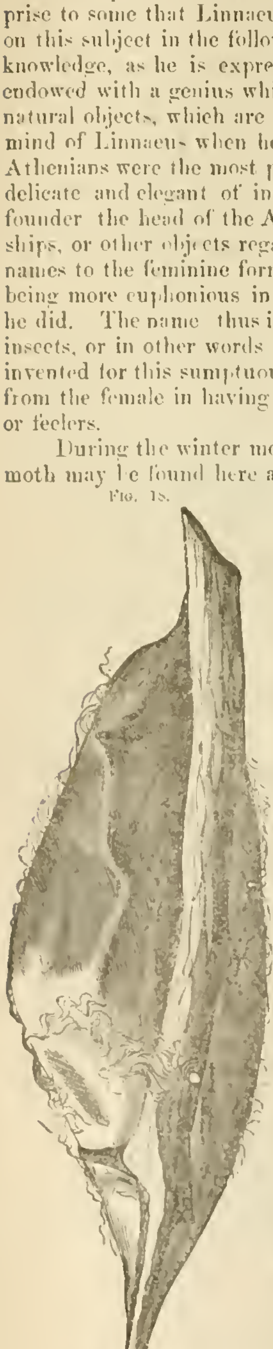
Fig. 17.

the posterior more uniformly brown; near the middle of each of the wings there is a nearly kidney shaped white spot shaded more or less with red, and margined with black. A wavy dull red band crosses each of the wings, edged inside on the front wings more or less faintly with white, while on the hind pair the band is widely and clearly margined with the same color. The outer edges of the wings are of a pale silky brown in which on the anterior pair runs an irregular dull black line, which on the hind wings is replaced by a narrow, double broken band of the same hue. The front wings next to the shoulders are dull red, with a curved white and black band, varying much in distinctness in different specimens, and near their tips, there is an eyelike black spot with a bluish white crescent. The upper side of the body and the legs are dull red, with a wide band behind the head and the hinder edges of the segments of the abdomen white ; the under side of the body is also irregularly marked with white. The under surface of the wings is very much like the upper, but somewhat paler.

Cecropia was the ancient name of the City of Athens, and it has been a matter of surprise to some that Linnaeus should have given this name to our moth. Dr. Fitch throws light on this subject in the following words. "The great legislator of this department of human knowledge, as he is expressively styled by Latreille, it has been frequently remarked, was endowed with a genius which, but few of his disciples have inherited, for selecting names for natural objects, which are most appropriate and happy. The idea which was present in the mind of Linnaeus when he named this splendid moth, we think is sufficiently evident. The Athenians were the most polished and refined people of antiquity. The moths are the most delicate and elegant of insects; they were the Athenians of their race. Cecrops was the founder the head of the Athenian people. When the names of men were bestowed upon cities, ships, or other objects regarded as being of the feminine, gender, classical usage changed these names to the feminine form. The moths (*Phalæna*) being feminine, and the name of Cecrops being more euphonious in this form, probably induced Linnæus to change it in the manner he did. The name thus implies this to be the leader, the head of the most elegant tribe of insects, or in other words the first of all insect kind. What name more appropriate can be invented for this sumptuous moth." The figure we have given is that of a male which differs from the female in having a smaller abdomen and larger and more deeply feathered antennæ or feelers.

During the winter months, when the apple trees are leafless the large cocoons of this moth may be found here and there, firmly bound to the twigs, they are also frequently found on currant bushes, and occasionally also on lilac, cherry, hazel, plum, blackberry, maple, willow and some other shrubs and trees; for this insect in its larval stage is a very general feeder. The cocoon, see fig. 18, (after Riley) is about three inches long, pod shaped and of a dirty brown colour, and is entirely constructed of silk, the fibres of which are very much stronger than those of the common silk worm *Bombyx mori*. The silk has been worked to a limited extent and manufactured into socks and other articles, which have been found very durable; but a drawback to the advancement of this branch of industry lies in the fact that the caterpillars do not bear confinement well, and hence are not easily reared.

FIG. 18.



The exterior structure of the cocoon is very close and papery-like, but on cutting through this, we find the interior—surround ing the dark brown chrysalis—made up of loose fibres of strong yellow silk. This snug enclosure effectually protects the insect in its dormant state from the extremes of weather during the long wintry months. When the time approaches for the escape of the moth, which is about the beginning of June, the internal dark brown chrysalis is ruptured by the struggles of the occupant, and the newly born moth begins to work its way out of the cocoon. As it is possessed of no cutting instrument of any kind, this would indeed be a hopeless task had not the all wise Creator made a special provision for this purpose, and to this end a fluid adapted for softening the fibres is furnished just at this juncture and secreted from about the mouth. On listening to the creature as it works its way through, you hear a scraping tearing sound, which is made by the insect working with the claws on its fore-feet, tearing away the softened fibres and packing them on each side to make a channel for its escape. The place of exit is the smaller end of the cocoon, which is more loosely made than any other part and through which, after the internal obstacles are overcome, the passage is effected without much further trouble.

We have frequently watched their escape. First through the opening is thrust the anterior pair of bushy looking legs, the sharp claws of which fasten on the outside structure; then with an effort the head is drawn forward, suddenly displaying the beautiful feather-like antennæ; next, the thorax, on which is borne the other two pairs of legs, is liberated, and finally, the escape is completed by the withdrawal of the abdomen, through the orifice thus made. Queer looking creatures they are when they first put in an appearance, with their large, fat, juicy bodies, and tiny wings. When the wings are fully expanded they measure from five to six inches or more across, but when fresh from the chrysalis they are but very little larger than the wings of a bumble bee. The first necessity now for the welfare of the individual is to find a suitable location where the wings may be held in a good position for expanding, for without such favourable circumstance they would never attain a serviceable size. It is necessary that a position should be secured where the wings may hang down as they are expanding, for which purpose the under side of a twig is often selected; and here, securely suspended by the claws, the wings undergo in a short time the most marvellous growth it is possible to imagine. The whole process, from the time of the escape of the moth to its full maturity, seldom occupies more than from half an hour to an hour, and during this time the wings grow from the diminutive size already mentioned to their full measure and capacity.

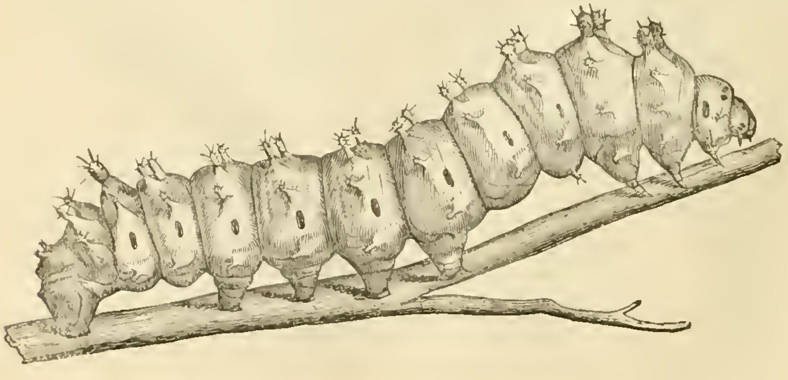
A wing clipped from the insect immediately after its escape, and examined under the microscope, reveals the fact that the thousands and tens of thousands of scales with which the wings are covered, and which afterwards assume such beautiful feather-like forms, are now nearly all threadlike and undeveloped. Impressed with this thought, the mind is fairly astonished at the almost incredible change wrought in so limited a time, for the growth embraces not only the extension of the surface of the wing, but the enlargement and maturity of every scale or feather on it, the individuals of which are but as dust to the naked eye. What a wonderful and intricate system of circulation and power of nutrition must be possessed to accomplish this marvellous result!

Soon after their exit these moths seek their mates, and after pairing, the female begins to deposits her eggs, a process which occupies some time, for the eggs are not laid in patches or groups, but singly; and are firmly fastened with a glutinous material to the under side of a leaf; and as it is seldom there are more than one or two laid on any single tree or bush, a considerable distance must be traversed by the parent in the transaction of this all important business.

The number of eggs which these moths lay is astonishing, we have known a single female to deposit within three days as many as 217. The eggs are about one-tenth of an inch long, nearly round and of a dull creamy white colour, with a reddish spot or streak near the centre, the duration of the egg stage is usually from about a week to ten days.

At the expiration of this period the larva eats its way out of the egg, the empty shell of which furnishes the young creature with its first meal. On its first appearance it is black, with little shining black knobs on its body, from which arise hairs of the same colour. Being furnished with a ravenous appetite its growth is very rapid; and from time to time its exterior coat or skin becomes too tight for its comfort, when it is ruptured and thrown off. At each of these changes or moultings, the caterpillar appears in an altered garb, gradually becoming more like the full grown larva represented by Fig. 19. It is very handsome. Its body is pale

Fig. 19.



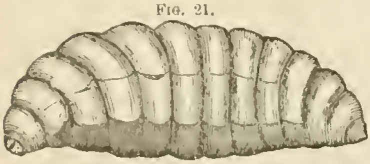
green, the large warts or tubercles on the top of the third and fourth segments are coral red, the remainder are yellow excepting those on the second and terminal segments, which, in common with the smaller tubercles along the sides, are blue. During its growth from the diminutive creature as it escapes from the egg to the monstrous-looking full grown specimen, it consumes an immense amount of vegetable food; and especially as it approaches maturity is this voracious appetite apparent. Where one or two have been placed on a young apple tree, they will often strip it entirely bare before they have done with it, and thus prevent the proper ripening of the wood, entailing damage to the tree, and, sometimes, endangering its life; hence, during their season, they should be watched for and destroyed. During the winter months, their cocoons may be looked for, and removed in time to check their further spread.

The natural increase of this insect being so great, wise provisions have been made to keep it within bounds. Being such a conspicuous object it sometimes forms a dainty meal for the larger birds; there are also enemies which attack the egg and young larvæ and besides these there are several parasites which live within the body of the caterpillar and destroy it before reaching maturity. One of the largest of these parasites is the long tailed Ophion (*Ophion macrurum*, Linn.) Fig. 20 (after Riley). This is a large yellowish brown Ichneumon fly, and is perhaps one of the commonest parasites affecting the cecropia. The female of this fly deposits, according to Mr. Trouvelot, from eight to ten eggs upon the skin of her victim. These eggs soon hatch into young larvæ which eat their way through the skin of the caterpillar, and at once begin to feed upon the fatty parts within. As only one of these parasitic larvæ can find food sufficient to mature, the rest either die from hunger or are devoured by the strongest survivor.

Fig. 20.

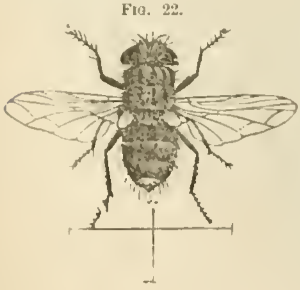
Mr. Riley, in *Am. Ent.*, Vol. II., says, "After the Cecropia Worm has formed its cocoon, the parasitic larva which had hitherto fed on the fatty portions of its victim, now attacks the vital parts, and when nothing but the empty skin of the worm is left, spins its own cocoon, which is oblong oval, dark brown inclining to bronze, and spun so closely and compactly, that the inner layers when separated have the appearance of gold beater's skin. If we cut open one of these cocoons soon after it is completed, we shall find inside a large, fat, legless grub, Fig. 21, which sometimes undergoes its transformations and issues as a fly in the fall, but more generally waits until the following spring.

Fig. 21.



"The Ichneumon Fly, last mentioned, usually causes a dwarfed appearance of the worm which it infests, and parasitized cocoons can generally be distinguished from healthy ones by their smaller size. The larvæ of the Tachina Fly which we now introduce to our readers, as parasitic on the Cecropia Worm, seem to produce an exactly opposite effect, namely, an undue and unnatural growth of their victim. In the beginning of September, 1866, we received an enormous Cecropia Worm. It measured over four inches, was a full inch in diameter, and weighed nearly two ounces, but like many other large specimens which we have since seen, it was covered with small oval, opaque, white egg-shells, clusters of four or five occurring on the back of each segment, invariably deposited in a traverse direction. The skin of the worm was black, where the young parasites had hatched and penetrated. The large worm soon died and rotted, and in about twelve days a host of maggots gnawed their way through the putrid skin. These maggots averaged about one-half inch in length, and in form were like those of the common Blow-fly. The head was attenuated and retractile and furnished with two minute curved hooks, and the last segment was squarely cut off, slightly concave and with the usual two spiracles or breathing holes which this class of larvæ have at their tails. Their colour was of a translucent yellow, and they went into the ground and

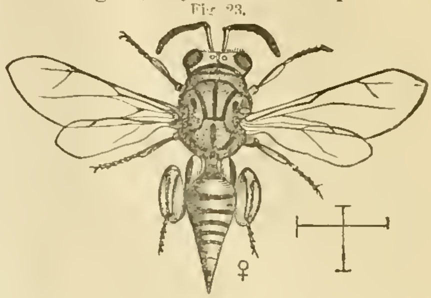
Fig. 22.



remained in the larva state all winter, contracted to pupæ in the April following, and the flies commenced to issue the last of May." This fly differs so little from the red tailed Tachina Fly (*Exorista militaris, Walsh*), see Fig 22, which infests the army worm that Mr. Riley is inclined to regard it as a variety of that species.

The Cecropia chalcis fly (*Chalcis Mariæ Riley*). We quote again from Mr. Riley.—" In May, 1869, we received from Mr. V. T. Chambers, of Covington, Ky., numerous specimens of the beautiful large chalcis fly figured herewith (Fig. 23), which he had taken from the cocoon of the Polyphemus moth, which is quite common and issues as early as the middle of February in that locality. He says, ' I was satisfied that the cocoon did not contain a living Polyphemus, and therefore opened it. It contained so little besides these insects and their exuviae as to suggest strongly the old idea that the caterpillar had been metamorphosed into them (as in a sense it had). There were 47 of them, of which 23 were females. As all the males and some of the females were dead when I opened the cocoon, I think it likely that the former never do emerge, and perhaps but few of the latter ; otherwise Polyphemus would soon be exterminated.'

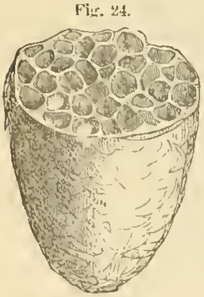
Fig 23.



Colours Black and Yellow.

" We can very well imagine that most of these chalcis flies would die in their efforts to escape from the tough cocoon of the Polyphemus, but it so happens that these same insects have been found by Mrs. Mary Treat, of Vineland, New Jersey, to prey upon the cecropia worm, from the cocoon of which they can much more easily escape.

Fig. 24.



" The Divorced Cryptus (*Cryptus nuncius*, SAY,—*extrematis*, CRESSON), another Ichneumon fly, infests the cecropia worm in great numbers, filling its cocoon so full of their own thin parchment-like cocoons that a transverse section (Fig. 24) bears considerable resemblance to a honeycomb. The flies issue in June, and the sexes differ sufficiently to have given rise to two species. We have bred seven females and twenty-nine males from a cocoon of the cecropia moth, all the males agreeing with the species described by Say as *nuncius*, and all the females agreeing with that described afterwards as *extrematis* by Mr. Cresson.

THE CLOUDED SULPHUR BUTTERFLY (*Colias Philodice*, GODT).

The clouded sulphur is everywhere one of our commonest butterflies, abundant in its season, in fields and roadways, frequently congregating in groups on the borders of streams and springs, where, in hot weather, they seem to enjoy settling on the cool, moist ground. They are still more abundant in clover fields as the season advances.

Fig 25.

Fig. 26.

Colours Yellow and Black.

The female of this species differs somewhat in its markings from the male, as will be readily seen by reference to the figures, 25 representing the male, 26 the female. The ground colour of the wings in both sexes is bright yellow marked on the outer edge with a dark brown or blackish border, narrower in the male than it is in the female, while in the latter it encloses on the anterior wings a broken row of irregular yellow spots, there is also a spot of black placed near the front edge of the fore wings, about half way between the base and tip, varying in form and distinctness. The hind wings in both sexes are less heavily margined, and near the middle is a dull, pale orange spot. Both wings are dusky towards the base, and the fringes are pink.

On the under surface the yellow colour is less bright, while the dark margins are either entirely wanting or else represented by a dusky shade margined occasionally within by a few dull brownish dots. The spot on the forewings is distinct, but paler and usually centered with a small silvery eye. That on the hind wings is much more distinct than above, being composed of a bright silvery spot in the centre defined by a dark brown line which is in turn encircled with dull orange. Immediately above and a little towards the outer edge is a much smaller spot of the same character; there is also a reddish dot on the anterior edge, about the middle of the wing. The antennæ are pink, with the knobs at their tips of a darker shade; the body is dark above; paler at the sides and underneath.

The insect appears first on the wing about the middle of May, becoming more plentiful towards the latter end of the month, but the time of its greatest abundance is later in the season, after the appearance of the second brood, which is during the latter part of July and throughout August. In the second volume of the "Entomologist," p. 8, Mr. Bethune remarks as follows: "On the 3rd of August, a lovely, bright, warm morning, after an excessively wet night, I drove about ten miles along country roads; every few yards there was a patch of mud, the effects of the heavy rain, and at every patch of mud there were from half a dozen to twenty specimens of *Colias philodice*, at least one, I should think for every yard of distance I travelled. I must then have seen, at a very moderate computation, about ten thousand specimens of this butterfly."

The caterpillar of the Clouded Sulphur feeds on the cultivated pea, on clover, on the Blue Lupin, *Lupinus perennis*, and no doubt on many other plants belonging to the order *Leguminosæ*. The egg, which is a beautiful object, is about one twenty third of an inch in length, tapering at each end, with twelve or fourteen raised longitudinal ribs, with smaller cross lines in the concave spaces between them. Its colour when first deposited is of a pale lemon yellow, which changes in three or four days to a pale red, then gradually to a bright red, and from that to dark brown just before the time of hatching. The duration of the egg stage is about seven days.

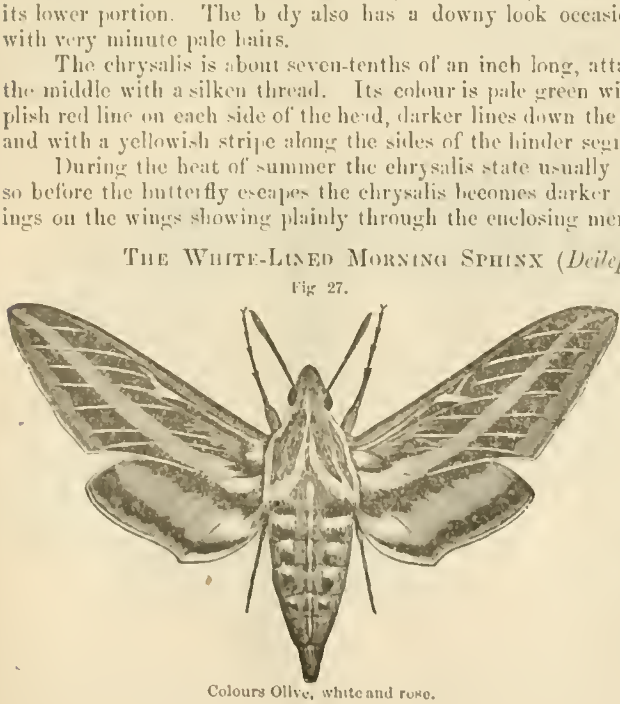
The young caterpillar just hatched is one-twelfth of an inch long and of a dull yellowish brown colour, but when a little older it changes to a dark green. When full grown it is about an inch long, with a dark green head and body, the latter with a yellowish white stripe on each side close to the under surface, with an irregular streak of bright red running through its lower portion. The body also has a downy look occasioned by its being thickly clothed with very minute pale hairs.

The chrysalis is about seven-tenths of an inch long, attached at its base, and girt across the middle with a silken thread. Its colour is pale green with a yellowish tinge, with a purplish red line on each side of the head, darker lines down the middle both in front and behind, and with a yellowish stripe along the sides of the hinder segments.

During the heat of summer the chrysalis state usually lasts about ten days. A day or so before the butterfly escapes the chrysalis becomes darker and semi-transparent, the markings on the wings showing plainly through the enclosing membrane.

The White-Lined Morning Sphinx (*Deilephila lineata*, Fabr.)

Fig. 27.



Colours Olive, white and rose.

The white-lined morning sphinx is a tolerably common insect throughout Ontario. It is seen on the wing generally about twilight or later, although it has been met with occasionally in the day time. In its flight it much resembles the humming bird, hovering over flowers into which it inserts its long and slender tongue in search of the nectar there stored, which constitutes its food. In common with many other sphinx moths its structure is robust and its flight rapid and powerful: hence it is difficult to capture, and even when taken will often flutter with such force as to seriously damage the covering and structure of its beautiful wings. When its wings are fully spread they measure from three to three-and-a-half inches across, (see Fig. 27, after Riley). The ground colour is a rich greenish olive. On the fore wings there is a pale band about the middle, extending from near the base to the tip, and along the outer margin runs another band nearly equal in width, but darker and less distinct; the veins also are lined with white. The hind wings which are small, are nearly covered by a wide central rosy band, becoming paler as it approaches the body, the hinder edge is fringed with white. On the anterior portion of the body there are six longitudinal stripes or lines, while the hinder part is alternately spotted with white and black. The entire under surface is much paler and duller in colour than the upper.

"The larva," Mr. Riley says, "feeds upon purslane, turnip, buckwheat, water melon, and even apple and grape leaves, upon any of which it may be found in the month of July. It descends into the ground, and within a smooth cavity, changes into a light brown chrysalis, from which the moth emerges during the month of September."

"The most common form of the larva is that given at Fig. 28. Its colour is yellowish green, with a prominent subdorsal row of elliptical spots, each spot consisting of two curved

Fig. 28.

black lines, enclosing superiorly a bright crimson space, and inferiorly a pale yellow line—the whole row of spots connected by a pale yellow stripe, edged above with black. In some specimens these eyelike spots are disconnected, and the space between the black crescents is of a uniform cream colour. The breathing holes are either surrounded with black or with black edged with yellow. The other form is black, and characterized chiefly by a yellow line along the back, and a series of pale yellow spots and darker yellow dots, as represented

Fig. 29.

in the illustration Fig. 29, even this dark form is subject to great variation, some specimens entirely lacking the line along the back, and having the spots of different shape."

"This insect has a wide range, as it occurs in the West Indies, Mexico and Canada, as well as throughout the United States. Feeding as it does, principally on plants of but little value, and being very commonly attacked by the larvæ of a Tachina fly, this insect has never become sufficiently common to be classed as injurious."

GRASSHOPPERS OR LOCUSTS.

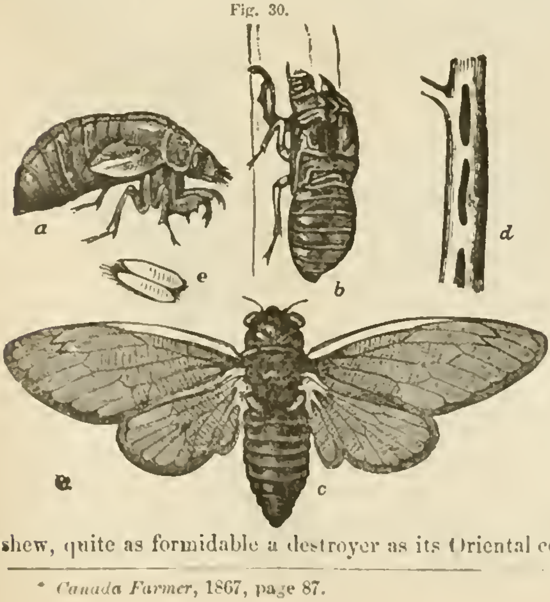
BY THE REV. C. J. S. BETHUNE, M.A.

Few, probably, of our Canadian fellow-countrymen are aware that the terrible Locust, "the scourge of nations," as it has been fitly termed, about whose destructive powers they read such appalling accounts in books of Oriental travel, is one of the insect enemies that some of the denizens of our Dominion have to contend against. And yet it is too true—as the records of the past season in our North-west Province of Manitoba abundantly prove. The locusts (or grasshoppers, as they are incorrectly termed) have laid waste great tracts of fertile country, and have brought ruin and desolation to many an unhappy settler in that far off region.

It is much to be regretted—to quote our remarks made on a former occasion*—that so much confusion exists in the popular use of terms in Natural History, and particularly in entomology, in consequence of which very serious errors become matters of common faith, much mischief is allowed to go unheeded, and the innocent are oftentimes punished for the guilty. The term "bug," for instance, is almost universally applied in the neighbouring States, and very generally in this country, to every kind of insect, so that it is no uncommon thing to hear a beautiful butterfly or lovely moth designated by the odious name of "bug," whereas the appellation belongs exclusively to those foul-smelling sucking insects of the order *Hemiptera*, which feed upon the juices of plants, and in some cases upon the blood of other insects, of animals and man. Again, the larva of almost every kind of insect is called "*the* grub;" larvæ that burrow into the trunks of trees and timber, "*the* borer," and so on to any extent. The consequence is that what is a remedy for one grub or borer, or so-called "bug," is indiscriminately made use of for the destruction of every other grub, or borer, or "bug," unmindful that the old proverb may be read in this way also—"What is one *insect's* meat is another's poison," and that the treatment that will exterminate one injurious insect is sometimes perfectly harmless in the case of another.

This confusion of terms is particularly unfortunate in the case of the insects that we are now treating of. Every one in this country is perfectly familiar with what is commonly called a "grasshopper," but how very few are aware that what they term a grasshopper, and see too often to think much about, is really the same kind of insect as the much dreaded, famine-producing Locust, that constituted one of the plagues of Egypt, and that is an object of so much terror wherever it prevails. A true locust it nevertheless is, and it were well, for many reasons, that our people became accustomed to call it by its right name. Our common species in this Province, while it does not possess the power of suddenly appearing in vast numbers and emigrating from place to place, occasionally becomes greatly multiplied and proves very destructive. The western locust (or grasshopper), however, differing but very slightly from our species, is, as we shall presently shew, quite as formidable a destroyer as its Oriental congener.

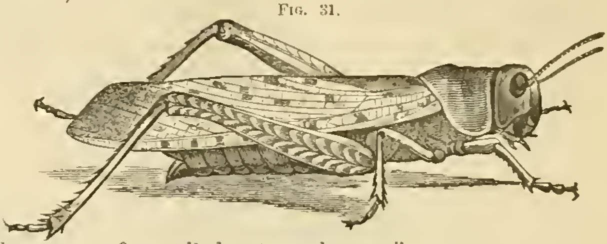
Fig. 30.



* *Canada Farmer*, 1867, page 87.

While the true American Locusts are commonly called "grasshoppers, and the true grasshoppers are termed crickets, katydids, &c., another element of confusion is mingled with our insect nomenclature by the common practice of giving the name of locust to the cicada, a totally different insect belonging to an entirely different order. The accompanying illustration will shew the reader the difference between these three kinds of insects better than any written description. Figure 30 represents different stages in the life of the Cicada or so-called "Seventeen year Locust" (*C. Septem-decim* LINN). *a* is the pupa ; *b* the empty pupa case after the perfect insect has emerged from it ; *c*, the perfect or winged insect ; *d*, the perforations in a twig for the deposition of eggs ; *e*, the egg. Figure 32 represents a katydid or true grasshopper (*Cyrtophyllum concavum*, SAY); and Figure 31 a true locust or so-called grasshopper (*Caloptenus spretus*, UHLER).

FIG. 31.



A single glance at these illustrations will shew the reader, the main differences between the three kinds of insects that we have been referring to. We wish it, therefore, to be plainly understood that in the account that follows : we shall use the term "Locust" in reference to the devastating insect represented in Figure 31, which is so often called a "grasshopper."

Fig. 32.

HISTORY OF THE LOCUST IN AMERICA.

From the various works that we have been able to consult we gather that visitations of locusts have occurred on a more or less extensive scale, from time to time, ever since the Central and Western portions of this Northern Continent have been occupied by Europeans. We have no difficulty, then, in believing that from time immemorial these destructive insects have played their important part in maintaining the balance of animal and vegetable life in accordance with the grand laws of the Omnipotent Creator. The earliest notice that we have found of a visitation of locusts refers back more than two centuries, to a period much anterior to the discovery of the Mississippi River by La Salle. In Gage's West Indies the following account is given of one of these visitations in Guatemala in the year 1632 :—

"The first year of my abiding there it pleased God to send one of the plagues of Egypt to that country, which was of locusts, which I had never seen till then. They were after the manner of our grasshoppers, but somewhat bigger, which did fly about in numbers so thick and infinite that they did truly cover the face of the sun, and hinder the shining forth of the beams of that bright planet. Where they lighted, either upon trees or standing corn, there was nothing expected but ruin, destruction and barrenness ; for the corn they devoured, the fruits of trees they ate and consumed, and hung so thick upon the branches that with their weight they tore them from the body. The highways were so covered with them that they startled the travelling mules with their fluttering about their heads and feet. My eyes were often struck with their wings as I rode along ; and much ado I had to see my way, what with a montero wherewith I was fain to cover my face, what with the flight of them which were still before my eyes. The farmers towards the South sea-coast cried out, for that their indigo, which was then in grass, was like to be eaten up ; from the *Ingenios* of sugar the like moan was made, that the young and tender sugar-canes would be destroyed ; but, above all, grievous was the cry of the husbandmen of the valley where I lived, who feared that their corn would in one night be swallowed up by that devouring legion. The care of the magistrates was that the towns of Indians should all go out into the fields with trumpets, and what other instruments they had, to make a noise and to affright them from those places which are most considerable and profitable to the commonweath; and strange it was to see how the loud noise of the Indians and sounding of the trumpets defended some fields from the fear and danger of them. Where they lighted in the mountains and highways, there they left behind them their young ones, which were found creeping upon the ground, ready to threaten such a second year's plague, if not prevented; wherefore all the towns were called, with spades, mattocks and shovels, to dig long trenches and therein to bury all the young ones. Thus, with much trouble to the poor Indians and their great pains (yet after much hurt and loss in many places) was that flying pestilence chased away out of the country to the South Sea, where it was thought to be consumed by the ocean, and to have found a grave in the waters, whilst the young ones found it in the land. Yet they were not all so buried, but that shortly some appeared, which, being not so many in number as before, were with the former diligence soon overcome."

About a century later than the date of the above account, the locusts are recorded to have laid waste, on several occasions, all the vegetation of Mexico and Yucatan, and to have produced famine and much consequent suffering among the people. To California, they appear to have been especially partial from the earliest times. The Jesuit Father Michael del Barco, who lived for thirty years in that country as a missionary among the heathen Indians, relates that from the arrival of the Jesuits in 1697 to the year 1722, they were free from any plague of locusts, but that in this year they caused fearful sufferings among the inhabitants. In 1746 and for three years following without intermission, they again invaded the land: after this they did not appear until 1753 and 1754; and finally, before the expulsion of the Jesuits, in 1765 and the two following years. Clavigero, in his History of California, gives a very interesting account of these several invasions, and describes the appearance and natural history of the insect with much minuteness; from his work we make the following extracts:—

"The female, at the latter part of July or early in August, lays a number of fine small eggs of a yellowish colour, in a string, united with a glutinous matter, which appears like a cord of fine silk. These are deposited together and dropped into a small hole which they make in the ground with a small apparatus attached to their tails. Each female lays from seventy to eighty eggs, and sometimes more.

"The birth of these new grasshoppers has no particular time, but is dependent upon the early or late appearance of the rains, but they generally hatch during the latter part of September or early in October. . . . . . Their life, from birth to death, lasts ten months, during which they cast their coats twice and change their colours five times. When the wings have become of sufficient strength and the body at its maturity, they then begin to ascend into the air and fly like birds, and commence their ravages in every direction, desolating the fields of every green thing. Their numbers become so extraordinary, that they soon form clouds in the atmosphere, of which the rays of the sun cast a shadow as they fly. They unite in masses of ten to twelve thousand, always following their conductors and flying in a direct line without falling behind, for they consume every growing thing before them. To whatever height their guides conduct them to obtain a sight of their food they follow, and as soon as growing crops or any verdure is sighted, instantly the swarm will alight and speedily devour and devastate the fields around to that extent, and with that promptitude, that when they are seen by a new swarm of their fellows, there is not anything more left to injure or consume.

"This lamentable insect plague is bad enough in old and cultivated countries, but in the miserable peninsula of California, where they eat up the crops, green trees, fruits, and pastures, they cause great mortality in the domestic animals of the missions, and with the effect of their ravages on the cereals and other garden productions cause great famines and sickness among the inhabitants and neophytes of the establishments. At one time immense multitudes of these voracious insects died, infecting the air dreadfully with the stench of their corruption and decay."

In Upper California, the Franciscan Missions of the early part of the present century, have suffered in a very similar manner. About the year 1827 or 1828, they ate up—we are told—nearly all the growing crops, and occasioned a great scarcity of wholesome food; again in

1834, they "destroyed all the crops of the rancheros and missions, with the exception of the wheat." In 1838, the field crops and gardens were again nearly destroyed. In 1846, there was another serious visitation, which extended over some of what are now termed the Western States, as well as California. In 1855, to pass over lesser visitations, there came one of the most terrible of all the recorded plagues of Locusts in California. As related by Mr. Taylor, of Monterey, (Smithsonian Report, 1858), between the middle of May and October, 1855, "these insects extended themselves over a space of the earth's surface, much greater than has ever before been noted. They covered the entire Territories of Washington and Oregon, and every valley of the State of California, ranging from the Pacific Ocean to the eastern base of the Sierra Nevada; the entire Territories of Utah and New Mexico; the immense grassy prairies lying on the eastern slopes of the Rocky Mountains; the dry mountain valleys of the Republic of Mexico, and the countries of Lower California and Central America, and also those portions of Texas which resemble, in physical characteristics, Utah and California. The records prove that the locusts extended themselves, in one year, over a surface comprised within thirty-eight degrees of latitude, and in the broadest part, eighteen degrees of longitude." The Sacramento newspapers of that year were filled with details of the plague; most accounts compared the swarms, when in flight, to dense snow-storms; they consumed everything before them—the foliage of trees, orchards, gardens, vineyards, fields of young grain, of crops and vegetables—everything was eaten up in a particular locality in a single day, leaving the ground a withered, blackened desert. That summer of 1855, was observed to be the hottest and driest that had been known for ten years."

During the next two years, 1856-7, the plague was almost entirely confined to the region lying east of the Rocky Mountains, and extending in places as far as the Mississippi River; throughout the States of Minnesota, Nebraska and Kansas, the locusts were especially destructive. Ten years later, in the summer of 1866, another noteworthy visitation took place throughout the same region. A correspondent of a Rock Island, Ill., paper (see *Practical Entomologist*, vol. ii., page 3), thus describes the plague in Nebraska: "The last day of August, near the middle of the afternoon, quite a number of grasshoppers were seen alighting, and that number rapidly increased till a little before sunset. The next morning they appeared much thicker, but were only so from having crawled more into the open air to sun themselves. About nine o'clock they began to come thicker and faster from a northerly direction, swarming in the air by myriads, and making a roar like suppressed distant thunder. By looking up to the sun they could be seen as high as the eye could discover an object so small, in appearance like a heavy snow storm. Each grasshopper very much like a very large flake, save that it passed by instead of falling. The number was beyond imagination, the air was literally full of them and continued so till late in the afternoon, countless millions passed on leaving other countless millions covering the earth and devouring the vegetation." Another writer from Kansas states that "Yesterday, September 10th, the locusts made their appearance here, and are devouring everything green. They almost darken the sun in their flight. I put in 65 acres of wheat in the last week of August, which looked fine, but it has nearly all disappeared; by to-morrow night there will not be a spear left. Early sown wheat will be totally destroyed." From the description given by another writer in Kansas, we may quote the following graphic account:—"There is something weird and unearthly in their appearance, as in vast hosts they scale walls, housetops and fences, clambering over each other with a creaking, clashing noise. Sometimes they march in even regular lines, like hosts of pigmy cavalry, but generally they rush over the ground in confused swarms. At times they rise high in the air and circle round like gnats in the sunshine. At such times, I think, they are caught by currents of our prevailing westerly winds and are thus distributed over vast tracts of country." The foregoing extracts will give our readers some little idea of the mode of appearance and the destructive powers of the locusts in the west. We might fill pages, a volume indeed, with similar accounts.

The next year 1867, and to some extent also in 1868 the locusts reappeared throughout the same region, and extended further to the eastward as well as westward. They proved more or less destructive in Western and Central Iowa, and in North Western Missouri, as well as almost all over Nebraska, Kansas, Texas and Utah. They have never, so far as we have been able to ascertain, passed to the eastward of the Mississippi River.

In 1869 and 1870, the ravages of the locusts seem to have been confined on this side of the Rocky Mountains, to portions of Nebraska, Colorado and Utah.

The Plague of Locusts in 1874.

Let us now turn to the terrible visitation of the present year, from the effects of which so many thousands are now suffering the privations of famine throughout immense tracts of country.

Last year (1873) the locusts or grasshoppers were stated to have inflicted considerable damage upon crops of various kinds in some of the Western States, principally Nebraska and Kansas; here and there also in Minnesota, Iowa and Dakota there were comparatively trifling visitations. But in the month of July of this year there began one of the most serious invasions that has ever occurred in the west. In point of numbers and in extent of area affected, the plague was probably no greater than on some previous occasions, notably that of 1855 that we have referred to above; the great difference, however, is caused by the fact that twenty years ago the country west of the Mississippi River was an almost uninhabited wilderness of prairie, while now it is traversed by a net work of railways, covered with populous towns and villages, and occupied to a very large extent by multitudes of industrious people. Twenty years ago the locusts affected the food supply, perhaps, of the buffalo, the Indian, and the scattered frontier settlers, but now their ravages cause destitution and misery in tens of thousands of homes.

Up to the beginning of July this year, all looked bright and fair for the western farmer. His crops of all kinds were, as a rule, growing luxuriantly; the prospect of a bountiful harvest was quite as good as usual. After that date, however, sooner or later in different localities, all these bright prospects were overclouded, in many instances utterly destroyed. The following extracts from various newspapers will abundantly tell the tale.

As early as the 19th of July a correspondent of the *Prairie Farmer* writes from Howard County, Nebraska: "Corn and potatoes were doing well until recently, when the grasshoppers [locusts] put in an appearance, and the result undoubtedly is, at the present moment, that there is not ten per cent. of these crops and of late oats left in this and the two neighbouring counties; and it is very doubtful if the countless millions of Vandals will leave a vestige of any green thing. The result must be almost certain starvation for new-comers, and must retard the development of this beautiful country for many years."

A lady correspondent of the same paper writes a few days later from Butler County, also in Nebraska:—"'The low-hung clounds have dropped their garnered fullness down.' But alas! and alack! they were not the long-looked-for rain clouds, but grasshoppers. As I told you before, they passed over on the 23rd, only a few alighting; but a strong south-west wind on the 24th brought back countless millions; and on the 25th their numbers were fearful to contemplate. They would rise in the air when the sun shone hot, but as it grew cooler they came down like the wolf on the fold. They settled like huge swarms of bees on every living thing. Fields of corn that had been untouched before were now stripped of tassel and blade. A field of early corn was being eaten so fast, that the girls went to save a few ears, instead of going to visit a sick schoolmate according to promise. Trees were so loaded with the pests, that those four and five feet high bent down till the tops touched the ground, and in some instances broke off; for three dreadful hours they dashed against the house like hail. So many came in at doors and windows that every aperture was closed; but not till they were so thick on the windows, that we were forced to make a business of slaying. The 25th of July will be remembered by the citizens of this and some other counties as the dark day, when desolation and devastation stared us in the face. * * * The wheat which was at first thought to be out of harm's way was cut off about one-fourth by the destroying angels. A statement in our county paper says the average will be about 8 or 9 bushels per acre. After the grasshoppers stopped their depredations, there were several damp cloudy days, that brought out new tassels and silks on the corn, but more than a week of hot, dry weather, with scorching winds checked its growth, so there will be none, excepting a very few fields that partially escaped. Turnips have been grown since the rain; and it is to be hoped there will yet be some potatoes; sweet potatoes were not hurt so badly as the common potato. Broom corn, cane and Hungarian grass were unscathed."

A writer from St. Paul, Minnesota, to the paper above mentioned, says that the locusts "have undoubtedly destroyed five hundred thousand bushels of wheat, and are likely to destroy another half million of bushels." Later on in the season the St. Paul *Press* publishes the following statement in reference to the plague of locusts in Minnesota:—"It is safe to estimate the tilled area in the ravaged district at 275,000 acres, and of the area in wheat in that district at 200,000 acres. Of this area, probably not less than 150,000 acres have been destroyed. This represents not less than 2,500,000 bushels of wheat devoured in the germ by the grasshoppers, or about one-twelth of the wheat crop of the state. Add to this area 50,000 acres of oats, at 33 bushels per acre, or 1,320,000 bushels in all, or one-twelfth of the oat crop of the state; 20,000 acres of corn, at 32 bushels per acre, 340,000 bushels, or one twelfth of the corn crop of the state, and perhaps 20,000 acres more in rye, buckwheat, barley, potatoes and other crops—and the full extent of the grasshopper havoc cannot be easily estimated."

Our readers may further judge of the extent of the calamity and sufferings consequent upon it, from the following Pastoral Letter, issued by the Bishop of Minnesota, and appointed to be read in all the Churches in his Diocese:—*To the Clergy and Congregations of the Diocese of Minnesota:* You are aware that several counties of the State have been desolated by locusts. In May I visited Martin county and saw the beginning of their ravages. I laid the facts before the Governor. The plague has increased. Many homes are desolated. They have the right to look to us for relief. They are our own flesh and blood. They are our brothers. They are God's children. The scourge is an awful one. It may be for *our* sins. It may be to try our faith in God. It may be to test our humanity.

I ask your prayers and your alms. I recommend that an offering shall be taken up on the last Sunday in July, and that a further special contribution of money and provisions shall also be taken at our Annual Harvest Home Festival.

Please send your offerings to Hon. Isaac Atwater, Minneapolis, who will send them to the Committee in St. Paul.

Praying God to bless you,
Your friend and Bishop,
H. B. Whipple.

Extract from a Widow's letter in Brown County.

"I mortgaged my farm to get seed last Spring. All is lost. What to do I do not know. It would take a tear out of a stone to hear the people talk. I had a nice piece of barley almost ready to cut. There is nothing left but the straw, the heads lying thick on the ground. Dear Bishop, I am almost heart-broken, and nearly crazy, to think of the long, cold winter, and nothing to depend on. May God help us. May the Lord look to every orphan and widow, and put it in the hearts of His children to help."

"The widow must not plead in vain."

The Bishop also issued a form of prayer for relief from the plague of locusts, to be used in the Churches throughout his Diocese.

From the September "Report of the Department of Agriculture," at Washington, we cull the following note from Kansas:—"The late summer and fall crops have been almost entirely destroyed by grasshoppers. The common jumping grasshopper did much damage through the early part of the season, but about the middle of August clouds of the flying ones made their appearance over the county, devouring and destroying vast quantities of vegetation. Gardens were quickly eaten up, corn-fields were stripped of leaves, and in many cases the corn was entirely eaten off; fruit trees are left with naked branches, and in many cases the half-ripened fruit is left hanging on the trees, presenting a sickening sight of death and destruction.

In addition to the actual loss by devastation, the loss caused by discouragement will be greater. Years of patient waiting, hard work, and self-sacrifice have been destroyed in a few days, with no known remedy for protection—just as the fruits of labour were beginning to be realized, destruction came—and the question with many is, "Is it of any use to try again?"

Here is a field for the Department of Agriculture. Some method of protection or relief must be had against the destruction of this insect, or an immense tract of magnificent country will never be what it would without this curse. I am one of those who believe all such things may be controlled by some practical method; it only requires study, enterprise and means to learn how. This county (Doniphan) could well afford to pay $100,000 for a guarantee that no grasshoppers should ever trouble it again. I have learned that vegetation highly cultivated and growing vigorously is less liable to be destroyed than when on the decline or growing feebly. Thus it is we often see a single tree in an orchard eaten even to the bark, while others of the same variety are not damaged so much ; and upon examination it will be invariably found that those mostly eaten were diseased, or had their vitality in some way impaired. This thing was noticeable when the same kind of insects were here six or seven years ago. Of all fruit trees, apple and pear trees suffer the most, while peaches, plums and cherries suffer the least. They eat the leaves off the apples, and leave most of the apples on, but of the peaches they will eat the fruit and leave the foliage ; but in many instances, when vegetation is not plenty, I understand they clean all as they go, and I have seen instances of this kind. The damage to vineyards in this county is not so great. They do not seem to relish grapes, and are satisfied by eating off the stems and letting the bunches fall to the ground. There will not be enough corn in this county to feed what stock there is in the county as it should be fed."

The same report states that "the plague"—as it justly terms it—is reported in two counties in Wisconsin, seven in Minnesota, five in Iowa, four in Missouri, thirty in Kansas and seven in Nebraska. It adds that "the wide-spread destruction which they (the locusts) have caused in the north-west has not been adequately described. In many places large masses of people will probably suffer during the coming winter for the necessaries of life, their crops having been swept by this remorseless enemy."

The next Monthly Report—that for October—records the prevalence of the plague in two more counties in Minnesota, two more in Iowa, four more in Missouri, four more in Kansas, four more in Nebraska, three in Texas, two in Colorado, and one in California. The following letter from Kansas is recorded "to give some idea of its ravages :"—"The farmers in my county had their land for wheat prepared in good time, and in a better condition than I ever saw. On the 6th of September the grasshoppers made their appearance all over the county. Farmers became alarmed and did not sow any wheat. About the 18th to the 20th they appeared to go away. Farmers commenced sowing and got in about two-thirds of their crop. On the 28th and 29th they came the second time, filling the air, reminding one of a snow-storm in December. Some who had sown early had wheat up nice, but you cannot find a spear in any place. Wheat which was sown before the grasshoppers came the first time has been eaten down, until the grain has finally ceased to grow. I am candidly of the opinion that every acre which is sown to-day in this county will have to be sown again. There is no other chance for it, and the great trouble will be that so many of our farmers have sown all their seed and are not able to buy again. And what will they do? Some who have not been two years on their claims are leaving them and going over into Missouri and Arkansas to winter—to find something to live upon."

We might go on to an almost unlimited extent with similar descriptions of the wide-spread devastation caused by these insects, and the consternation they have produced throughout the west. Every agricultural newspaper and a large number of city papers have published throughout the past season similar records of ruin and suffering. To assist their brethren in the afflicted regions, large sums of money have been contributed both by State Governments and by individuals ; but it is greatly to be feared that the utmost liberality will hardly save from ruin, though it may relieve temporarily, many farmers who had recently settled on those hitherto attractive plains. Not only, it should be remembered, have they suffered from a dire plague of locusts, but they have also been the victims of a long-continued drought ; accompanied in some localities by a terrible hot wind, resembling the *sirocco* that blasts southern Europe with the dry heat of the African desert ; to add also to their series of calamities, the Chinch-bug* destroyed in many places those crops that the Locusts spared.

To illustrate the reality and intensity of the sufferings that we have alluded to, we shall give one extract only out of a large number that might be quoted. The writer of a letter to the *Prairie Farmer*, dated Kearney, Nebraska, November 16th, thus describes the condition of things in his neighbourhood :—"Your readers have been pretty fully posted as to the ravages of locusts over this entire region, the devastation extending from Central Minnesota to the southern limit of Kansas, the whole country being almost as utterly destroyed, so far as provisions are concerned, as if it had been swept by the scathing flames. I speak more understandingly of my own neighbourhood, and shall endeavour to state facts that may be firmly relied upon, and which can be verified if necessary, by the testimony of others in my own

* For a description of the Chinch-bug, see the report of the Entomological Society of Ontario, for 1871.

vicinity. The wheat crop, what there was of it, considering the dry weather, was good. But fully one-half of the settlers had no wheat at all; their sole dependence was corn and potatoes. In many instances the very uncertain product of prairie sod. Thus nearly half of our people were dependent solely upon the two above articles, both of which were almost entirely swept away by drought, bugs and locusts combined. *Every* family nearly, that was able to do so, having friends in Iowa and Missouri, have gone there to winter, some may return, others never will. Many proved upon their claims and have left the country forever. The number of actual homestead settlers is thus reduced fully one-half in my own neighbourhood, and of that one-half, not one family in ten have provisions, fuel or clothing to last them through the winter. Fully two-thirds have not food enough to last until the 1st of December. I find from conversation in Kearney, with settlers both north and south for a distance of thirty to fifty miles, that the same statement holds true over almost the entire region. Thus notwithstanding the *cry* of some of our papers that "we are not beggars," more than two-thirds of those now on their homesteads must either beg or starve. In less than thirty days there will be starvation and death unless these needs are promptly met.

"There is no corn, no oats, no feed of any kind for stock, except what is shipped in from a distance. There is no fuel except coal, at from $8 to $11 per ton. There is no work, no money. There is no seed corn, and in very many instances, no seeds of any kind for another year's planting. On the 13th inst., I met two of my neighbours. One has a family of six to provide for, three of them young children. Says he: 'I have just flour enough to last until Saturday night.' The other has a family of ten, four of whom are sick, and have been since September. One child, a bright boy of some four years, has lost the entire use of his limbs, and now has to have the care of a helpless babe. This man has flour for ten days, and potatoes that will enable him to get along for a week or two longer. Last winter this family of children were entirely without shoes or stockings, with clothing just sufficient to cover nakedness, and ragged at that. The writer of this article has flour for a week—fifty pounds—and pays for it in breaking one acre of prairie, thus giving three dollars in work for $1.20 worth of flour. He does not state this complainingly, being glad to get work to feed his five babies at any price. I merely give these three cases as a sample. While I give but three, there are many others all around me in fully as deplorable a situation. This want extends over the whole area of country, west, north and south, and the farther the settlement is from the supplies, the greater the wants and privations of the settlers."

The Plague of Locusts in Manitoba.

Thus far we have been describing the extent and the terrible results of this year's plague of Locusts in the Western States of the Union. We have now, unhappily, to record its occurrence in our own new Province of Manitoba, which adjoins the State of Minnesota, so frequently referred to above. From the following record of visitations previous to this year, it will be observed that they were, in almost all cases, simultaneous with those in the neighbouring States, that we have described in the earlier part of this paper. For this record we are indebted to the letter of the Winnipeg Correspondent of the Toronto *Globe*, which appeared in that paper on the 5th of August last:—

"Grasshoppers first appeared in Red River towards the end of July, 1818, six years after the commencement of the settlement. They covered the settlement belt, but did not utterly destroy the wheat crop, it being nearly ripe at the time. Barley and other crops were swept away. They deposited their eggs and disappeared, and the following spring the crop of young grasshoppers was immense. These departed before depositing their eggs, but devoured all vegetation on their route, thus destroying all the crops of 1819. Great numbers came in during the season of 1819 and deposited their eggs, so that in 1820 the crops were again all destroyed. Thus for three successive years were the crops in this country destroyed by these pests. They then disappeared for thirty six successive years, the next visitation being in 1857, when they visited the Assiniboine settlement, doing but little injury beyond depositing their eggs. The following season their progeny destroyed all the crops within their reach. In 1864 they again appeared in considerable numbers but did little injury to the wheat crop. The following year the young grasshoppers partially destroyed the crops, leaving many districts entirely untouched. The largest swarm ever known came in August, 1867, but the crops were so far advanced that season that they did but little in jury. Their eggs produced such immense swarms the following spring that they destroyed everything that had been sown throughout the settlement, and famine ensued. In 1869 they again visited the country, but too late to do much harm. The season following, however, they destroyed most of the growing crops. In 1872 immense hordes of these winged pests again visited a part of the country about the beginning of August. The country west of Headingly escaped, and generally the wheat was not much injured, but they played sad havoc with the gardens. Nothing was sown the following spring throughout the infested district, but throughout the western settlements a large crop was grown and saved."

From the same source we have obtained the following particulars respecting the ravages of the Locust in different parts of the Province:—

"THE SOUTH.—From West Lynne (Pembina) northward as far as Scratching River the oats and barley have been entirely destroyed, and the wheat partially.

"PALESTINE.—The latest reports from this settlement confirm the accounts that the settlement is laid waste.

"MANITOBA LAKE.—The shores of this lake are strewn three feet in many places with dead grasshoppers, the wind having driven them into the lake, where they were drowned and cast ashore.

"THE BOYNE SETTLEMENT.—They are very thick here, and have completely destroyed the oats and barley, and about half ruined the wheat.

"PORTAGE LA PRAIRIE.—From Poplar Point to the Portage the fields are swarming with grasshoppers, which have devoured the crops. Scarcely anything has escaped.

"RAT CREEK.—In this neighbourhood it is reported that the crops of Kenneth McKenzie, Hugh Grant and others, are being destroyed, and that the former had commenced cutting his oats and barley for fodder rather than let the pests take all.

"ROCKWOOD.—The crops in this settlement have suffered severely. Oats and barley completely destroyed, and wheat badly injured.

"WOODLAND.—Most of the settlers in this neighbourhood are entirely cleaned out.

"COUNTY OF PROVENCHER.—All the crops along the Red River, from Pembina to Stinking River, have been eaten up, excepting, in some instances, a portion of the wheat and potatoes have escaped.

"WINNIPEG.—The gardens in this city, and the oats and barley in the neighbourhood, are being destroyed. During the evenings, at the going down of the sun, they seek the board fences and sides of houses in such numbers that in many cases it is impossible to distinguish the colour of the houses, or the material of which they are built."

As yet we do not know whether the Locust ravages are wont to extend over the great fertile region to the north-west of Manitoba—that magnificent agricultural region drained by the Saskatchewan River; we hope, and we are strongly inclined to think, that the plague, if noticeable at all, is there trifling in character and moderate in extent. Should it be otherwise, should that "fertile belt" be as subject to these visitations as the States to the south of it unhappily are, it must prove a great hindrance to its rapid settlement. If, on the other hand, it possesses an immunity not shared in by the Western States, it will certainly draw from them, before many years are over, and as soon as railway facilities are afforded for transportation of goods and produce, a very large portion of those settlers who are now eaten out of house and home. We fully expect to see the tide of immigration which for a few years past has been setting so strongly towards the plains of Kansas and Nebraska, turned towards our own more highly-favoured, even though more northern regions of Assiniboine and Saskatchewan.

DESCRIPTION OF THE INSECT.

Let us turn now to a description of the insect respecting whose powers of destruction we have heard so much. As we have already remarked, there is very little difference in appearance between our common "grasshopper" and the famine-producing Locust of the West. They both belong to the same genus (*Caloptenus*) of the family Acrydidæ and of the order of Orthoptera—straight-winged insects. The Acrydidæ, or Locusts, are distinguished from their kindred, the true grasshoppers, by the following characteristics:—The former have short antennæ (or feelers), never exceeding the body in length; the latter have very long thread-like antennæ. The tarsi, or feet, of the former are three-jointed; of the latter four-jointed. The female of the former has the tip of the abdomen furnished with four very short bony pieces, two of which curve upwards and two downwards (they may be observed in figures 33 and 34); the female of the latter has a long curved, often sword-shaped, ovipositor. The former, again, live upon the ground; the latter for the most part on grass and trees.

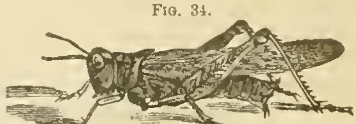
All Orthopterous insects—including, of course, those we are now treating of—undergo what is termed an incomplete metamorphosis—that is to say, their larvæ and pupæ resemble all along the perfect insect, except that the wings are not fully developed and the size of the mature insect is not attained. To make our meaning clearer, we may mention that Lepidopterous insects (butterflies and moths) undergo a perfect or complete metamorphosis; as every one knows, the caterpillar, or larva, is totally different from the winged insect, while the chrysalis or pupa is entirely different from either. In food, habits and appearance, the insect undergoes a complete change at each metamorphosis. In the case of Locusts, on the contrary, one can hardly say with certainty when the larval state ends and that of the pupa begins; or when, again, the pupal condition merges into that of the perfect insect.

The genus *Caloptenus*, to which we are now confined, is represented almost all over the world. In North America eight different species have been described by entomologists, but we are inclined to think that some of these are little more than varieties of others. Three species only are prevalent in large numbers—viz., *C. spretus*, *C. femur-rubrum*, and *C. bivittatus*; the last mentioned does not occur in Canada, so far as we are aware, and is of small importance economically as compared with the other two. We are thus reduced to the two species that we spoke of at the outset: our common red-legged Locust, or "grass-hopper" (*Caloptenus femur-rubrum* Burm.), represented in figure *b*; and the hateful Locust (*C. spretus* Uhler), figure *a*.

Fig. 33.

b

Fig. 34.



a

The reader will observe that there is but a very slight difference in appearance between the two species. The left hand, our common species, only differs, one may say, from its most destructive fellow on the right, by its having shorter wings. It is owing to this difference in length and expanse of wing that the one species is confined to the neighbourhood where it was born, while the other rises aloft into the air, and is literally "borne upon the wings of the wind" to regions far away from its place of birth.

As the Red-legged Locust must be so familiarly known by every one—during most summers, indeed, it is hardly possible to walk a few yards in the open air without startling numbers into flight—and as it is fairly represented in the above figure (*b*), we may content ourselves with quoting the following brief description by Dr. Harris. The insect is "grizzled with dirty olive and brown, a black spot extending from the eyes along the sides of the thorax; an oblique yellow line on each side of the body beneath the wings; a row of dusky, brown spots along the middle of the wing covers; and the hindmost shanks and feet blood-red, with black spines. The wings are transparent, with a very pale, greenish-yellow tint, next to the body, and are netted with brown lines. The hindmost thighs have two large spots on the upper side and the extremity black; but are red below, and yellow on the inside. The appendages at the tip of the body in the male are of a long triangular form. Length from three quarters of an inch to an inch; expansion of the wings from $1\frac{1}{4}$ to $1\frac{3}{4}$ of an inch."

The Hateful Locust (*C. Spretus*), figure *a*, can scarcely be distinguished in colour or general appearance from the foregoing species; the principal difference, as already stated, is in the length of the wings. In this species they are about one-third longer than the body of the insect; they are quite transparent with slightly dusky nerves, and when seen high up in the air against the sun, have the appearance of large snow-flakes. The eggs are deposited in the ground, in a cocoon-shaped mass, covered with a tough, glutinous secretion, and vary in number from fifty to a hundred. They are laid in the latter part of the summer and remain in their place of deposit until the following spring; usually they hatch out in March, making their appearance with the earliest vegetation of the locality. There is a good deal of difference of opinion with regard to the head quarters of this insect; many writers affirm that all the swarms comes from the cañons of the Rocky Mountains; others again, and with more reason, we believe, hold that they breed throughout all the mountain valleys and plains of the west, but chiefly in those vast tracts of uninabited country, lying on the slopes of the Rocky

Mountains in Arizona and New Mexico; they breed also, there can be no doubt, in the regions that they invade, but owing to differences of climate, these broods do not always mature. They delight most in a very dry, hot atmosphere.

Like many other species of Orthoptera, the males produce sounds by means of an apparatus that may be "likened to a violin, their legs being the bows, and the projecting veins of their wing-covers the strings. When a locust begins to play, he bends the shank of one hind leg beneath the thigh, where it is lodged in a furrow designed to receive it, and then draws the leg briskly up and down several times against the projecting lateral edge and veins of the wing-cover. He does not play both fiddles together, but alternately, for a little time, first one and then the other, standing meanwhile upon the four anterior legs and the hind leg which is not otherwise employed." (Harris.) When in flight, the swarm produces a loud pattering sound, which as Dr. Thomas remarks, is probably due to the beating of the air by the wings, as it is not confined to the male sex. If any of our readers are curious upon the subject of insect music, they will find an interesting paper upon "the Songs of the Grasshoppers," by our much esteemed friend, Mr. Scudder, in the *American Naturalist* (vol. 9, page 113); in it not only is the apparatus described, but the notes are se t to music, and no doub can be sung by any accomplished vocalist!

Before closing this portion of our remarks, we would acknowledge our indebtedness, and call attention, to the admirable "Synopsis of the Acrididæ of North America," by the Rev. Cyrus Thomas, Ph.D., published by the Government of the United States as a portion of Dr. Hayden's Report on the U. S. Geological Survey of the Territories. It is magnificently printed in quarto form, and is a complete monograph of the family. We take this opportunity of thanking Dr. Hayden for his courtesy in favouring us with a copy.

MEANS OF REDUCING THE RAVAGES OF THE LOCUSTS.

When a species of insect comes in countless millions suddenly, without any forewarning, upon a locality hundreds of miles away, it may be, from its place of birth, and devours in a single day every green thing upon the surface of the country, it seems almost impossible to suggest any remedy. Something, however, may, we believe, be done, but any measure to be in the least degree efficacious must be adopted universally over a large area of country. Before considering any method of combatting the plague, we must mention one remedy that has been received by the press with some degree of amusement, though gravely propounded by the editors of the *American Naturalist.* After referring to the destitution in Minnesota and the application from its State authorities to the general government for aid, they put the question:—

"Why should not the grasshopper be eaten in turn?" Why not, indeed? For, as they state, "the grasshopper, or locust of the East, is universally eaten in portions of Africa and Western Asia, and pronounced a nutritious and palatable article of diet by Arab chiefs as well as Hottentot savages. They are eaten roasted whole, minus the legs, or roasted and powdered. We would recommend that experiments be made as to the best modes of preparing the locust for food. They should be thoroughly cooked to guard against parasitic worms. Not willing to urge the use of grasshoppers as food for others, without first eating them ourselves, we may say that we have found the grasshopper, first killed by boiling water, and then fried in butter, at least as palatable as many articles of food eaten by civilized people; and to people actually famishing, as is said to be the case in Minnesota, it will be worth their while to avail themselves of a food stuff which millions, perhaps, of people in other lands regard as wholesome."

In corroboration of this use of the locusts, we may add, that Dr. Livingstone speaks highly of the locust as an article of food in Africa, and considers them superior to shrimps. Honey, when it can be obtained, is often eaten with them, and, while improving the flavour, renders them more digestible. We need hardly remind our readers that this was the food of St. John the Baptist in the wilderness. The ancient historian, Herodotus, relates that locusts are used for food, being first dried in the sun, than reduced to powder, and drunk in milk. In his well-known work, on South Africa, Cumming states that "Locusts afford fattening and wholesome food to man, birds and all sorts of beasts; cows, horses, lions, jackals, hyænas, antelopes, elephants, &c., devour them. Our hungry dogs made a fine feast on them. . . . . We roasted a quantity for ourselves and our dogs." Kirby and Spencet

(People's Edition, page 173.) state that, "as locusts are the greatest destroyers of food, so as some recompense, they furnish a considerable supply of it to numerous nations." After quoting a number of authorities for this statement, they add that "they are preferred by the Moors to pigeons; and a person may eat a plateful of two or three hundred without feeling any ill effects. They usually boil them in water half-an-hour (having thrown away the head, wings and legs) then sprinkle them with salt and pepper, fry them, adding a little vinegar." We trust that the editors of the *Naturalist* will try this recipe next summer! Among the food products of the North American Indian (Report of Agricultural Department, Washington, 1870,) we find enumerated grasshoppers or locusts, which are eaten by the Diggers of California and the Plains. They roast them in holes in the ground and mix them with powdered acorns; sometimes they make of them a soup or mush. Mr. Taylor, however, (Smithsonian Report, 1858,) referring to the same custom, declares that this kind of food is always found to sicken the Indians, and that this result is vouched for by the early settlers and the natives, and also by many travellers and voyagers who have visited California and the Rocky Mountain country, and by the Jesuits of Lower California. From these statements we may infer that the locusts on the western side of the Rocky Mountains, considered to be a distinct species from the *C. spretus* of the eastern side, are unwholesome, but it remains to be proved that a nutritious article of diet may not be obtained from the latter. Certainly, it is an experiment worth trying; if successful, we should have a double benefit—the lessening of the numbers of the locusts, and a supply of food wherewith to meet the famine that they have produced. Such a fate for the invaders would be true poetic justice.

In the Smithsonian Report for 1858, to which we have already referred, there is an interesting article, translated from the Russian of V. Motschulsky, in which much valuable information is afforded respecting the mode of dealing with locusts in Southern Russia and other neighbouring countries with regard to natural remedies. He states that "whole generations of them succumb to the climatic influence of those countries to which, impelled by hunger, they betake themselves. Winds and storms not unfrequently cast vast swarms of them into lakes and seas, and other millions perish in crossing rivers. Frogs, lizards and various birds, especially of the starling, blackbird, lark, crow, jackdaw, stork and other species devour them with great avidity. Domestic fowls, as geese, ducks, turkeys and chickens are exceedingly fond of such food." Among insects several species of ichneumons (Hymenoptera) destroy them both in the egg and larval states. He concludes that "of the eggs laid by the locusts about one-tenth only succeed in passing through all the transformations of their existence, and with this tenth part alone it comes in contact with the husbandman. But even this is sufficiently great to furnish matter for reflection to every one who knows by experience what an attack of locusts is."

After describing a large number of artificial modes of contending against the locusts, some of which are quite useless, and others more or less successful, he draws up a number of general conclusions. Those at all applicable to North America we shall quote, with a few remarks upon them.

(*a*) "It is necessary to observe in the autumn, especially after a hot summer, where the locusts have deposited their eggs, and to accustom persons appointed for the purpose to do so." Much might, we think, be done in this way both by the State authorities in the west, by municipalities and by individuals.

(*b*) "As soon as the labours of tillage will permit, people should be sent out in the fall to collect the locusts' eggs, provided with instruments for turning up the ground. If the eggs are deposited where ploughs and harrows can pass, these should be made use of. The egg-tubes of the locusts should be poured into sacks, and either measured or weighed, and a suitable award paid for the amount collected, so as to stimulate numbers to busy themselve in this useful labour." If a certain price per bushel or hundred-weight were offered for the egg-cases by the various local authorities in the regions affected, not only would the numbers of the locusts be greatly reduced, but remunerative employment would bo afforded to those who have been suffering by their ravages. In many places the locusts deposit their eggs where they have just ravaged the fields, consequently the inhabitants will not have far to go in order to find the germs of the next year's trouble. It would be desirable, too, that well-equipped expeditions of competent persons should be sent out to explore the regions bordering on the Rocky Mountains, from which the swarms emanate in the first instance.

(*c*) "All the places where locusts' eggs are found should be ploughed over, if possible, two or three times very late in the autumn. Special attention should also be given to bar-spots in the fields, where not unfrequently great quantities of egg-tubes may remain unobserved." This plan of deeply ploughing under the eggs of the grasshoppers, or of ploughing them up so as to expose them to all the changes of the weather, has been found very effective in Manitoba and other places.

(*d*) " Breeding large quantities of domestic fowls and training them to feed on young locusts, is exceedingly advantageous to the husbandman." Geese, chickens, turkeys and guinea-fowl are especially mentioned. This plan would be of very slight use as a protection against the migrating swarms of locusts, but it might be of some little value in places where they breed. It is well known that a large brood of turkeys is invaluable to a farmer where the common red-legged locust abounds.

(*e*) If the locusts settle anywhere in a thick mass, large numbers may be destroyed in the evening, when they are quiet, by means of heavy iron or wooden rollers drawn by horses or oxen. This method might be of some slight advantage if generally adopted, but usually, by nightfall, most of the damage is done.

A large number of other methods are mentioned, but they are entirely inapplicable to the vast and thinly populated regions of the west.

A remedy is much employed, on the other hand, in America which could not be made use of in Russia, viz., fire. It is only during dry and very hot weather that the invasions take place. When a swarm has once alighted and has commenced the work of destruction it is often practicable to set fire to the fields and crops in places and thus kill or drive away the destroyer. In this case the remedy is almost as bad as the disease, but yet it has been adopted in many instances with good results.

Noises made by trumpets, guns, cannons, &c., sometimes drive away a small body of locusts, but they are utterly useless when the invasion takes place on a large scale.

On the whole, it seems as if man can do but very little to ward off the attacks of this fearful scourge. Still it is proper that every effort should be made to find out the exact habits of the insect, and the particular localities from which it emanates; it is fitting, too, that no means should be left untried that affords any prospect of lessening the destruction that they occasion. The Arabian fable we cannot but feel, has much truth at the bottom of it; they represent a locust as saying to Mahomet, " We are the army of the Great God ; we produce ninety-nine eggs, if the hundred were completed we should consume the whole earth and all that is in it." While the people of the West are in the hands of Providence to protect them from such mighty armies as these, they can best help themselves by going to the root of the evil—that is to say, by reducing to the utmost extent the numbers of eggs that are laid for future broods.

After all the accounts that we have given of these insects, we feel that nothing can equal in sublimity and correctness the description afforded by the Prophet Joel, ii. 2—11.

" A day of darkness and of gloominess, a day of clouds and thick darkness, as the morning spread upon the mountains: a great people and a strong; there hath not been ever the like, neither shall be any more after it, even to the years of many generations. A fire devoureth before them and behind them a flame burneth: the land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them. Like the noise of chariots on the tops of the mountains shall they leap, like the noise of a flame of fire that devoureth the stubble; as a strong people set in battle array. Before their face the people shall be much pained ; all faces shall gather blackness. They shall run like mighty men ; they shall climb the wall like men of war; and they shall march every one on his ways, and they shall not break their ranks, neither shall one thrust another, they shall walk every one in his path, and when they fall upon the sword they shall not be wounded. They shall run to and fro in the city, they shall run upon the wall, they shall climb up upon the houses, they shall enter in at the windows like a thief. The earth shall quake before them, the heavens shall tremble, the sun and the moon shall be dark, and the stars shall withdraw their shining, and the Lord shall utter His voice before His army, for His camp is very great, for He is strong that executeth His Word, for the day of the Lord is great and very terrible, and who can abide it ?"

While the foregoing paper was passing through the printer's hands, we cut from the Albany *Country Gentleman*, the following official statement of the misery caused by the plague of

Locusts in the Western States, which fully corroborates any expressions that we have used above :—

"The Western Grasshoppers.—Commissioner-of-Agriculture Watts has issued a synopsis of information received concerning the extent of suffering from the grasshopper plague, which we copy, somewhat condensed :

"*First.*—The area of this visitation comprises a zone 200 to 225 miles wide, extending from the settlements of Southern Dakota, through Nebraska and Kansas, over 500 miles in length, and inclining to south. A few western counties of Iowa aud Minnesota report injuries. The extent of territory visited by these insects in 1874 very considerably exceeds 100,000 square miles.

"*Second.*—The grasshopper district west of Missouri embraces population of Kansas, Nebraska and Southern Dakota, amounting to over 500,000 in 1870, with a large increment since. Including counties east of the Missouri in Iowa and Minnesota more or less affected by the plague, I think it not extravagant to assign 750,000 as the approximate population of these districts.

"*Third.*—In Kansas, cases of total destitution in 50 counties reported vary from 40 to 2,000 ; reports from counties not in this list show injuries as severe as in any others. The average of such cases 555 in each county. These do not include cases of partial destitution, which, in some counties are quite large, ranging from 26 to 1,000. The cases of total and partial destitution in these 30 counties amount to over 40,000, while in other counties there are, probably, cases unreported sufficient to swell the aggregate to 50,000 .In the more thinly populated counties of Nebraska and Dakota the number of such cases is, of course, smaller. Adding the cases east of Missouri, I do not think it out of the way to estimate the number of people affected by this pest at 75,000 to 100,000."

ON SOME INJURIOUS INSECTS.

By W. Saunders, London, Ontario.

The Codling Moth (*Carpocapsa pomonella*, Linn).
The Pear Tree Slug (*Selandria cerasi*, Peck).

The Codling Moth (*Carpocapsa pomonella*, Linn).

This is, indeed, one of the most troublesome insects with which we have to contend, and one of the most difficult to deal with, and, although of foreign introduction, has spread over the greater part of our country entailing a yearly loss on our apple crop which it would be difficult to over estimate. We shall briefly give the various features in its life history with a cut illustrating the insect as it appears in its various stages, and then detail such measures as have been suggested with a view to its destruction.

Fig. 35.

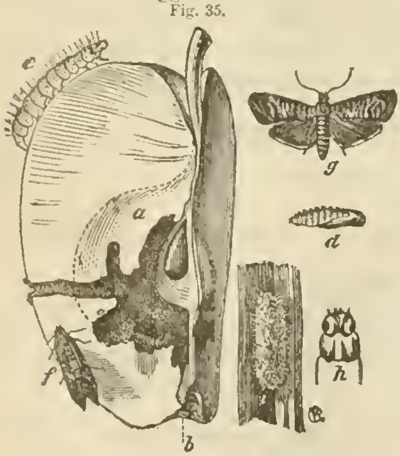


Fig. 35 represents a section of an apple which has been occupied by a codling worm—*b* shews the point of entrance of the young worm, the place of exit of the matured larva being shown at the left hand side of the figure; *e*, the full-grown worm : *h*, its head and first segment magnified ; *i*, the cocoon; *d*, the pupa removed from the cocoon; *f*, the moth with wings closed ; *g*, the same with wings expanded.

Soon after it leaves the fruit in the fall, the larva selects some secluded of nook or cranny, under loose bark of tree or other convenient hiding place, and there spins its tough papery-looking cocoon, and within this secure retreat it remains in the larval condition until early in spring, when, a few weeks before the final change takes place, it enters the chrysalis state. It seems strange that this tiny creature should be endowed with such a power of varying the length of its larval existence, that at this season the larva should remain so long unchanged, while, in the case of the earlier summer brood, the change to chrysalis takes place almost immediately after the spinning of the cocoon. About the time of the opening of the apple blossoms this insect bursts its prison house and appears as a winged moth. See Fig. 35, *g*.

The moth deposits her eggs singly, and usually in the calyx or eye, just as the young apple is forming. In about a week the larva is hatched, and at once the tiny worm begins to eat its way through the apple to the core. Its castings are commonly pushed out through the hole by which it has entered, which is from time to time enlarged for the purpose ; these usually adhere to the apple, so that, before the worm is full grown, infested fruit may generally be detected by the mass of reddish-brown exuviæ protruding from the eye. Sometimes, as the larva approaches maturity, it eats a passage through the apple at the side, and out of this opening its castings are thrust, and here the mature worm escapes when full grown. The occupied apple generally falls prematurely to the ground, sometimes with the worm in it, but more commonly after the worm has escaped. The larvæ which leave the apples while still on the trees, either crawl down the branches to the trunk of the tree, or otherwise let themselves down by a fine silken thread, which they spin at will, to the ground ; in either case, the greater portion of them take refuge under the rough loose bark on the trunk of the tree, and there spin their cocoons. The second brood of moths appear from about the twentieth to the last of July. We have taken them on the wing at night as early as the nineteenth, but specimens confined in breeding boxes, have not, as a rule, made their appearance until about the end of the month. In the winged state they seldom live more than a few days, and in this brief space they pair, and the female deposits her eggs for the second brood of larvæ, and, for this purpose, wisely shows a preference for the later apples. The codling moth also attacks the pear, in some localities, most disastrously for the crop ; the fruit, however, seldom falls to the ground until some time after the worm has left.

Dr. Wm. Le Baron, State Entomologist, of Illinois, has devoted much time and attention to the study of the history and habits of this insect, and has published in his last annual report an excellent paper on this subject. Mr. Riley, of St. Louis, has also made observations and experiments on this same insect, which corroborate those of Dr. Le Baron, these are referred to in the fifth and sixth annual reports on the noxious, beneficial and other insects of the State of Missouri ; from both these sources we shall glean and make free use of such facts as we think will interest our readers.

The number of eggs each moth is capable of laying will, probably, average not less than fifty, but these are not all matured at once, but may be found, by careful dissection of the body of the moth, in various stages of development. Hence they must be deposited successively, the period probably extending over a week or more.

Remedies.

This is an all important matter in which, in this instance, man must rely chiefly on his own efforts, for although, doubtless, a large number of the worms and chrysalids are annually destroyed by birds, and another limited portion by parasitic insects, still from the advantageous shelter afforded them by the apple, and the fact of their movements after leaving it being mostly in the night time, the codling worm enjoys much immunity from natural foes.

Dr. Le Baron divides this practical portion of the subject, as far as man's work is concerned, into four heads, and here we cannot do better than quote from his excellent paper :—

"1st. Destroying the insects in their winter quarters.

"2nd. Picking the wormy apples from the trees.

"3rd. Gathering the wormy apples from the ground, or letting swine and sheep have the range of the orchard.

"4th. Entrapping the worms in bands and other contrivances."

1st. *Destroying the insects in their winter quarters.*—When we consider that each female moth is capable of laying fifty eggs or more, and that every worm of the first brood ruins an apple, we can see the importance of destroying these insects before they leave their winter quarters. We have already mentioned that in the state of nature, these worms pass the winter in cocoons, concealed under the bark, or in the crevices of apple trees. The summer brood of worms, which remain but two weeks in the pupa state, sometimes content themselves with a very slight protection, but it is the nature of the insect to seek deep concealment, and the instinct of the second brood, which is to survive the winter, leads them to search for the deepest protection they can find. We, therefore, rarely find them under shallow and loose scales of bark, but very often in deep cracks and crevices, partially embedding themselves in the substance of the wood or bark. Any superficial scraping of the trees, or whitewashing, or other outward applications would not, therefore, be likely to reach many of them ; and inasmuch as they may be hidden upon any part of the trunk or large branches, any attempt to discover them with the intention of digging them out would, evidently, be impracticable ; but at the point where we become powerless the woodpeckers come to our aid. In their search for just such hidden worms as these, those busy foragers unite business with pleasure, and all through the wintry day the sharp rattle of their beaks may often be heard in the orchard, as with ear intent and sharpened beak, and appetite not less sharp, they pursue their hidden prey with unerring and fatal precision.

"A more efficacious way of destroying these worms as far as our own instrumentality is concerned, is to search for them about the barrels and bins in which fall and winter apples have been kept. I have heard of instances where the sideboards of the bins have been taken away from time to time, as the apples were removed and thrown one upon another, in which these boards became so fastened together by the webs of the worms between them, that a number of boards could be raised by taking hold of the upper one only. There can be no doubt that the destruction of the codling-worm at this stage of its existence, would be very effective, and that it has been by far too much neglected."

Our esteemed President, Rev. C. J. S. Bethune in his remarks on this subject in our report for 1870, says "a very favourite locality for these worms is the space between the hoops and staves of the barrels. We have found hundreds in such positions especially in the winter of 1868–9. Where this occurs it is by all means worth while to scald the barrels thoroughly outside as well as inside, as soon as they are emptied or even to burn them. When boxes or bins are made use of for storing the fruit, the worms are sure to find some crevices to suit them, which should be searched for, and treated as in the case of the barrels."

2nd. *Picking the wormy apples from the trees.*—We have stated above that the young worms, soon after they have entered the apple, begin to throw out their castings through the hole which they made in entering. As this hole must be originally almost microscopically minute, it is evident that they must enlarge the opening for this purpose. We further stated that a portion of the castings adhere to the rough and shrivelled calyx, forming a rust coloured mass, which is easily seen from the ground below. Some horticulturists have availed themselves of this circumstance for the purpose of removing the wormy apples from the trees before the worms have escaped. The plan is to beat off the wormy apples, or else pick them off by means of a wire hook attached to the end of a pole. These two methods can be very usefully combined by first jarring or beating off those apples which readily fall, and then going over the trees a second time with the pole and hook. The apples thus removed should of course be fed to swine, or otherwise treated so as to destroy the worms within. Too much value cannot be attached to these simple expedients, which in the case of a few choice trees, or even a small orchard, might almost be made to supercede the necessity of any other treatment."

"3rd. *Gathering the wormy wind-fall apples from the ground, or letting swine or sheep have the range of the orchard.*—This plan has been generally recommended as of very great importance. Its efficacy will depend, of course, upon the proportion of worms which fall to the ground in the apples, as compared with those which leave the apples whilst hanging upon the tree. Those which crawl down the branches spin up before reaching the ground, and those which let themselves down by a thread, would, for the most part, be detected only by birds or by domestic fowls, and as there is reason to believe that they usually perform this act in the night, even these must fail to capture them."

"With regard to those wind falls which contain worms, it is necessary to gather them frequently, that is every day or every second day at farthest. The apples do not usually fall until the worms are nearly matured, and they leave them in the course of a few days. If you examine indiscriminately a large number of wind-fall apples lying under the trees, you will be surprised to find how few worms they contain, they evidently having left the fruit before it fell, or soon after."

"But the most important question in this connection is, what proportion of the worms leave the apples before they fall from the tree? I have endeavoured to arrive at an approximate estimate upon the subject by putting two or more bands upon the same tree, upon the presumption that the worms descending from above will spin up in the upper band, and those crawling up from the ground in the lower. The following tables numbered for the purpose of reference give the results of these experiments. The wind-fall apples were left in every case as they fell upon the ground.

"On the tenth of July, 1871, I put bands as follows, upon four trees, the ground underneath being bare, or free from grass or rubbish of any kind. One band was put about a foot from the ground, another about two feet higher on the trunk, and others on two or three of the larger branches, eight or ten feet from the ground. They were examined July 28th. eighteen days after they were put on."

No. 1.

Whole number of worms in all stages...... 220

Number of empty pupa cases	28	
Number of pupæ	127	
Number of enclosed but unchanged larvæ	55	
	—	220

Number of all stages in lowest bands	94
Number of all stages in upper trunk bands	83
Number of all stages in bands on limbs	43

No. 2.

(Same trees examined August 11th, two weeks later.)

Number of pupa cases	16	
Number of pupæ	24	
Number of larvæ	15	
	—	65

Of these there were in lowest bands 21, middle or upper trunk 13, and on limbs 31.

No. 3.

(Same trees August 25th, two weeks from last.)

Number of pupa cases	1	
Number of pupæ	4	
Number of larvæ unchanged	41	
	—	46

Distributed as follows, in lowest bands 24, middle or upper trunk 15, in bands on limbs 7.

No. 4.

(Same trees September 9th, fifteen days later. Found larvæ only.)

Number in lowest bands	33	
Number in middle bands	39	
Number in bands on limbs	9	
	—	81

No. 5.

(Same trees September 23rd, two weeks later. Larvæ only.)

Number in lowest bands	28	
Number in middle bands	22	
Number in bands on limbs	4	
	—	54

"On the fourth of July, 1872. I selected a smooth thrifty apple-tree, six inches in diameter, growing upon grass land, and well filled with apples, bearing many marks of being wormy, but remarkably tenacious, and consequently but few lying upon the ground. Put two bands upon the trunk, one a foot and a half above the other.

"Examined July 23rd, a moderate number of apples having in the meantime fallen upon the ground.

Whole number in the lower band	150	
Whole number in the upper band	110	
	——	260

"The bands in this experiment were made of carpet six inches wide, and long enough to go twice around the tree, making a very abundant covert for the worms. As might have been anticipated, in this case the greater part of the worms in the upper band were found in its upper half, indicating that the worms had reached it by descending from above; and on the other hand, the greater part of the worms in the lower band were in its lower half, showing that they had come up from the ground. We say the greater part, but not all, implying that some worms in each case had passed over one band and gone on to the next."

The above tables furnish data for many interesting and practical deductions.

"First, as respects the question now under consideration, namely, what proportion of the worms leave the apples before they fall from the tree; if we add together all the worms found in the highest and the lowest bands respectively, and divide those in the middle or upper trunk bands equally between the other two, we shall have 436 in the lower bands, and 290 in the upper, implying at first view that much the larger number came up from the ground. But there are several circumstances in these experiments which must be taken into account, and which will somewhat modify this conclusion. First, many of the limbs have no bands upon them, and the worms from these may be presumed to have found covert chiefly in the upper bands on the trunk. Second, two of the trees experimented upon were large rough trees, and a part of the worms undoubtedly spun up under the scales of bark on the limbs above the bands. And thirdly, we do not know what proportion of the worms may have let themselves down to the ground by threads, and thus found shelter under the lowest bands. Taking these circumstances into account, we shall perhaps arrive at an approximation sufficiently accurate for practical purposes, if we divide the whole number of worms equally between the upper and lower bands, from which we infer that about half the worms crawl down the tree, and the other half reach the ground either in the apples or by threads. We must infer from this as far as one series of experiments enables us to judge, that the gathering of windfall apples, either by ourselves or by the aid of domestic animals, enables us to destroy less than half of the codling worms.

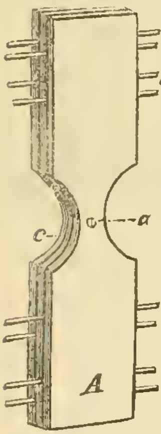
"The animals used for this purpose are hogs and sheep, the latter are more cleanly, and equally effective, but they are liable to damage young trees by gnawing the bark."

4th. *Entrapping the worms under bands, &c.*—Our own experience in a series of experiments, very similar to those above detailed, was much the same, excepting in the number of larvæ captured, which from five trees did not, at any one time, exceed 47, the distribution in the upper and lower bandages being nearly in the same proportion as that given by Dr. Le Baron. This method of entrapping the worms under bands is without doubt the most effective remedy yet devised, and if it were generally and persistently followed would effect a large yearly saving in the crop of this valuable fruit. It is of great importance that united effort should be made in this case, as the evil is an increasing one, and the yearly loss now entailed something enormous. With us we have known the full-grown larva to be found under bandages as early as the 4th of July, hence we think that their application should not be delayed later than the 1st. Indeed it would be wise to apply them a few days earlier than this. By referring to the first and second captures in Dr. Le Baron's first experiment, it will be observed that quite a number of empty pupa cases were found, 54 in all, showing that sufficient time had elapsed before examination to allow of the larvæ passing through the stage of chrysalis, and escaping as a perfect insect to continue its work of destruction. To prevent escapes of this sort we should recommend that the bandages be examined every ten days until the latter end of August. After this, worms of the second brood only will be found, and since these remain in the larval state until the following spring, the bands subsequently might be examined at leisure.

As to the material to be used for bandaging we have found old sacking, (which can often be obtained at trifling cost), to answer a very good purpose, cut into strips from six to eight inches wide, and long enough to go two or three times around the tree, and tied in the middle with a piece of stout twine. Strips of old carpet or cloth where they can be obtained, would, of course, prove equally good. In the excellent report of the Michigan Pomological Society, for 1873, we find that much interest is being excited throughout that State in reference to the codling moth, and many practical discussions are reported on the best means of fighting it, all however, agreeing in recommending the use of bandages. One apple grower recommends a bandage of common brown paper tied around the tree with a string; another while recommending the paper thinks the string too much trouble, and advises the use of a tack to fasten the end of the bandage with. One advantage claimed for this material for bandaging is that birds readily find the hiding places of the larvæ, pierce through the thin covering and capture the worms, thus employing the efficient aid of our feathered friends in this useful work. One gentleman is reported to take no trouble to remove his paper bandages, merely securing them to the tree and allowing the birds to do the capturing, replacing the paper only when it is torn to shreds. Another prefers to use bands of cloth four inches wide, fastening the end with a tack, he usually finds all the worms by simply turning the edges of the cloth up and down without taking off the band. Still another thinks all strings and tacks a bother, and fastens the bandage quite securely by merely tucking the end under.

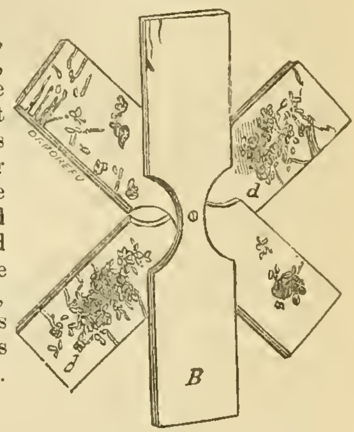
With reference to the economy of paper bandages, Mr. Riley in his fifth annual report, thus writes, "common straw paper 18 x 30 can be bought for 60 cents per bundle. Each bundle contains 240 sheets, and each sheet folded lengthwise thrice upon itself, will give us eight layers between two and three inches wide, and be of sufficient length to encircle most ordinary trees. It is easily drawn around the tree and fastened with a tack, and so cheap that when the time comes to destroy the worms, the bandages containing them may be detached, piled in a heap and burned, and new ones attached in their place. If eight bandages are used to each tree during the season the cost will be just two cents per tree."

Fig. 36.



Wier's shingle trap, (see Figs. 36 and 37, 36, the trap closed, 37, the same opened), has also been recommended, it is made usually of three pieces of old shingle about a foot long, and from four to six inches wide, fastened together and then nailed or screwed to the tree. In arranging the pieces the narrower ones should be placed next to the tree; it is also recommended to put a few bits of straw between the shingles so as to keep them slightly apart, experience, however, teaches that this trap is not so efficient or convenient as either of the bandages already referred to.

Fig. 37.



Brief Summary.

While all other available means tending to the lessening of the numbers of the codling moth worms should be unhesitatingly employed, the chief reliance should be placed on the bandages, use strips of cloth, old carpet or sacking where these can be had, but if these materials are not readily procurable use paper or cotton. Bandages should be from four to eight inches wide and either fastened with a string or with a tack at the end, and will be all the better if long enough to go twice around the tree; they should be fastened about half way up the trunk of the tree some time during the latter part of June, and be examined every ten days from the first of July until the last of August and at least once after the crop is secured. Care must be taken in unwinding the bandages to prevent the worms from escaping by dropping to the ground, which they readily do when their cocoons are thus torn asunder. A common clothes wringer, to pass the bandages through, is one of the readiest and surest methods of destroying the worms; and in this way the bandages can be rapidly handled and re-applied. Be careful to scrape the rough bark off old trees so that the worms may not find suitable hiding places either in descending or ascending the trunk until they reach the bandage; attend to these instructions regularly and thoroughly, and try and induce all your neighbours to follow your example and rest assured that good results will attend united effort.

Parasites recently discovered.

To Mr. Riley, of St. Louis, belongs the honour of being the first to discover true parasites affecting the codling moth worm, descriptions of which are given in his Fifth Annual Report (873). "Both of them are Ichneumon flies and the first may be called

"The Ring-Legged Pimpla (*Pimpla annulipes*, Br).

Fig. 38.

"This is a black fly, varying considerably in size, the female sometimes measuring but ¼, at others fully ½ inch exclusive of ovipositor; the male somewhat smaller. The genus Pimpla was briefly characterized in my last report, p. 43, where it was shown that this same species attacks the walnut case bearer (*Acrobasis juglandis*, LeB). I annex a lateral outline of a female Pimpla, Fig. 38, the male has a more slender abdomen which is unarmed.

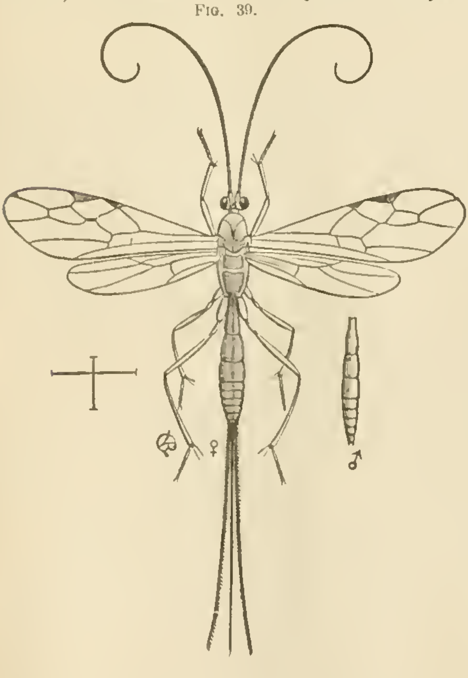
"Pimpla Annulipes is black: the abdomen rough punctured above, with the borders of the joints polished and inclined to brown. The tegulæ are white, and the legs are reddish, with the exception of the middle and hind tibiæ, which are dusky—especially the hind pair—and have a broad white annulus, sometimes indistinct on the middle pair. The posterior tarsi are dusky, especially at tip. The palpi are pale yellow. Cresson says it may be distinguished from the other species of the genus, by the scutellum being black, the tegulæ white, and the anterior coxæ yellowish red.

"This fly eats its way through the chrysalis and the cocoon of the Codling Moth, without having previously made any cocoon of its own. It was quite abundant last summer as from one lot of *Carpocapsa* cocoons, I obtained 21 parasites—all of them females but one. It is a widely distributed and common species. The second parasite may be called the

"Delicate Long-sting (*Macrocentrus delicatus*, Cres).

"It has recently been described by Mr. E. T. Cresson (*Trans. Am. Ent. Soc.* iv., p. 178), and is a somewhat variable species, occurring throughout the Eastern, Middle and Western, States, and in Mexico. I subjoin a description drawn up from my bred specimens.

Fig. 39.



"Male. Length 0·25; expanse 0·45; inch. Slender, colour pale, polished, honey yellow; uniformly and sparsely pubescent; tinged with brown superiorly, the basal joint of abdomen and a medio-dorsal line on the other joints being quite brown. *Head*, with the eyes (except at disc), and a spot between ocelli, brown-black; palpi long and almost white; antennæ one-fourth longer than the whole body, about 48 joints, exclusive of bulbus, curled at tip, the ends of basal joints and the whole of joints dusky. *Thorax*, with the sutures well defined, and two small triangular black spots behind front tegulæ, the metathorax strongly trilobed; legs very long, pale honey yellow, with tips of tibiæ and tarsi faintly dusky; wings yellowish, hyaline and iridescent, with the veins luteous, and the stigma pale honey yellow.

"Female. Rather larger and with the abdomen somewhat paler, otherwise similarly marked. Ovipositor yellow, ⅓ longer than body, the sheaths quite pilose, and inclining to fuscou. Described from 2 females and 1 male.

"It is a graceful fly with very long antennæ and legs, and the female with a long ovipositor Fig. 39, "(the hair lines at the side of the figure show the natural size of the fly)." The colour is pale honey yellow inclining to brown above. The unfortunate apple-worm is probably pierced while yet in the fruit, as it always succumbs soon after forming its cocoon, and before changing to chrysalis ; while in the case of *Pimpla*, it is probably attacked either while leaving the fruit or after having spun its cocoon. The larva of the Delicate Long-sting forms, for itself, within the cocoon of its victim, a sufficiently tough, thin, oblong-oval, shiny, brown cocoon from which the perfect fly issues by cutting open a lid at one end.

"As both these parasites transform within the *Carpocapsa* cocoon, it is next to impossible and quite impracticable, to separate friend from foe in removing and destroying the contents of the bandages. But where it is desired to disseminate the parasites they may be bred by enclosing large numbers of *Carpocapsa* cocoons in some tight vessel."

On the 13th of August, 1873, we took a number of chrysalides of the Codling Moth under a bandage on an apple tree and among them there was one which was infested by Ichneumons. The chrysalis when emptied was found to contain six of the parasitic larvæ of which the following description was taken. Length a little over one-tenth of an inch, body tapering almost to a point towards the head. Colour, dull, yellowish white with a tinge of yellow along the dorsal region, very transparent the internal organs showing plainly through. On each segment is a transverse row of short whitish spines, terminal segment encircled with stouter whitish spines. No proper feet or prolegs, but in moving, the mouth-parts attach first with a sucker-like disk and the hinder portions of the body are drawn gradually forward, different portions of the under surface bring furnished with small fleshy prominences which are attached and in turn withdrawn from the surface on which the larva is moving; the principal points of attachment, however, seem to be the first and terminal segments, under the latter when viewed sideways, there appears a fleshy projection much larger than any of those on the other segments, and this projection expands into a flattened disk which holds the larva firmly to the place of attachment.

We did not succeed in rearing these larvæ ; after the chrysalis which contained them was broken open they, one after another died in spite of all our efforts towards their preservation. Whether this would have proved distinct from the species last described by Mr. Riley, and thus made a third true parasite on this pest we are unable at present to determine.

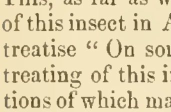
The Pear Tree Slug.

Selandria Cerasi. Peck.

In the year 1790 Prof. Peck wrote a pamphlet entitled "Natural History of the Slug Worm," which was printed in Boston the same year by order of the Massachusetts Agricultural Society, and which obtained the Society's premium of fifty dollars and a gold medal. This, as far as we have been able to learn, was the first published record relating to the ravages of this insect in America. Forty-two years later (in 1841) Dr. Harris published his valuable treatise "On some of the insects injurious to vegetation in Massachusetts," in which when treating of this insect he gives the substance of Prof. Peck's remarks in a condensed form, portions of which material we shall avail ourselves of without further acknowledgement. Although seventy-five years have passed since Prof. Peck's memoir was written, but very little has been added during the interval to our common stock of knowledge in reference to this pest. In the meantime, however, it has spread over the whole country, damaging more or less seriously the foliage of our pear, cherry, quince and plum trees every year.

These insects pass the winter in the chrysalis state, the parent flies, the progenitors of the mischievous brood of slugs, appearing on the wing from about the third week in May until the middle of June. The fly (See Fig. 40) "is of a glossy black colour, excepting the first two pairs of legs, which are dirty yellow or clay coloured with blackish thighs, and the hind legs which are dull black with clay coloured knees. The wings are somewhat convex and rumpled or uneven on the upper side like the wings of the saw flies generally. They are transparent, reflecting the colours of the rainbow, and have a smoky tinge forming a cloud or broad band across the middle of the first pair ; the veins are brownish. The body of the female measures more than one-fifth of an inch in length, that of the male is smaller." Early in June these flies may be found resting in the early morning, or in the cool of the evening, on the upper or under side of the leaves of pear, cherry or plum trees, some seasons they are very plentiful, while at other times but few are met with. When jarring our plum trees for curculios at this season we usually find some on the sheets after jarring, they fall to the ground very

Fig 40.



much like the curculio does, and remain for a short time motionless; their structure, however, is not such as will permit of their disguising themselves as thoroughly as the "little turk" does, and hence they are easily detected. During the past season these flies were very numerous during the early part of June, and their progeny was destructive in a corresponding degree later in the summer.

After pairing the female places her eggs singly within little semicircular incisions through the skin of the leaf, which is frequently followed by some discolouration at the point of insertion. Harris says that the eggs are generally placed on the lower side of the leaves, whereas in our experience we have found them quite as often on the upper side. According to the same author the flies all finish this business of egg depositing and disappear within the space of three weeks. "The flies have not the timidity of many other insects, and are not easily disturbed while laying their eggs. On the fourteenth day afterwards the eggs begin to hatch, and the young slug worms (see those on leaf in Fig. 41) continue to come forth from the fifth of June to the 20th of July, according as the flies have appeared early or late in the spring."

Fig. 41.

"At first the slugs are white; but a slimy matter soon oozes out of their skin, and covers their backs with an olive-coloured sticky coat. They have twenty very short legs, or a pair under each segment of the body excepting the fourth and the last. When fully grown (See *a* Fig. 41) they are about nine-twentieths of an inch in length. The head which is of a dark chestnut colour is small, and is entirely concealed under the fore part of the body. They are largest before, and taper behind, and in form somewhat resemble minute tadpoles. They have the faculty of swelling out the fore part of the body, and generally rest with the tail a little turned up. These disgusting slugs live mostly on the upper side of the leaves of the pear and cherry trees, and eat away the substance thereof, leaving only the veins and the skin beneath untouched. Sometimes twenty or thirty of them may be seen on a single leaf; and in the year 1797 they were so abundant in some parts of Massachusetts that small trees were covered with them, and the foliage entirely destroyed, and even the air by passing through the trees, became charged with a very disagreeable and sickening odour, given out by these slimy creatures. The trees attacked by them are forced to throw out new leaves, during the heat of the summer, at the ends of the twigs and branches, and this unseasonable foliage which should not have appeared until the next spring, exhausts the vigour of the trees, and cuts off the prospect of fruit."

"The slug worms come to their growth in twenty-six days, during which period they cast their skins five times. Frequently as soon as the skin is shed, they are seen feeding upon it; but they never touch the last coat which remains stretched out upon the leaf. After this is cast off, they no longer retain their slimy appearance and olive colour, but have a clean yellow skin, entirely free from viscidity. They change also in form and become proportionally longer, and their head and the marks between the rings are plainly to be seen. In a few hours after this change they leave the trees, and, having crept or fallen to the ground, they burrow to the depth of from one inch to three or four inches, according to the nature of the soil. By moving their body the earth around them becomes pressed equally on all sides, and an oblong, oval cavity is thus formed, and is afterwards lined with a sticky glossy substance, to which the grains of earth closely adhere. Within these little earthen cells or cocoons the change to chrysalids takes place, and in sixteen days after the descent of the slug worms, finish their transformations, break open their cells, and crawl to the surface of the ground, where they appear in the fly form. These flies usually come forth between the middle of July and the 1st of August, and lay their eggs for a second brood of slug-worms. The latter come to their growth and go into the ground in September and October, and remain there till the following spring, when they are changed to flies and leave their winter quarters. It seems that all of them, however, do not finish their transformation at this time; some are found to remain unchanged in the ground till the following year; so that if all the slugs of the first hatch in any one year should happen to be destroyed, enough from a former brood would still remain in the earth to continue the species."

"The disgusting appearance and smell of these slug-worms do not protect them from the attacks of various enemies. Mice and other burrowing animals destroy many of them in their cocoons, and it is probable that birds also prey upon them when on the trees both in the slug and winged state. Professor Peck has described a minute ichneumon fly, stated by Mr. Westwood to be a species of Encyrtus, that stings the eggs of the slug fly, and deposits in each one a single egg of her own. From this in due time a little maggot is hatched, which lives in the shell of the slug-fly's egg, devours the contents, and afterwards is changed to a chrysalis, and then to a fly like its parents. Professor Peck found that great numbers of the eggs of the slug-fiy, especially of the second batch, were rendered abortive by this atom of existence.

Sand, ashes, lime and hellebore have been recommended as remedies for this pest but the last mentioned is by far the most reliable. In 1870 we tried some experiments with these remedies, and reported in the CANADIAN ENTOMOLOGIST for September of that year, as follows :—

THE PEAR TREE SLUG.

This disgusting little larva, the progeny of a little blackish sawfly, has been very abundant during the past season and has been the subject of some notes and experiments. In the first place we noted that there were two broods in the season. The parents of the first brood, which pass the winter in the chrysalis state, appear on the wing about the second or third week in May, depositing eggs from which the slugs are hatched, becoming full grown from the middle to the end of June, then entering the chrysalis state underground ; the second brood of the flies make their appearance late in July. This year we noticed them at work depositing eggs on the 21st, the young slugs were abundant and about a quarter of an inch long on the eighth of August aud by the sixth of September many of them were full-grown. With us they were much more destructive to cherry trees than to pear, consuming the upper surface of the leaves, soon giving the trees a scorched and sickly aspect, and in many cases the foliage fell off, leaving the trees almost bare.

As soon as the slugs were observed at work in Spring, they were treated to a plentiful supply of dry sand, thrown up into the higher branches with a shovel, and shaken over the lower ones through a sieve, which stuck thickly to their slimy skins, completely covering them up. Thinking we must have mastered them by so free a use of this long trusted remedy, we took no further heed of them for some days, when to our surprise, they were found as numerous as ever. The next step was to test this sand remedy accurately to see what virtue there was in it. Several small branches of pear trees were selected and marked, on which there were six slugs, and these were well powdered over—entirely covered with dry sand ; on examining them the next morning it was found that they had shed the sand-covered skin and crawled out free and slimy again. The sand was applied a second and third time on the same insects with similar results ; and now being convinced that this remedy was of little value, they were treated to a dos of hellebore and water, which soon finished them. Ashes were now tried on another lot, the same way as the sand had been, with very similar results. It was also intended to try fresh air slacked-lime, which we believe would be effectual, but having none on hand just then, the experiment was postponed, and the opportunity of testing it lost for the season. We must not omit mention of an experiment with hellebore. On the 13th of August, at eight a.m., a branch of a cherry tree was plucked, on which there were sixty-four slugs ; the branch had only nine leaves, so that it may be readily imagined that they were thickly inhabited. A dose of hellebore and water was showered on them about the usual strength, an ounce to the pailful, when they soon manifested symptoms of uneasiness, twisting and jerking about in a curious manner ; many died during the day, and only six poor, sickly-looking specimens remained alive the following morning, and these soon after died.

During the past season these slug worms have been unusually abundant on our pear trees, in many cases destroying the foliage so thoroughly that they looked as if they had been scorched by a fire, every leaf in some instances dropping from the trees, so that for a time they were bare as in mid-winter. Nearly a thousand trees in the young pear orchards of the writer suffered severely. During the latter part of June and the early days of July we had no opportunity of inspecting these trees, and when we visited them on the 7th of July they were so much injured that we thought they could not be much worse, and as the slugs were then full-grown and fast disappearing and the application of a remedy to so many trees a matter of much labour nothing was attempted to remedy the evil then.

It was observed that some trees were remarkably exempt from the attacks of these slugs Clapp's favourite deserves to be especially mentioned on this account, its thick glossy leaves seemed to be uninviting, and when all around were seared, and browned, and withered trees of this variety wherever found were covered with a foliage rendered doubtly attractive and beautiful by the waste and dismal appearance of those about them. The following notes were taken at the time in reference to the relative damage inflicted on the different varieties of pear trees in those portions of the orchards most injured. Beurre Giffard most of the trees slightly, a few badly damaged. Ananas d'Ete, but slightly injured. Beurre d'Amanlis, same as Beurre Giffard. Beurre Goubault, entirely stripped. Brandywine, some stripped, others but little affected in the same row. Doyenne d'Ete, badly injured. Bartlett suffered very much, nearly all the trees being stripped. Edmunds injured badly, but not so much as Bartlett. Souvenir de Congress, nearly stripped. Kirtland, Dwarfs, not much affected. Standards, badly injured. Leech's Kingsessing, scarcely touched. Osbands Summer, badly damaged, not a leaf left on many of the trees. Rostiezer, some very badly injured, others not so much. Dearborns Seedling, nearly stripped. Tyson, badly affected. Ott's Seedling, not much injured Marechale de la Cour, nearly free. Beurre de Montgeron, Frederica Bremer, Abbott and Fleur de Niege, scarcely touched. Beurre Diel, some few trees very much injured, others not so badly. Gansel's Bergamot, stripped. Buffum and Beurre Superfin, scarcely injured. Sheldon, injured, but not badly. Beurre de Waterloo, scarcely touched. Beurre Amande, singularly free. Beurre St. Nicholas, Oswego Beurre and Golden Beurre, not much injured. Beurre de Paimpool, nearly stripped. It was intended to go over all the other varieties in a similar manner, but opportunity did not offer. In the course of another fortnight new leaves began to push out vigorously on the defoliated trees and within a month or six weeks all was green again.

In the meantime these mischief makers were preparing for a second descent, and we in turn were preparing to receive them ; on the 29th of July, when going through the orchards in the afternoon, the new brood of flies were found in the greatest abundance, resting on the young leaves, or on those portions of green which still remained on the leaves partially eaten by the last brood, they were congregated, however, more especially on those trees where green leaves were most abundant. On disturbing them they would fall to the ground with the antennæ bent under their bodies, and the head bent forward. On half a dozen trees we caught about 60 specimens, and might have taken hundreds, they were so thickly spread that in many instances there were two and three on a single leaf. By the last week in August, the second brood of slugs were hatched ; some very tiny creatures, others by this time half grown. Now, those trees which had previously escaped were all more or less covered, and would no doubt soon have been stripped, had not some measures been at once taken to destroy them. A raised platform was rigged up in a one horse cart in which was placed a barrel of water in which a pound of powdered hellebore had been mixed, and from the elevated stand this mixture was showered lightly on the trees from the rose of a watering pot. It was astonishing how quickly the trees were cleaned scarcely one could be found on a tree the morning after the application had been made, and ten pounds of hellebore with five or six days work of man and horse served to go over the whole ground, the work being completed in much less time than we had supposed it could.

THE GRAPE VINE PHYLLOXERA.

(*Phylloxera vastatrix*, PLANCHON.)

COMPILED BY THE REV. C. J. S. BETHUNE, M.A.

With the exception of the Colorado Potato Beetle, and the Locust of the Western States, of which we have given an account in another article, there is probably no insect that attracts more general attention at the present time than the destructive Grape-Vine Phylloxera (*P. vastatrix*, Planchon). To us in Canada it is but little known, but as its ravages may spread over our own vineyards at any time, and as it must be an object of interest to all vinegrowers, we think it proper to present to the readers of this Report an account of the insect and such other particulars as we are enabled to gather together. The fact of the rare occurrence of the insect in this country, and the consequent difficulties in the way of its study, is a sufficient reason, we trust, why we should offer a compilation from the writings of others, rather than attempt any original remarks of our own. Our quotations, unless otherwise specified, will be taken from the admirable paper on the Phylloxera, by our valued friend, Professor C. V. Riley, State Entomologist of Missouri, contained in his last Report (*Sixth Annual Report on the Insects of Missouri*, 1874, pages 30-87.) The estimation in which Mr. Riley's work in this respect is held in the great vine-growing countries of Europe, may be judged from the fact that, in the month of February last, he was presented with a very handsome gold medal by the Minister of Agriculture and Commerce of France, "in appreciation of his discoveries in Economic Entomology, and especially of his services rendered to French grape culture."

Though one form of the insect, the gall-inhabiting type, was noticed by Dr. Fitch, State Entomologist of New York, as long ago as 1856, very little attention was paid to it for some years. At length the serious disease of the grape-vine began to attract attention in France, and to cause so much alarm, that the authorities offered a prize of 20,000 francs for an effectual and practicable remedy. The disease was at first termed *pourridie*, or rotting—the roots becoming swollen and bloated, and finally wasting away. There were no end of surmises and theories as to cause, until Professor J. E. Planchon, of Montpellier, in July, 1868, announced that it was due to the puncture of a minute insect belonging to the plant-louse family (*Aphididæ*), and bearing a close resemblance to our gall-louse." The following January, Professor Westwood, of Oxford, England, announced that he considered both the gall and root-inhabiting types to be different forms of the same insect. Shortly after a French writer gave it as his opinion that the European insect was identical with the American species long before described by Dr. Fitch. "This opinion," says Mr. Riley, "gave an additional interest to this insect, and I succeeded, in 1870, in establishing the identity of the French gall-insect with ours. During the same year I also established the identity of the gall and root-inhabiting types, by showing that in the fall of the year the last brood of gall-lice betake themselves to the roots and hibernate thereon. In 1871, I visited France and studied their insect in the field; and in the fall of that year, after making more extended observations here, I was able to give absolute proof of the identity of the two insects, and to make other discoveries, which not only interested our friends abroad, but were of vital importance to our own grape-growers, especially in the Mississippi Valley. I have given every reason to believe that the failure in the European vine, (*Vitis vinifera*). when planted here, the partial failure of many hybrids with the European *vinifera*, and the deterioration and death of many of the more tender-rooted native varieties, are mainly owing to the injurious work of this insidious little root-louse. It had been at its destructive work for years, producing injury the true cause of which was never suspected until the publication of the article in my fourth Report. I also showed that some of our native varieties enjoyed relative immunity from the insects' attacks, and urged their use for stocks, as a means of re-establishing the blighted vineyards of Southern France."

"The disease continued to spread in Europe, and became so calamitous in the last-named country that the French Academy of Sciences appointed a standing Phylloxera Committee. It is also attracting some attention in Portugal, Austria and Germany, and even in England, where it affects hot-house grapes."

Natural History of the Insect.

The genus Phylloxera is characterized by having three-jointed antennæ, the third or terminal being much the longest, and by carrying its wings overlapping, flat on the back instead of roof-fashion. It belongs to the sub-order of whole-winged bugs (*Homoptera*), and forms a connecting link between two of its great families, the Plant-lice (*Aphididæ*) on the one hand, and the Bark-lice (*Coccidæ*) on the other. It is generally considered, however, to pertain to the former family, though some naturalists, with the not uncommon love of introducing new names and minute classifications, have desired to found a new family for this special insect.

Not the least interesting feature in the economy of the Phylloxera is the different phases or forms under which it presents itself. Among these forms are two constant types which have led many to suppose that we have to do with two species. The one type, which for convenience Mr. Riley terms *gallæcola*, lives in galls on the leaves; the other which he calls *radicicola*, lives on swellings of the roots. They may be tabulated thus:—

Type 1. Gallæcola (see Figure 43, *f*, *g*, *h*),
Type 2. Radicicola.
A, Degraded or wingless form (see Figure 44, *e*, *f*, *g*.)
B, Perfect or winged form (see Figure 45, *g*, *h*.)

"Type Gallæcola or Gall-inhabiting.—The gall or excrescence produced by this insect is simply a fleshy swelling of the under side of the leaf, more or less wrinkled and hairy, with a corresponding depression of the upper side, the margin of the cup being fuzzy, and drawn together so as to form a fimbriated mouth. It is usually cup-shaped, but sometimes greatly elongated or purse-shaped.

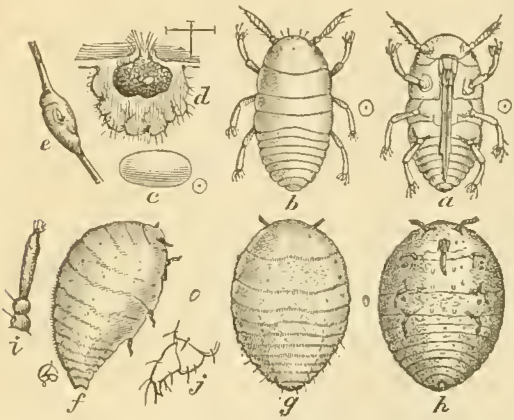
Soon after the first vine-leaves that put out in the spring have fully expanded, a few scattering galls may be found, mostly on the lower leaves, nearest the ground. These vernal galls are usually large, (of the size of an ordinary pea), and the normal green is often blushed with rose where exposed to the light of the sun. On carefully opening one of them (Fig. 43, *d*) we shall find the mother-louse diligently at work surrounding herself with pale-yellow eggs of an elongate oval form, scarcely .01 inch long, and not quite half as thick (Fig. 43, *c*). She is about .04 inch long, generally spherical in shape, of a dull orange colour, and looks not unlike an immature seed of the common purslane. At times, by the elongation of the abdomen, the shape assumes, more or less perfectly, the pyriform. Her members are all dusky, and so short compared to her swollen body, that she appears very clumsy, and undoubtedly would be outside of her gall, which she never has occasion to quit, and which serves her alike as dwelling-house and coffin. More carefully examined, her skin is seen to be shagreened or minutely granulated and furnished with rows of minute hairs. The eggs begin to hatch when six or eight days old into active

Fig. 42.

Under side of Leaf covered with Galls.

little oval, hexapod beings, which differ from their mother in their bright yellow colour and more perfect legs and antennæ, the tarsi being furnished with long, pliant hairs, terminating in a more or less distinct globule. In hatching, the eggs split longitudinally from the anterior end, and the young louse whose pale yellow is in strong contrast with the more dusky colour of the egg-shell, escapes in the course of two minutes. Issuing from the mouth of the gall, these young lice scatter over the vine, most of them finding their way to the tender terminal leaves, where they settle in the downy bed which the tomentose nature of these leaves affords, and commence pumping up and appropriating the sap. The tongue-sheath is blunt and heavy, but the tongue proper—consisting of three brown, elastic and wiry filaments, which, united, make so fine a thread as scarcely to be visible with the strongest microscope—is sharp, and easily run under the parenchyma of the leaf. Its puncture causes a curious change in the tissues of the leaf, the growth being so stimulated that the under side bulges and thickens, while the down on the upper side increases in a circle around the louse, and finally hides and covers it as it recedes more and more within the deepening cavity. Sometimes the lice are so crowded that two occupy the same gall. If, from the premature death of the louse, or other cause, the gall becomes abortive before being completed, then the circle of thickened down or fuzz enlarges with the expansion of the leaf, and remains (Fig. 43, *c*) to tell the tale of the futile effort. Otherwise, in a few days the gall is formed, and the inheld louse, which, while eating its way into house and home, was also growing apace, begins a parthenogenetic maternity by the deposition of the fertile eggs, as her immediate parent had done before. She increases in bulk with pregnancy, and one egg follows another in quick succession, until the gall is crowded. The mother dies and shrivels, and the young, as they hatch, issue and found new galls. This process continues during the summer until the fifth or sixth generation. Every egg brings forth a fertile female, which soon becomes wonderfully prolific. The number of eggs found in a single gall averages about 200 ; yet it will sometimes reach as many as 500, and, if Dr. Shimer's observations can be relied on, it may even reach 5,000. I have never found any such number myself ; but, even supposing there are but five generations during the year, and taking the lowest of the above figures, the immense prolificacy of the species becomes manifest. As summer advances they frequently completely cover the leaves with their galls, and settle on the tendrils, leaf-stalks and tender branches, where they also form knots and rounded excrescences (Fig. 43, *e*) much resembling those on the roots. In such a case, the vine loses its leaves prematurely, usually, however, the natural enemies of the louse seriously reduce its numbers by the time the vine ceases its growth in the fall, and the few remaining lice, finding no more succulent and suitable leaves, seek the roots. Thus by the end of September, the galls are mostly deserted, and those which are left are almost always infested with mildew, and eventually turn brown and decay. On the roots the young lice attach themselves singly or in little groups and thus hibernate. The male louse has never been seen, nor does the female ever acquire wings. Indeed, too much stress cannot be laid on the fact that *Gallæcola* occurs only as an agamic and apterous female form. It is but a transient summer state, not at all essential to the perpetuation of the species, and does, compared with the other type, but trifling damage. It has been found occasionally by Mr. Riley on all species of the grape-vine (*vinifera*, *riparia*, *æstivalis* and *Labrusca*) cultivated in the Eastern and Middle States, and on the wild *cordifolia* ; but it flourishes only on the river-bank grape (*riparia*), and more especially on the Clinton and Taylor, with their close allies. Thus while legions of the root-inhabiting type (*radicicola*) are overrunning and devasting the vineyards of France, this one is almost unknown there except on such American varieties as it infests with us."

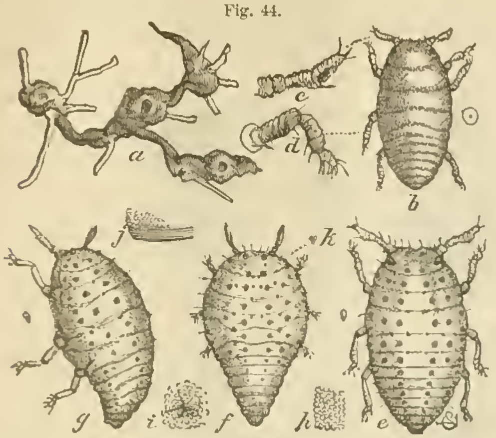
Fig. 43.



Type Gallæcola :—*a*, *b*, newly-hatched larva, ventral and dorsal view ; *c*, egg ; *d*, section of gall ; *e*, swelling of tendril ; *f*, *g*, *h*, mother gall-louse—lateral, dorsal and ventral views ; *i*, her antenna ; *j*, her two jointed tarsus. Natural sizes indicated at sides.

"TYPE RADICICOLA OR ROOT-INHABITING.—We have seen that, in all probability, *gallæcola* exists only in the apterous, shagreened, non-tubercled, fecund female from. *Radicicola*, however, presents itself in two principal forms. The newly-hatched larvæ of this type are undistinguishable, in all essential characters, from those hatched in the galls, but in due time they shed the smooth larval skin, and acquire raised warts or tubercles; which at once distinguish them from *gallæcola*. In the development from this point the two forms are separable with sufficient ease: one (A) of a more dingy greenish yellow, with more swollen fore-body, and more tapering abdomen; the other (B) of a brighter yellow, with the lateral outline more perfectly oval, and with the abdomen more truncated at tip." *

Fig. 44.



TYPE RADICICOLA.—*a*, roots of Clinton vine, showing relation of swellings to leaf-galls, and power of resisting decomposition; *b*, larva as it appears when hibernating; *c*, *d*, antenna and leg of same; *e*, *f*, *g*, forms of more mature lice; *h*, granulations of skin; *i*, tubercle; *j*, transverse folds at borders of joints; *k*, simple eyes.

"The first or mother form (Fig. 44, *f*, *g*,) is the analogue of *gallæcola*, as it never acquires wings, and is occupied, from adolescence till death, with the laying of eggs. which are less numerous and somewhat larger than those found in the galls. I have counted in the spring as many as two hundred and sixty-five eggs in a cluster, and all evidently from one mother, who was yet very plump and still occupied in laying. As a rule, however, they are less numerous. With pregnancy this form becomes quite tumid and more or less pyriform, and is content to remain with scarcely any motion in the more secluded parts of the roots, such as the creases, sutures and depressions, which the knots afford. The skin is distinctly shagreened (Fig. 44, *h*,) as in *gallæcola*. The warts, though usually quite visible with a good lens, are at other times more or less obsolete, especially on the abdomen. The eyes, which were quite perfect in the larva, become more simple with each moult, until they consist, as in *gallæcola*, of but triple eyelets (Fig. 44, *k*,) and, in the general structure, this form becomes more degraded with maturity, wherein it shows the affinity of the species to the *Coccidæ*, the females of which, as they mature, generally lose all trace of the members they possessed when born."

"The second or more oval form (Fig. 44, *e*,) is destined to become winged. Its tubercles when once acquired, are always conspicuous; it is more active than the other, and its eyes increase rather than diminish in complexity with age. From the time it is one-third grown the little dusky wing-pads may be discovered, though less conspicuously than in the pupa state, which is soon after assumed. The pupæ (Fig- 45, *e*, *f*,) are still more active, and after feeding a short time, they make their way to the light of day, crawl over the ground and over the vines, and finally shed their last skin and assume the winged state. In their last moult the tubercled skin splits on the back, and is soon worked off, the body in the winged insect having neither tubercles nor granulations."

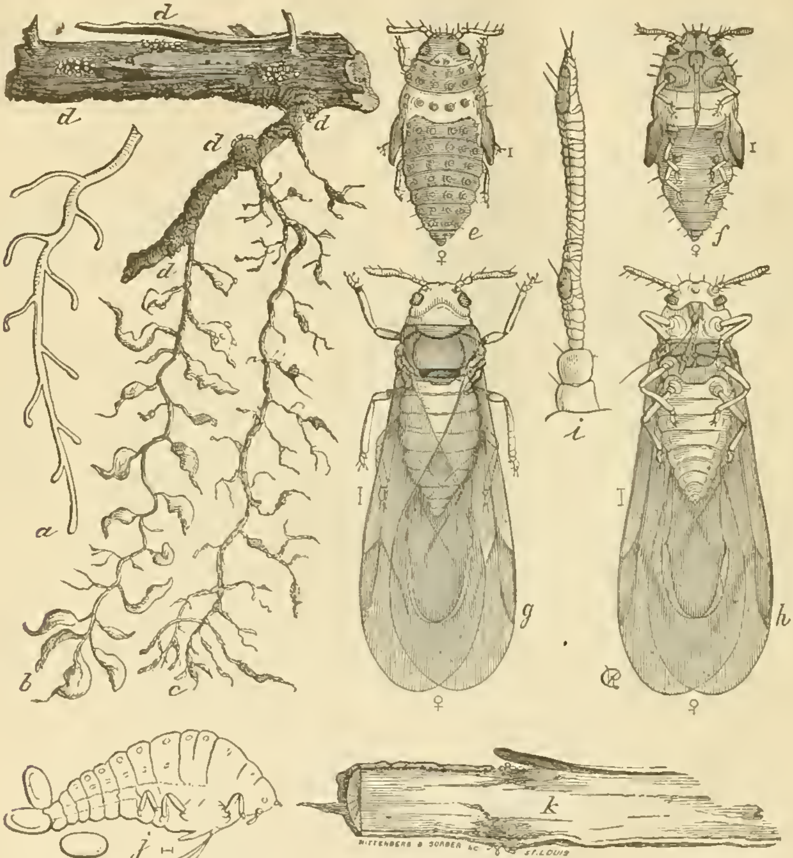
"The winged insects are most abundant in August and September, but may be found as early as the first of July, and until the vines cease growing in the fall. The majority of them are females, with the abdomen large and more or less elongate From two to five eggs may invariably be found in the abdomen of these, and are easily seen when the insect is held up to the light, or mounted in balsam or glycerine."

"As fall advances the winged individuals become more and more scarce, and as winter sets in only eggs, newly-hatched larvæ, and a few apterous egg-bearing mothers, are seen. These last die and disappear during the winter, which is mostly passed in the larva state, with here and there a few eggs. The larvæ thus hibernating (Fig. 44, *b*) become dingy, with the body and limbs more shagreened and the claws less perfect than when first hatched; and, of thousands examined, all bear the same appearance, and all are furnished with strong

* "It is not to be understood, in making these distinctions, that these differences of form are so constant that they can always be relied on; for the form of the body varies, so that the wingless mother may present the more perfect oval of that destined to become winged."

suckers. As soon as the ground thaws and the sap starts in the spring, these young lice work off their winter coat, and, growing apace, commence to deposit eggs. All, without exception, become mothers, and assume the degraded form (A) already described.

FIG. 45.



TYPE RADICICOLA :—*a*, shows a healthy root ; *b*, one on which the lice are working, representing the knots and swellings caused by their punctures ; *c*, a root that has been deserted by them, and where the rootlets have commenced to decay ; *d*, *d*, *d*, show how the lice are found on the larger roots ; *e*, female pupa, dorsal view ; *f*, same, ventral view ; *g*, winged female, dorsal view ; *h*, same, ventral view ; *i*, magnified antenna of winged insect ; *j*, side view of the wingless female, laying eggs on roots ; *k*, shows how the punctures of the lice cause the larger roots to rot.

"At this season of the year, with the exuberant juices of the plant, the swellings on the roots are large and succulent, and the lice plump to repletion. One generation of the mother form (A) follows another—fertility increasing with the increasing heat and luxuriance of summer—until at last the third or fourth has been reached before the winged form (B) makes its appearance in the latter part of June or early in July. Such are the main features which the development of the insect presents, to one who has studied it in the field as well as in the closet.

"Since I proved, in 1870 (adds Mr. Riley), the absolute identity of these two types by showing that the gall-lice become root-lice, the fact has been repeatedly substantiated by different observers. Yet, strange to say, no one has heretofore succeeded in making gall-lice of the young hatched on the roots, though I formerly supposed that Signoret had done so. It is, therefore, with much satisfaction that I record the fact of having succeeded this winter in obtaining galls on a young Clinton vine from young *radicicola*, and of thus establishing beyond peradventure, the specific interrelation and identity of the two types. I make this announcement with all the more pleasure, that for three years past, both on vines growing out-doors and in pots in-doors, I had in vain attempted to obtain the same result."

PRACTICAL CONSIDERATIONS.

"THE MORE MANIFEST AND EXTERNAL EFFECTS OF THE PHYLLOXERA DISEASE.—The result which follows the puncture of the root-louse is an abnormal swelling, different in form, according to the particular part and texture of the root. These swellings, which are generally commenced at the tips of the rootlets, where there is excess of plasmatic and albuminous matter, eventually rot, and the lice forsake them and betake themselves to fresh ones—the living tissue being necessary to the existence of this as of all plant-lice. The decay affects the parts adjacent to the swellings, and on the more fibrous roots cuts off the supply of sap to all parts beyond. As these last decompose, the lice congregate on the larger ones, until at last the root system literally wastes away."

"During the first year of attack there are scarcely any outward manifestations of disease, though the fibrous roots, if examined, will be found covered with nodosities, particularly in the latter part of the growing season. The disease is then in its incipient stage. The second year all these fibrous roots vanish, and the lice not only prevent the formation of new ones, but, as just stated, settle on the larger roots, which they injure by causing hypertrophy of the parts punctured, which also eventually become disorganized and rot. At this stage the outward symptoms of the disease first become manifest, in a sickly, yellowish appearance of the leaf and a reduced growth of cane. As the roots continue to decay, these symptoms become more acute, until by about the third year the vine dies. Such is the course of the malady on vines of the species *vinifera*, when circumstances are favourable to the increase of the pest. When the vine is about dying, it is generally impossible to discover the cause of the death, the lice which had been so numerous the first and second years of invasion, having left for fresh pasturage."

MODE OF SPREADING.—The gall lice can only spread by travelling, when newly-hatched from one vine to another; and, if this slow mode of progression were the only one which the species is capable of, the disease would be comparatively harmless. The root-lice, however not only travel under-ground along the interlocking roots of adjacent vines, but crawl actively over the surface of the ground, or wing their way from vine to vine and from vineyard to vineyard. Doubts have been repeatedly expressed by European writers as to the power of such a delicate and frail-winged fly to traverse the air to any great distance. On the 27th of September, 1873, the weather being quite warm and summer-like, with much moisture in the atmosphere, Mr. Riley witnessed the insect's power of flight. Some two hundred winged individuals, that he had confined, became very restless and active, vigorously vibrating their wings and beating about their glass cages. Upon opening the cages, the lice began to dart away and were out of sight in a twinkle. They have been caught in spider-webs in Europe, and captured by Mr. Riley on sheets of paper prepared with bird-lime and suspended in an infested vineyard; it is clear, then, that they can sustain flight for a considerable time under favourable conditions, and with the assistance of the wind, they may be wafted to great distances. These winged females are much more numerous in the fall of the year than has been supposed by Entomologists. Wherever they settle, the few eggs which each carries are sufficient to perpetuate the species, which, in the fullest sense, may be called contagious.

"SUSCEPTIBILITY OF DIFFERENT VINES TO THE DISEASE. As a means of coping with the Phylloxera disease, a knowledge of the relative susceptibility of different varieties to the attacks and injuries of the insect is of paramount importance. As is so frequently the case with injurious insects, and as we have a notable instance in the common Currant Aphis (*Aphis Ribesii*), which badly affects the leaves of some of the Currants, but never touches the Gooseberry which belongs to the same genus. The Phylloxera shows a preference for and thrives best on certain species, and even discriminates between varieties; or, what amounts to the same thing, practically, some varieties resist its attacks and enjoy a relative immunity from its injuries. It would be useless, and certainly unnecessary here, to attempt to ascertain the reason why certain vines thus enjoy exemption while others so readily succumb; but in a broad way it may be stated that there is a relation between the susceptibility of the vine and the character of its roots—the slow-growing, more tender-wooded and consequently more tender-rooted varieties succumbing most readily; the more vigorous powers resisting best."

From Mr. Riley's synopsis of experiments and observations we gather the following statement respecting the different varieties of grape:—

European Vine (*Vitis vinifera*)—Rarely subject to leaf-gall, but it generally succumbs to the attacks of root-lice after a few years.

River-bank Vine (*V. riparia*)—The Cornucopia, Alvey and Othello suffer very little or not at all from Leaf-galls, but to a considerable extent from Root-lice. The Clinton and Taylor are very subject to the Leaf-galls, but from the great vitality of their roots they do not succumb to the attacks of the Root-lice. The Golden Clinton and Louisiana do not suffer much from either. The Marion a good deal affected by the former, but little by the latter. The Delaware suffers considerably from both.

Summer Grape (*V. æstivalis*)—The Cunningham, Norton's Virginia, and Rutlander suffer not at all from the Leaf-gall, and very little from the Root-lice. The Herbemont and Cynthiana suffer slightly from both.

Northern Fox Grape (*Labrusca*)—The Challenge, Dracut Amber, Israella, Martha, Northern Muscadine and Wilder, are not subject to the Leaf-gall, and only slightly to the root-lice. The Diana, Goethe, Hartford, Isabella, Ives, Maxatawney, North Carolina, Rebecca and Salem are also free from the Leaf-gall, but have the Root-lice more abundant and suffer more from its attacks. The Catawba and Iona do not suffer from the Leaf-gall, but are most subject to the Root-lice The Concord has the Leaf-galls but rarely, and does not suffer much from the Root-lice ; the Creveling also is usually free from the former, but suffers much more from the latter.

Southern Fox Grape.—This species is entirely free from the Phylloxera in any form.

The above enumeration is founded principally upon Mr. Riley's observations in the central portion of Missouri ; he has also examined many of the varieties in Kansas, Illinois, New Jersey, Pennsylvania and New York The Arnold's hybrids, which he has examined, all suffer, he states, but some of them more than others.

Means of Coping with the Disease.—Grafting the more susceptible varieties on the roots of those that have a greater power of resistance, would probably counteract the disease to a great extent. This plan is now being tried on a large scale, but it will be necessary to wait a year or two before any positive conclusions can be obtained.

" In planting a new vineyard the greatest care should be taken not to introduce Phylloxera on the young plants, and a bath of weak lye or strong soap suds before planting will, perhaps, prove the best safeguard. Remembering that the lice are spreading over the ground from July till fall, and principally in the months of August and September, a thorough sprinkling of the surface with lime. ashes, sulphur, salt or other substance destructive to insect life, will, no doubt, have a beneficial effect in reducing their numbers and preventing their spread.

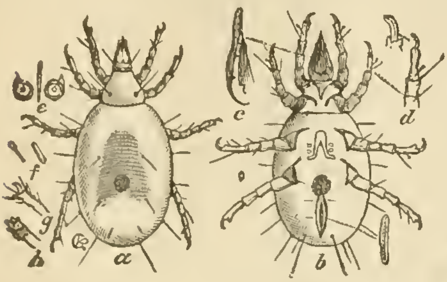
The insect has been found to thrive less and to be, therefore, less injurious in a sandy soil ; while mixture of soot with the soil has had a beneficial effect in destroying the pest. It is, therefore, recommended for the more susceptible varieties, and that they be planted in trenches first prepared with a mixture of sand and soot. An addition of lime will also prove beneficial. There is every reason to believe that vines are rendered less susceptible to the disease by a system of pruning and training that will produce long canes and give them as nearly as possible their natural growth.

Natural Enemies.—There are a number of predaceous insects which serve to keep the leaf-lice in check ; but as the injury is mostly done underground it will suffice to enumerate the principal of these in this connection. The most efficient is a black species of Fringe-wing or Thrips with white wings (*Thrips Phylloxeræ*). They are found in several different kinds of Phylloxera galls, and do more than any other species to keep the leaf inhabiting species within bounds."

The next most efficient aids in the destruction of the leaf-lice are the lace-winged flies (*Chrysopa*) ; the lady birds (*Coccinella*) ; certain Syrphus fly larvæ ; a few true bugs and other insects.

The enemies known to attack the Phylloxera underground are, naturally enough, fewer in number. In one instance, Mr. Riley relates, I have found a Scymnus larva at the work six inches below the surface, and there is a Syrphus fly, whose larva lives under-ground and feeds both on the apple-tree root-louse and on this grape root-louse. Wonderful indeed is the instinct which teaches this blind larva to penetrate the soil in search of its prey; for the egg must necessarily be laid at the surface. But though the underground enemies of its own class are few, I have discovered a mite which preys extensively upon this root-inhabiting type, and which renders efficient aid in keeping it in check in this country. This mite (*Tyro glyphus phylloxeræ*, Planchon & Riley, Fig. 46,) belongs to the same genus as the cheese and meal mites, and the species which infests preserved insects, and is such a pest in cabinets. At is the rule with mites, it is born with but six legs, but acquires eight after the first or second moults. It varies considerably in form, with age, and in studying it with a view of distinguishing it specifically from other described species, I have noticed all the different tarsal characters shown as *d*, *f*, *g* and *h*, (Fig. 46), and on which distinct genera have been founded. Mites present themselves in such different forms that the adolescent stages of the same species have been made to represent distinct families by authors who never studied the development of these beings. The species under consideration, when young, mostly contents itself with the altered sweets of the roots which rot from the punctures of Phylloxera, while when older it preys by preference on the lice themselves."

Fig. 46.



Phylloxera Mite, *a*, dorsal, *b*, ventral view of female, *c*, mouth-parts, *d*, *f*, *g*, *h*, forms of tarsal appendages, *e*, ventral tubercles of male.

"Direct Remedies.- The leaf-lice, which do not play such an important part in the disease as was at first supposed, may be controlled with sufficient ease by a little care in destroying the first galls which appear, and in pruning and destroying the terminal growth of infested vines later in the season. The root-lice are not so easily reached. As the effort will be according to the exigency, we may very naturally look to France for a direct remedy, if ever one be discovered. But of all the innumerable plans, patented or non-patented, that have been proposed, of all the many substances that have been experimented with under the stimulus of a large national reward, no remedy has yet been discovered which gives entire satisfaction, or is applicable to all conditions of soil. Nor is it likely that such a remedy ever will be discovered.

"While, therefore, not very satisfactory results have followed the use of pure insecticides, the application of fertilizers intended to invigorate the vine, and at the same time injure the lice, has been more productive of good. Especially has this been the case with fertilizers rich in potassic salts and nitrogenous compounds, such as urine. Sulphuret of potassium dissolved in liquid-manure; alkaline-sulphates, with copperas and rape seed; potassic salts, with guano; soot and cinders are, among other applications, most favourably mentioned.

Mr. Riley closes his very able Essay with the following remarks:—"We have in the history of the Grape Phylloxera, the singular spectacle of an indigenous American insect being studied, and its workings understood in a foreign land, before its presence in its most injurious form was even suspected in its native home. The Franco-Prussian war, with all its fearful consequences to France, has passed away; the five milliards of francs (one thousand million dollars) have been paid as indemnity to her victors, in so short a time that the civilized world looked on in wonder and astonishment. Yet this little Phylloxera, sent over doubtless in small numbers, by some American nurseryman, a few years since, continues its devastating work, and costs that unfortunate country millions of francs annually. The last German soldier has been removed—at terrible cost it is true—from French soil, but the Phylloxera army remains; and if another five milliard francs could extirpate the last individual of this liliputian insect host from her soil, "la belle France" would be cheaply rid of the enemy. Had the world, twenty years ago, possessed the knowledge we at present have of this insect and of its dangerous power, a few francs might have originally stayed its invasion of that great vine-growing and wine-making country. Needs there any more forcible illustration of the importance of economic entomology!"

In confirmation of this statement, we read in the monthly report of the Department of Agriculture (Washington, August and September, 1874), that "the Prefect of the Department of the Rhone, in France, has published a decree directing the mayor of each Commune within his jurisdiction, upon the indication of the presence of the Phylloxera, to proceed at once to determine the limits of each local district infected by the insect. Every vine affected and all the roots within five meters are to be dug up and burned. This decisive measure has not escaped sharp criticism. To save the vine lands of the Rhone from destruction by this pest, it is now proposed to secure winter irrigation by a grand canal connected with that river. M. Dumont, *Ingénieur en chef des chaussés*, has developed, before a governmental commission, a scheme for the construction of such a canal, within four years, at a cost of 102,000,000 francs. This, it is supposed, will rescue from destruction over 60,000 acres of vine lands, yielding products worth 200,000,000 francs per annum and taxes amounting to 20,000,000 francs."

REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

PROVINCE OF ONTARIO,

FOR THE YEAR

1874.

Printed by order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 86 & 88 KING STREET WEST.

1875.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

FOR THE YEAR 1874.

INCLUDING REPORTS ON SOME OF THE NOXIOUS AND BENEFICIAL INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario;

WILLIAM SAUNDERS,

Editor of the Entomologist;

EDMUND BAYNES REED,

Vice-President of the Entomological Society of Ontario.

Printed by Order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 86 & 88 KING STREET WEST.

1875.

CONTENTS.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

FOR THE YEAR 1874.

INCLUDING REPORTS ON SOME OF THE NOXIOUS AND BENEFICIAL INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.

Head-Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario;

WILLIAM SAUNDERS,

Editor of the Entomologist;

EDMUND BAYNES REED,

Vice-President of the Entomological Society of Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE YEAR 1874.

To the Honourable the Commissioner of Agriculture,—

Sir,—I have the honour to submit for your consideration the Report of the Entomological Society of Ontario for the year 1874, embracing a detailed statement of receipts and expenditures during the year, which accounts have been duly audited, also a list of the office-bearers elected for the year 1875.

The annual meeting of the Society was held at the City of Toronto, at the same time as the Exhibition of the Agricultural and Arts Association in accordance with the provisions of the statute, when the various reports were then presented and approved of.

I have also the pleasure of submitting herewith a Report on some of the Noxious, Benefical and Other Insects of this Province, which has been prepared on behalf of the Society by the Rev. C. J. S. Bethune, M.A., Mr. Wm. Saunders and Mr E. B. Reed.

The Canadian Entomologist, the organ of the Society is still issued monthly, and has now nearly reached the completion of its sixth volume, the regular issue of our journal for the past six years has enabled us with the help of our esteemed contributors to disseminate a vast amount of practical, as well as scientific knoweledge relating to Entomology which has done much towards increasing the interest felt in this branch of Natural History so important to the agriculturist.

In order to illustrate the pages of this Report, we have procured as large a number of new wood cuts and electrotypes as the limited means at our disposal would admit of, we can only regret that it is not more profusely illustrated as we feel sure that such illustrations add greatly to the interest and usefulness of our report.

I have the honour to remain, sir,
Your obedient servant,

J. H. McMechan,
Secretary-Treasurer Entomological Society of Ontario.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The fourth annual meeting of the above Society was held (by the kind permission of the Provost) in the library of Trinity College, Toronto, on the 23rd of September, at 3.30, P.M. The report of the Secretary-Treasurer was presented, showing a slight increase of membership and a satisfactory condition of the finances, after which the President read his annual address, which was by request of those present, kindly placed at the disposal of the Printing Committee for publication.

The following Officers were then elected :—

President.—Rev. C. J. S. Bethune, M.A., Port Hope.
Vice-President.—R. V. Rogers, Kingston.
Secretary-Treasurer.—J. H. McMechan, London.
Council.—E. Baynes Reed, W. Saunders, Rev. G. M. Innes, J. M. Denton, London, G. J. Bowles, Montreal.
Editor of Entomologist—W. Saunders.
Editing Committee.—Rev. C. J. S. Bethune, M.A., E. Baynes Reed, J. G. Bowles.
Library Committee.—W. Saunders, E. Baynes Reed, J. H. McMechan.
Auditors.—Chas. Chapman and J. H. Griffiths, London.

FINANCIAL STATEMENT OF THE SECRETARY-TREASURER.

Receipts.

To Balance from previous year	$177 62
" Government Grant additional for 1873	500 00
" " " " " 1874	750 00
" Members' fees	137 52
" Sales cork, pins, labels, &c	195 02
	1760 16

Disbursements.

By Canadian Entomologist, printing	518 75
" Pins, cork, &c	91 02
" Engravings	118 10

By Library	$58	95
" Editor's salary for 1872	100	00
" " " " 1874	100	00
" Secretary's salary for 1873	50	00
" " " " 1874	50	00
" Expenses, sundry small	120	18
" Rent	80	00
" Expenses of Report	51	00
" Balance, cash in bank	422	16
	1760	16

We certify the above as a correct statement of accounts for the year ending September 23, 1874, as shown by Treasurer's books and with vouchers for the same.

J. H. Griffiths, } *Auditors.*
Chas. Chapman, }

REPORT OF THE COUNCIL.

It is gratifying, at the expiration of this the fourth year of the existence of our Society, to be able to report its continued well-being and progress, and to know that its efforts are being more and more recognized as an aid to those agricultural interests which constitute the chief source of the wealth of our Province.

The *Entomologist* is still regularly published, and has now nearly reached the close of its sixth volume. By its regular issue there has been placed before our members much useful and practical information relating to many of the commoner insect pests, with instructions as to the use of the best remedies to check their ravages. Besides this it has formed, and still forms, a valuable medium for the publication of such scientific matter in relation to the life history of our insects, which, while of immediate interest to only a limited number of our readers, is of great importance to those engaged in the study of the science of Entomology. We feel that our journal has done and is still doing a good work in this respect; and it is pleasing to know that our efforts in this direction are warmly appreciated by scientific men in the adjoining Republic and in Europe, as well as in our own country.

As mentioned in the Report of the last Annual Meeting, a cordial invitation was extended by the "American Association for the Advancement of Science," at the meeting held in Portland, in 1873, to the members of our Society to be present at the meeting in 1874, in Hartford. A deputation was appointed by your Council to attend this meeting on behalf of our Society, in reference to which the following report appeared in the September number of the *Entomologist*:—

THE AMERICAN ASSOCIATION.

At the recent gathering of this scientific body in Hartford, Conn., there were brought together an unusual number of Entomologists. This was owing partly, no doubt, to the kind invitation extended by the Association to the American and Canadian Entomological Societies to appoint special meetings of their members to be held at that time and place, with the view of having these important societies fully represented. In response to this invitation, a number of members of the American Entomological Society were present, while our Canadian Entomologists were represented by the worthy President of our Society, Rev. C. J. S. Bethune, M.A., and the Editor of the *Entomologist*. Several evenings were occupied by these "brethren of the net" in interesting and profitable discussions on the habits and peculiarities of various insects, the time passing so pleasantly that the midnight hours were reached ere separation could be effected. After mature deliberation it was resolved to organize under the name of "The Entomological Club of the A. A. A. S.," and the following constitution was adopted: —

TITLE.

I. The name of the association shall be "The Entomological Club of the American Association for the Advancement of Science."

OBJECTS.

II. The annual re-union of the Entomologists of America, the advancement of entomology, and the consideration of all general questions relating to the science that may from time to time arise.

MEMBERSHIP.

III. All members of the American Association for the Advancement of Science who are interested in entomology, shall *ipso facto* be members of the club.

OFFICERS.

IV. The officers of the club shall be a President, a Vice-President, and a Secretary, to be elected annually by vote of the members.

DUTIES OF THE OFFICERS.

V. The President, or in his absence the Vice-President, shall preside at all meetings; the Secretary shall perform all the usual duties of a recording and corresponding Secretary.

MEETINGS.

VI. A meeting shall be held in each year at the place of meeting appointed by the American Association for the advancement of Science; it shall commence at 2.30 p.m., on the day before the meeting of the American Association for the advancement of Science, and be continued throughout that evening; further meetings may be held as time will permit during the week following.

The following resolutions were also unanimously passed:

Resolved, That the members of the American Entomological Society and the Entomological Society of Ontario, together with all other persons interested in entomological science, be cordially invited to attend and take part in the proceedings.

Resolved, That the Secretary be requested to publish notices of the meeting in such periodicals devoted to natural history, and especially in those devoted to entomology as are published on the continent; and further that the members be requested to bring with them at the annual re-unions specimens for exchange and exhibition, and especially types of species that they may have described during the year.

At a subsequent meeting of the Club, the following officers were elected: President, Dr. John L. Leconte, Philadelphia, Pa.; Vice President, Samuel H. Scudder, Cambridge, Mass.; Secretary, Chas. V. Riley, St. Louis, Mo. We feel sure that under such able direction, the Entomological Club of the A. A. A. S. will prosper, and be the means of stimulating many to increased effort, and thus greatly advance the interests of our favourite study.

As it may interest many to know who were present at these meetings, we furnish the following list: Dr. John L. LeConte, Philadelphia, Pa.; Dr. J. G. Morris, Baltimore, Md.; Prof. S. S. Haldeman, Chickis, Pa.; Dr. H. A. Hagen, Cambridge, Mass.; S. H. Scudder, Cambridge, Mass.; A. R. Grote, Buffalo, N. Y.; Dr. G. M. Levette, Indianapolis, Ind.; C. V. Riley, St. Louis, Mo.; O. S. Westcott, Chicago, Ill.; J. A. Lintner, Albany, N. Y.; H. F. Bassett, Waterbury, Conn.; George Dimmock, Springfield, Mass.; B. Pickman Mann, Cambridge, Mass.; E. P. Austin, Cambridge, Mass.; Dr. R. King, Kalamazoo, Mich.; Chas. P. Dodge, Washington, D. C.; Mr. Patton, Waterbury, Conn.; Rev. C. J. S. Bethune, M.A., Port Hope, Ont.; W. Saunders, London, Ont. During the meetings of the Association several interesting and valuable papers on Entomological subjects were read by Dr. LeConte and Messrs. Scudder, Riley and Grote.

The branches of our Society organized at London, Montreal and Kingston, continue to thrive, and by their frequent meetings and social intercourse stimulate the members resident in these cities to greater application in the service of entomology. We trust that such of our members as can, will aid the editor of the ENTOMOLOGIST by sending him from time to time, memoranda of their observations, on the habits and life history of our insects with any other notes they may deem of interest to the lovers of our favourite science.

Submitted on behalf of the Council by
J. H. McMECHAN,
Secretary-Treasurer.

ANNUAL MEETING OF THE LONDON BRANCH.

The annual meeting of the London Branch of the Entomological Society of Ontario was held at the residence of Mr. W. Saunders, on the 17th of February.

A goodly number of members were present, and the following officers were elected for 1874: President, A. Puddicombe; Vice-President, H. P. Bock; Secretary-Treasurer, J. G. Geddes; Curator, J. Williams; Auditors Messrs. C. Chapman and J. Griffiths.

A box of Lepidoptera from Miss Carey, of Amherstburg, was shown by Mr E. B. Reed, containing some interesting specimens taken in that locality; among others there were fine examples of *Papilio thoas* and *Philampelus satellitia.*

W. Saunders exhibited a box of Coleoptera, embracing a large number of species kindly donated by Theodore L. Mead, Esq., of New York. Also, several boxes of European insects, presented by Francis Walker, Esq., of the British Museum. The Secretary was instructed to tender to Mr. Walker the sincere thanks of the Society for his continued liberality in this matter—the cabinets of the Society and those of the members also having been repeatedly enriched with valuable specimens through his kindness.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The first annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 6th, 1874, when the following officers were elected for the ensuing year:

W. Couper, President; G. J. Bowles, Vice-President; F. B. Caulfield, Secretary-Treasurer; G. B. Pearson, Curator; Council—W. Hibbins, sen., C. W. Pearson, P. Knetzing.

The reports of the Council and Secretary Treasurer were read, and, on motion, adopted. The Branch, although young, is in a prosperous condition, the expenses of the past year having been met, leaving a small balance on hand, and the list of members is gradually increasing. Owing to the lateness of the season but little field work has been done, but some rare captures have been made already. The Branch meets as usual at the residence of the President, No. 67, Bonaventure Street, Montreal, P. Q. All business communications to be addressed to the Secretary-Treasurer, F. B. Caulfield, 254, St. Martin Street, Montreal, P. Q.

FIRST ANNUAL REPORT OF THE COUNCIL OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

During the summer of 1873 a fortunate circumstance occurred to which this Branch owes its origin. The following gentlemen, viz., Wm. Couper, F. B. Caulfield, Wm. Hibbins, C. W. Pearson and G. B. Pearson, met by chance on the Montreal Mountain, where the subject was discussed, and it was then decided to hold a meeting at the residence of Mr. Caulfield, in order to make further arrangements for its formation. This meeting was held on the 30th of August, when it was resolved to form a branch in connection with the Entomological Society of Ontario, and the Secretary *pro. tem.* was instructed to write to the parent society, asking permission to form a Branch Society in this city. This proposition was at once accepted by the parent Society.

On the 16th of October the following officers were elected for the ensuing year:—William Couper, President; M. Kollmar, Vice-President; F. B. Caulfield, Secretary-Treasurer; Council—G. J. Bowles, P. Knetzing and C. W. Pearson; Curator, William Hibbins.

By-Laws were framed for the guidance of the Branch, which were approved by the parent Society. Our monthly meetings have been regularly held and well attended, and your Council congratulate the Society on benefits derived. During the eight meetings which have been held, independent of the production of original communications on Entomology, there were remarkably good exhibitions of insects, which also tended to give additional information to members.

The first meeting of the Branch in August, 1873, consisted of seven members, and since then five additional members have been elected.

The following papers were read during the winter months:—

"A Dissertation on Northern Butterflies," by William Couper; "On the Cicindelidæ Occurring on the Island of Montreal," by F. B. Caulfield; "On Some of the Benefits Derived from Insects," by F. B. Caulfield.

The following works have been donated during the year:—

"On Some Remarkable Forms of Animal Life from the Great Deeps of the Norwegian Coast," by G. O. Sars, 1 Vol.; "On Norwegian Crustaceans," by G. O. Sars, 2 Vol.; "Synopsis of the Acrididæ of North America," by Cyrus Thomas, 1 Vol.

Your Council would suggest that the Curator procure store boxes for the preservation of the specimens obtained for the Society during the approaching season. In this way the nucleus of a collection can be formed prior to the purchase of a cabinet, which your Council trusts the Society will be possessed of before next winter.

Your Council would also suggest that members carry note-books wherein to record Entomological observations, especially relative to insects injurious to the crops; also, of such species as are considered beneficial in checking the progress of destructive insects. As this is one of the principal objects of the Society, field notes of this nature are always valuable, and should form subjects of investigation and discussion at our meetings. Attention should be given to the larval forms of insects, as this is a specialty of Entomology from which much knowledge is yet to be obtained.

Your Council strongly impress on the members to use their influence in promoting a knowledge of the importance of the study of Entomology, more especially with Agriculturists and horticulturists, in order to enable them to check the ravages of the numerous insects injurious to vegetation

All of which is respectfully submitted.

C. W. Pearson,
Geo. Jno. Bowles.

Wm. Couper, Chairman.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1874.

To the Members of the Entomological Society of Ontario:—

Gentlemen,—I beg to offer you again, after the lapse of a year, my hearty congratulations upon the continued prosperity of our Society. As you have already learnt from the Report of our Secretary-Treasurer, we have been favoured with a slight increase in our list of membership—as large, indeed, as can fairly be expected in a Society which confines itself to the study of a particular branch of Natural Science, and which cannot therefore attract into its ranks many who are not specially engaged, to some extent at least, in this limited field of investigation.

It is especially pleasing to find that our number of branches continues to increase—a highly successful one, with its headquarters in Montreal, having been organized since our last annual meeting. Its first annual report has been already presented to us in the pages of our journal.

The Canadian Entomologist, upon whose success the well-being and fair fame of our Society so largely depends, has—I am sure you will agree with me—been more ably sustained than ever before. The thanks of the whole Society are assuredly due to the energetic and talented Editor, Mr. Saunders, who has been, indeed, its mainstay from the issue of its first number till now. It would be well if all our members would aid him, not only by contributions, but also by increasing the circulation, and thereby improving the means of support of the publication.

When I applied just now the term "limited" to our field of enquiry, I only did so when considering Entomology as one amongst a large number of sections of the great circle of natural sciences, which includes within its area the study of all things material which come within the range of man's intellectual powers. · If we look, however, at Entomology and its objects alone, we cannot fail to see at once that it is practically without limit—that there is work enough for thousands of investigators for almost innumerable generations to come. And when we couple with Entomology other kindred sciences, such as Botany, Geology and Physical Geography, which are so closely allied that no student can safely overlook them, we begin almost to be overwhelmed with the vast extent of this field of knowledge that we seek to explore. So vast, indeed, is the field that no one now ventures to survey the whole of it, except in a very general way; each explorer finds himself compelled—if he would do any effective work—to confine his labour to some one or two of its sections or subsections. By this division of labour, all departments of the Science will by degrees be taken up, and much that is now a '*terra incognita*' will become familiar to the patient explorer.

In our own country—within the bounds of this great Dominion—there is need of many more students and explorers. Even in this Province of Ontario, the headquarters of our Society, where more has been done than in any other part of Canada, there is yet room for a great increase to our band of collectors and investigators. How incomplete, for instance, is even yet our list of Diurnal Lepidoptera, and how many pages are still blank in the life history of some of our commonest butterflies? Our able Editor, my excellent friend, Mr. Saunders, has done much to fill up these blank pages, and his work is everywhere recognized as thorough and authoritative; but yet there remains much more to be done, that we hope our members will before long accomplish. If we turn to Crepuscular and Nocturnal Lepidoptera, we must feel almost appalled at the extent of our ignorance. For those who have the time and the ability, I can think of no more interesting or attractive field of enquiry—none that will sooner or better repay the pains-taking student, whether he looks for fame or pleasure, whether he sighs for fresh fields to conquer, or desires to set his foot where man has not trodden before. In a department where so much remains to be done, we all, I am sure, offer a most cordial welcome to one who has recently cast in his lot among us, and has traversed the broad Atlantic in order to study the Noctuidæ of this country. I allude to Mr. George Norman, of St Catharines, late of Forres, in Scotland.

In another order of insects, the Coleoptera, much, no doubt, has been accomplished. Through the pains-taking labours of a Billings and a Pettit, not to mention other good workers, and by the aid of the great authorities in the neighbouring States, Dr. Leconte and Dr. Horn in particular, we have been able to increase our list of Canadian beetles from a few hundreds at the birth of the Society, to more than as many thousands now. But still how very much more remains to be done? What a field of labour there is before both student and collector in the Carabidæ, the Staphylinidæ, the Curculionidæ and other numerous families of beetles! May we not hope that during the coming winter our present scattered stores of knowledge will be utilized and made available for the good of all, by the compilation and publication of a large addition to our old and valuable list of Canadian Coleoptera?

If there remains so much to be done in these two favourite orders, what shall I say of the remainder, that are so generally neglected? It is surely time that some of our members should devote themselves to the working up of such interesting orders as the Neuroptera, the Hymenoptera, the Orthoptera, the Hemiptera, even if no one can be found at present to take up the study of the more difficult Diptera.

In all these orders there is the nucleus of a collection in the cabinets of our Society, while no doubt much additional material would be furnished by individuals to any member who will take up in earnest the study of any one of them. It would be a great contribution to our knowledge of Canadian insects if there could be published by the Society carefully prepared lists of as many species as possible in each of these orders. Such lists would, of course, be very incomplete at first, but they could easily be so arranged in publication that additions might be made to them at any time, as our stores of knowledge increase.

Such, gentlemen, are some of the modes in which, I think, we should endeavour to extend the operations of our Society. If each year, when we assemble together for our annual meeting, we can point to some such work done in the previous twelvemonth, we shall have good reason to congratulate ourselves upon real permanent progress—upon building up the foundation of an Entomological structure that will prove enduring and substantial in time to come.

Thus far I have referred to Entomology as a purely scientific pursuit; there is another aspect in which we cannot refrain from regarding it, viz., as a subject of very great economic importance to every inhabitant of our land. This view of Entomology has been especially brought before us of late by the havoc that has been produced in our farms and gardens by hordes of destructive insects.

The dreaded Colorado Potato Beetle (*Doryphora decem-lineata*) has spread eastward with great rapidity, and has now reached the Atlantic coast in some parts of the United States. I have been informed by friends who reside in various parts of the Union, that while little, if any, diminution in the numbers of the pest is to be observed in the west, it is becoming very destructive where it has attained to its second year of colonization. During the first year of its invasion of a particular locality, no appreciable damage is done by it, but as its armies increase in geometrical progression, the potato crops of the following season generally suffer to a terrible extent. It has now covered the whole of the Province of Ontario, and is very destructive throughout the western half of it, though we are happy to say that our intelligent farmers and gardeners are effectually using the remedies suggested by our colleagues, Messrs. Saunders and Reed, in their Report to the Legislature a few years ago. In Quebec it is but beginning to be observed; no doubt it will be found there in myriads next year. Across the border, it has penetrated to the western portion of Vermont, into New Jersey, down to the sea coast in Pennsylvania, and in Maryland; at Baltimore, Md., it is very abundant, while straggling outposts have been found as far south as Washington. The whole of New York and Ohio have been pretty well covered with the insect, while in Missouri it is as abundant as ever. In Indiana and Michigan there is a local diminution in the numbers of the pest, but no where are there as yet any signs of its cessation. The people of Europe are now beginning —and with good reason—to feel alarmed at the prospect of its crossing the Atlantic. The English and French scientific and agricultural publications are commencing to publish notices of the insect and to talk of restrictive measures, while in Germany, we are told that stringent regulations will probably soon be put in force by the Government to prevent the invasion of the country. Unless some regulations of this kind are put in general force throughout the whole of Western Europe, I believe that—judging from the spread of noxious European insects on this side of the Atlantic—the Colorado Beetle will soon become there as familiar an object and as destructive a pest as it is here.

While the Colorado Beetle from the Rocky Mountains has been overspreading the whole northern continent eastward, there has been moving southward and westward in a similar manner another insect—the Cabbage Butterfly (*Pieris rapæ*)—that is almost as injurious as the other. This insect, an European importation, as of course you all know, starting from Quebec some few years ago—there first noticed by our friends Messrs. Couper and Bowles has now spread westward over almost the whole of Ontario. At Port Hope it has been this year by far the most common of all butterflies; thousands were to be seen throughout the whole season, from early summer to the present time, flitting about along every road, and hundreds hovering over or alighting in every garden. There is hardly a cabbage or cauliflower fit to be eaten anywhere in the neighbourhood, while stocks and mignonette have been ruthlessly demolished in all the flower gardens. Its spread westward, however, has hardly been as rapid as its movements to the south. The two maritime provinces of New Brunswick and Nova Scotia, and all the New England States, have for some time been occupied, and now I am told that this year it is most plentiful as far south as Washington, and that it is by no means rare in Virginia.

While referring to the wonderful spread of noxious insects during the past few years, and to their excessive prevalence now, I must not omit to mention the affliction caused to our north-west Province of Manitoba and to many of the western States by the swarms of locusts, or grasshoppers as they are termed (*Caloptenus spretus*). The accounts of the sufferings caused by this terrible plague are perfectly appalling, and rival anything that we have read of the ravages of the Eastern locusts. Happily for us they do not seem to extend much further to the east than the Missouri River, though, occasionally they penetrate to some of the broad prairies beyond. As a detailed account of this insect will probably be afforded you in the forthcoming Annual Report of our Society, I need not detain you with any further remarks upon it.

The only other insect to which I need now call your attention for a moment, is the Grape Vine *Phylloxera.* I am glad to learn that its ravages in the vineyards to the south of us have been comparatively trifling this year, and that in all probability the summer droughts to which we are so liable, will prevent its ever being as formidable a foe as it was at one time apprehended.

To turn from this not very cheerful subject, I may mention, before concluding, that Mr. Saunders and myself duly attended the recent meeting at Hartford, Conn., of the American Association for the Advancement of Science. There we had the pleasure of meeting a large number of Entomologists from all parts of the United States, and we had the further gratification also, of being presided over, in general session, by the ablest of American Entomologists, Dr. Leconte, and in the Zoological Section, by another great worker in our department, Mr. S. H. Scudder. Informal meetings of Entomologists were frequently held, and finally it was agreed upon to form an Entomological Club of members of the A.A.A.S., who should assemble annually a day before the meeting of the Association in the place that may be from time to time selected for its sessions. In this way we trust that much may be done for the furtherance of our favourite branch of science, and that Entomologists generally, from all parts of the continent, will bring together their types of new species and the surplus of their collections for mutual information and benefit.

Without further trespassing upon your time and attention, I beg to thank you, gentlemen, for the kind consideration you have shown to my colleagues and myself during our term of office, and with hearty wishes for the continued prosperity of our Society,

I have the honour to be, gentlemen,

Your obedient servant,

CHARLES J. S. BETHUNE,
President E. S. of O.

Trinity College School,
Port Hope, September 22nd, 1874.

INTRODUCTORY.

Once again at the close of another year, a few of the members of the Entomological Society of Ontario have undertaken the task of endeavouring to lay before the public, some information respecting the habits and lives of the insect world, and more especially those members of it which have a direct or indirect influence upon the growth or well-being of the produce of field or forest.

It is a satisfaction to know that these annual reports are read and appreciated, and that many of our practical Fruit-Growers and Agriculturists are desirous of obtaining some knowledge of the transformations of the various and beautiful members of the insect world, of those beautiful atoms of God's creation, each in its appointed sphere fulfilling the purpose for which it was created, drawing forth our wonder, our admiration and our praise; for "He who wondereth at nothing hath no capabilities of bliss, but he that scrutinizeth trifles hath a store of pleasure to his hand, and happy and wise is the man to whose mind a trifle existeth not."

> "He prayeth best who loveth best
> All things both great and small,
> For the dear God that loveth us,
> He made and loveth all."

ENTOMOLOGICAL CONTRIBUTIONS.

By E. B. Reed, London, Ont.

1. The Io Moth (*Saturnia Io*).
2. The Flat-headed Apple-tree Borer (*Chrysobothris femorata*).
3. The Locust Tree Borer (*Clytus pictus*).

1. The Io Moth *Saturnia* (*Hyperchiria*) *Io.* [Fabr].

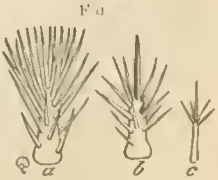
Order, Lepidoptera; Family, Bombycidæ.

This lovely moth is well worthy a place in the cabinet of the collector, and from its brilliant colouring and conspicuous markings is always sure to attract notice and admiration.

The moth belongs to a family which has received the name of "Bombyces" from *Bombyx* the ancient name of the silk worm. As, however, it is in the larval or Caterpillar state that this insect more frequently meets our eye, we will begin by a description of it in that stage. The full grown larva of which, fig. 1 is an admirable representation, is of a most delicate apple or pea-green colour with a broad dusky white stripe at each side bordered with lilac on the lower edge. The body is covered with spreading clusters of green bristles tipped with black. These bristles are exceedingly sharp, and when the insect is handled will produce a very irritating sting similar to but much sharper than that of the nettle, and the effect of which causes a reddening of the flesh and the immediate appearance of raised white blotches which last for a considerable time. Fig. No. 2 shews the appearance of these bristles, some of them as *b.* being stouter and more acute than the others and able to inflict a sharper and more penetrating sting. This stinging property is very curious and is not very easily explained; Mr. C. V. Riley writing of a very similar insect, the *Saturnia Maia*, says, "that the sting is caused by the prick of the spines, and not by their getting broken in the flesh. From the fact that the spines appear hollow, one would naturally attribute their irritating power to some poisonous fluid which they eject into the puncture. But I have been unable to resolve any apical aperture, nor was Mr. Lintner more successful. Hence I infer that the irritating property belongs to the substance of which the spines are formed, and this opinion is strengthened by the fact that those of a dead larva, or of a cast-off skin which has been in my cabinet for several years, still retain the irritating power, though so brittle that it is not easy to insert them."

Fig. 1.

Fig. 2.



In the earlier stages the caterpillars are gregarious, feeding together side by side and in going to and returning from their place of shelter, moving in regular files after the manner of the processionary caterpillars of Europe (*Cnecocampa processionea*). This marching habit is so very peculiar that it is well worth describing. Though the insects move without beat of drum they maintain as much regularity in their steps as a file of soldiers. The celebrated naturalist Reaumur, writing of the European Procession Moth says, "I kept some for a little time in my house in the country, I brought an oak branch which was covered with them into my study, where I could much better follow the order and regularity of their march than I could have done in the woods. I was very much amused and pleased at watching them for many days. I hung the branch on which I had brought them against one of my window shutters. When the leaves were dried up, when they had become too hard for the jaws of the caterpillars, they tried to go and seek better food elsewhere. One set himself in motion, a second followed at his tail, a third followed this one, and so one. They began to defile and march up the shutter, but being so near to each other that the head of the second touched the tail of the first. The single file was throughout continuous; it formed a perfect string of caterpillars of about two feet in length, after which the line was doubled. Then two caterpillars marched abreast, but as near the one which preceded them, as those who were marching in single file were to each other. After a few rows of our processionists who were two abreast, came the rows of three abreast; after a few of these came those who were four abreast; then there were those of five, others of six, others of seven and others of eight caterpillars. This troop so well marshalled was led by the first. Did it halt, all the others halted; did it begin again to march, all the others set themselves in motion and followed it with the greatest precision. That which went on in my study goes on every day in the woods where these caterpillars live. When it is near sunset you may see coming out of any of their nests by the opening which is at its top, which would hardly afford space for two to come out abreast, one caterpillar, as soon as it has emerged from the nest, it is followed by many others in single file; when it has got about two feet from the nest, it makes a pause during which those who are still in the nest continue to come out; they fall into their ranks, the battalion is formed; at last the leader sets off marching again, and all the others follow him. That which goes on in this nest passes in all the neighbouring nests; all are evacuated at the same time."

According to "Harris," the caterpillars of the Io Moth do not spin a common web, but when not eating they creep under a leaf where they cluster side by side. When about half grown the caterpillars disperse, each seeking a location for itself. They moult five times, the larvae devouring their cast off spinous skins. After being in the larval state about eight weeks, they arrive at maturity, and are then about two and a half inches long, and present the appearance of Fig. No. 1.

Their food plants are very numerous. They have been found on Black Locust, Indian Corn, Willows, Sassafrass, Wild Cherry, Elm, Hop Vine, Balsam, Balm of Gilead, Dogwood, Choke Cherry, Currant, Cotton and Clover. I this year found two larvæ on the English Filbert, and bred them to maturity on that plant. I have, however, more commonly found them on the Choke Cherry. The larvæ when full grown ceases eating, and crawls to the ground, where, amongst the loose leaves and rubbish, it forms a rough outer covering, within which it makes a slight cocoon of tough, gummy, brown silk. In this retreat a transformation is soon effected to the pupal or chrysalis state, from which, having remained therein during the winter and spring months, the moth emerges in the perfect winged condition about the month of June.

The moths are remarkable for the difference between the sexes both in size and colour.

Fig. 3.

The male (Fig. 3), which is much the smallest, is of a deep Indian or maize yellow colour.

On the forewings are two oblique, wavy lines near the hind margin and a zig-zag line near the base. There is also a large, dark, reddish, central reniform spot or blotch; this is very marked in all the Canadian specimens I have seen, although in the cut, which is drawn by Mr. Riley, probably from a specimen taken in the Western States, the spot is not so distinct. The hind wings are broadly shaded with purple next to the body; near the hinder margin is a curved purplish band, and within this again is a smaller one of a dark purple or violet colour. In the centre of this last band and the middle of the wing is a large round blue spot, with a whitish centre and a broad border, almost black. It is from these prominent eye-spots that the moth derives its name, in allusion to the classical Grecian fable of the beautiful Io who, having incurred the displeasure of the jealous Juno, was placed by her under the watchful vigilance of the hundred-eyed Argus.

The under side of the wings is of the same deep yellow—the forewings having the inner margin broadly shaded with purple and shewing the reniform eyed spot very distinctly; the hinder wings are more uniform in colour, with a transverse purple line, and a very small distinct white spot representing the centre of the large spot on the upper side. The body is also deep yellow—somewhat darker on the thorax. The antennæ, as usual in the males of the bombyces, are beautifully pectinated, presenting a double comb like appearance The male varies slightly in size, from two and a half to two and three-quarter inches in width.

Fig. 4.

The female (Fig. No. 4) is considerably larger, ranging from three to three and a half inches. The specimens vary much in colour, from a dark purplish brown to a warm ochreous red The fore wings have similar wavy zig-zag lines, the reniform blotch being less distinct than that in the male; the inner margin is of a deeper colour, and with the head and thorax is thickly coated with a short wooly, pilose covering. The hind wings are marked in a similar manner to those of the male. The undersides of the wings have the same uniform colour, and are marked much like those of the male.

The body is ochreous yellow, a little lighter above, and each segment is bordered with a narrow, reddish band.

"The moths have a fashion of sitting with their wings closed, and covering the body like a low roof. the front edge of the underwings extending a little beyond that of the upper wings and curving upwards."

The eggs are deposited on the under side of the leaf, and are described by Mr. Riley as being compressed on both sides and flattened at the apex, the attached end smallest. Their colour is cream white with a small black spot on the apical end and a larger orange one on the sides. A cluster found on Sassafrass by a western lady contained about thirty eggs. The moths are nocturnal, flying only by night.

The Flat-Headed Apple-Tree Borer.

Chrysobothris femorata, (Fabr).

Order, Coleoptera; Family, Buprestidæ

Among apple-growers there has been during the past year or two a great complaint of some borer infesting their trees, and investigation has shown that it is to this little beetle that the injuries may be traced.

Fig. 5.

Although insignificant in size, yet its larva is capable of doing immense mischief in our orchards. The beetle belongs to a family of insects which is especially remarkable for their rich and varied colouring, many having most brilliant tints. The one we are describing, fig. 5, is of a greenish brassy black colour above, the under side having a bright coppery hue. It is about half an inch in length It is of an oblong oval shape, blunt round head, and tapering towards the tail. It flies by day and is very swift on the wing. It may often be seen during the summer months running up and down the trunk and limbs of trees or resting itself, basking in the sunshine.

The larva, fig. 6., is a pale yellow, footless grub, its anterior end being enormously enlarged, round and flattened. Dr. Fitch worked up the history of this little pest some years ago. According to his account "the parent beetle deposits its egg on the bark from which a worm hatches and passes through the bark, and during the earlier stages of its life, consumes the soft sap wood immediately under the bark. But when the worm

Fig. 6.

approaches maturity and has become stronger and more robust, it gnaws into the more solid heart-wood, forming a flattish and not a cylindrical hole such as is formed by most other borers, the burrow which it excavates being twice as broad as it is high, the height measuring the tenth of an inch or slightly over. Within this hole the larva may be almost always found with its tail curled round completely towards the head, in a manner peculiar to the larvæ of beetles belonging to the family *Buprestidæ*. It remains in the tree about a year. It is in the latter end of the summer, that the larva penetrates into the hardwood of the tree; its burrow extending upwards from the spot under the bark where it had previously entered. On laying open one of the burrows Dr. Fitch found it more than an inch in length, and all its lower part filled and blocked up with the fine sawdust like castings of the larva. With regard to remedies, Dr. Fitch advises three: "First, coating or impregnating the bark with some subtance, repulsive to the insect. Second, destroying the beetle by hand-picking; and Third, destroying the larva by cutting into and extracting it from its burrow."

His advice is so plain and comprehensive than I cannot do better than quote it at length. "As it is during the month of June and forepart of July that the beetle frequents the trees for the purpose of depositing its eggs in the bark, it is probable that whitewashing the trunk and large limbs, or rubbing them over with soft soap early in June, will secure them from molestation from this enemy. And in districts where this borer is known to infest the apple trees the trees should be repeatedly inspected during this part of the year, and any of these beetles, that are found upon them should be captured and destroyed. It is at mid-day of warm sunshiny days that the search for them will be most successful, as they are then most active, and shew themselves abroad. The larvæ, when young, appear to have the same habit with most other borers, of keeping their burrow clean by throwing their castings out of it through a small orifice in the bark. They can therefore be discovered, probably, by the new, sawdust like powder, which will be found adhering to the outer surface of the bark. In August or September, whilst the worms are yet young, and before they have penetrated the heart-wood, the trees should be carefully examined for these worms. Whenever, from any particles of the sawdust like powder appearing externally upon the bark, one of these worms is suspected, it will be easy, at least in young trees, where the bark is thin and smooth, to ascertain by puncturing it with a stiff pin, whether there is any hollow cavity beneath, and if one is discovered, the bark should be cut away with a knife until the worm is found and destroyed. After it has penetrated the solid wood, it ceases to eject its castings and consequently, we are then left without any clue by which to discover it. Hence the importance of searching for it seasonably."

The natural food of this insect is believed to be the white oak, but it is found also on many other trees, such as apple, peach and plum, and, according to Mr. C. V. Riley has most seriously affected the soft maples in the valley of the Mississippi. The beetle when caught contracts all its limbs and feigns death.

The Locust-Tree Borer. [*Clytus Pictus.*—Fabr.]

Order, Coleoptera; Family, Cerambycidæ.

This active little beetle belongs to the same family as the *Clytus Speciosus*, of Say, whose attacks on the maple tree I described in my report for 1872.

This is a very common insect, and a most fatal obstacle to the cultivation of the locust tree in Ontario.

In 1866, at the meeting of the Entomological Society of Canada, Prof. Croft, of Toronto, drew the attention of the members to the ravages during the past summer, of this beetle, and stated that many of the acacia trees of Toronto and the vicinity, had fallen victims to the larvæ. Since that date the writer has watched with interest the steady westward progress of this destructive pest. Indeed, so rapid has been its spread, that there is hardly a locality in Ontario now, where it has not made its appearance, and we may almost give up any attempt to check its ravages, or to successfully procure the cultivation of the locust tree.

These beetles are so common now that they will be readily recognized without any engraving. They are from three quarters to half an inch in length. Colour, velvet black, with transverse lemon-yellow bands, of which there are three on the head, four on the thorax and six on the elytra or wing covers, making thirteen in all; the tips of the elytra are also edged with yellow. The third band on the body is very noticeable, as it forms a very distinct representation of the letter W. The thorax is very globular. The antennæ are dark brown. The underside of the body has the outer edges of the segments, bordered with yellow stripes. The legs are rust-red.

"In the month of September," writes Dr. Harris, "these beetles gather on the locust trees, where they may be seen glittering in the sunbeams, with their gorgeous livery of black velvet and gold, coursing up and down the trunks in pursuit of their mates, or to drive away their rivals, and stopping every now and then to salute those they meet with a rapid bowing of the shoulders, accompanied by a creaking sound, indicative of recognition or defiance. Having paired, the female, attended by her partner, creeps over the bark, searching the crevices with her antennæ, and dropping therein her snow-white eggs, in clusters of seven or eight together, and at intervals of five or six minutes, until her whole stock is safely stored. The eggs are soon hatched, and the grubs immediately burrow into the bark, devouring the soft inner substance that suffices for their nourishment till the approach of winter. During winter they remain at rest in a torpid state. In the spring they bore through the sap-wood, more or less deeply into the trunk, the general course of their winding and irregular passages being in an upward direction from the place of their entrance. For a time they cast their chips out of their holes as fast as they are made, but after a while the passage becomes clogged, and the burrow more or less filled with the coarse and fibrous fragments of wood, to get rid of which the grubs are often obliged to open new holes through the bark. The seat of their operations is known by the oozing of the sap, and the dropping of the sawdust from the holes. The bark around the part attacked begins to swell, and in a few years the trunks and limbs will become disfigured and weakened by large porous tumours caused by the efforts of the trees to repair the injuries they have suffered." The habits of this insect seem to have been known for a long time, for we find a description of them made in 1771, by Dr. J. R. Forster, and Dr. Fitch records that Petivera gave a figure and description of it in his "Gazophylacium," published in London in 1702.

The beetle is, undoubtedly, a native species, it never having been found in any other country. In remarking on their destructive powers, Dr. Fitch states, "that one of the principal thoroughfares leading east from the city of Utica was formerly planted on its south side with locust trees, these had become so large and ornamental as to render this one of the most admired avenues in the suburbs of that city. When some thirty (now 40), years since, these trees were invaded by this insect, to such an extent, that in the course of two or three seasons, they were totally ruined, many of them being killed outright, and the remainder having their limbs and branches so lopped off, that they could never recover from the deformity." Micheaux also reported that fifty years ago this insect had become so destructive, that many people in different parts of the States were discouraged from planting the locust.

In my own experience, three or four seasons have completely killed the largest trees, and about half that time for many of those of smaller size. The numbers and fecundity of the beetle are very great. I well remember in the early fall of 1873, on passing a small clump of locusts growing in St. Paul's Churchyard, London, Ont., my attention being arrested by the breaking off of a branch of considerable size from one of these trees, and my curiosity being excited, I made an examination, and found that the branch had been eaten almost through by the larvæ, and on looking up at the trunk of the tree, I counted over fifty beetles running up and down; that tree was completely killed that season. I had occasion to pass these trees going up and down to my office, and I am satisfied I must have killed fully one hundred that year, merely treading on them as I found them on the sidewalk beneath, or in the neighbourhood of these trees.

These beetles may often be found feeding on the pollen of the Golden Rod (*Solidago*). Dr. Fitch suggests, "as a feasible plan of checking the multiplication and destructiveness of these borers, to plant a small patch of the Golden Rod where locust trees are grown, that the beetles when they issue from the tree may resort to the flowers as is their habit. They can readily be found thereon, and captured and destroyed. It will be a pastime to the children of the household, whose sharp eyes qualify them well for this employment, to search their flowers."

The gathering should be begun as soon as the beetles begin to appear, and should be continued for several successive seasons ; if none of the Golden Rod can be conveniently grown. numbers of the beetles may still be caught while pairing on the trunk of the trees ; if too high to reach, a sharp rap against the tree will cause them to drop to the ground. when with a little activity they can be secured.

The grub remains in the tree about a year ; the beetle when handled, makes a peculiar sharp creaking noise.

NOTES OF THE PAST SEASON.

By W. Saunders.

The Currant Worm (*Nematus ventricosus*, Klug).

This troublesome pest has been in most localities as abundant as ever during the past summer. Whatever checks nature may have provided to prevent its excessive increase, they seem, as yet, to avail but little, for the larvæ continue to swarm in hundreds and thousands on currant and gooseberry bushes throughout the summer, demanding constant vigilance and liberal supplies of hellebore if the foliage is to be preserved.

For the benefit of those who may not possess copies of our previous reports we have introduced again figures of this insect with such additional notes on this species in its various stages as we have been able to gather during the summer.

Fig. 7.

Fig 7 shows the eggs as they are laid on the under side of the leaves. These eggs (described from specimens found on the 28th June) are when first laid about $\frac{34}{100}$ths of an inch long, nearly cylindrical, rounded at the ends, white, glossy and semi-transparent. Eggs found on the same bushes, the same day, but probably laid some days before, measured $\frac{44}{100}$ths of an inch in length with a corresponding increase in diameter. From this it is reasonable to infer that the eggs increase in size before hatching, the elastic membrane which forms their covering expanding with the development of the enclosed larvæ. The eggs, of which we have examined large numbers, we have never found embedded in the substance of the leaf (as some have stated they are) to any perceptible extent; careful examination under a powerful microscope has failed to reveal any abrasion of the surface after the egg has been forcibly removed.

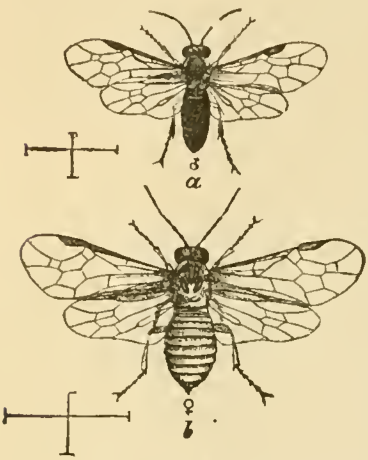
Fig. 8.

Fig. 8 represents the larvæ nearly full grown, and Fig. 9 the perfect insects, the smaller one being the male, the larger one the female.

On the 19th of June, on going into the garden about 7 A.M., we noticed these perfect insects flying about in scores in sunny spots, around and under gooseberry bushes; in about an hour afterwards when visiting the same spot for the purpose of capturing some, only one here and there could be found, and these had settled on the bushes. A male and female were captured and enclosed in a gauze bag, which was tied so as to enclose a small branch of a gooseberry bush with several leaves on it, all quite free from eggs. When examined in the evening of the same day, the female was seen laying her eggs; the next morning, on opening the bag, it was found that 48 eggs had been deposited during the interval, the female being still very active. On the

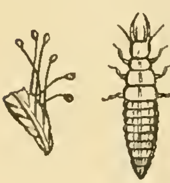
24th of June, this branch was examined again, when quite a number of the young larvæ were found just hatched from the eggs which had then only been laid between four and five days; many of the eggs, however, were found dried up, for which no cause could be discovered.

Fig. 9.



On the 30th of June, the larvæ of a lace wing fly *Chrysopa* was observed sucking the juices from the young larvæ of *N. ventricosus.* This friendly helper was a little more than a quarter of an inch long, and had placed itself in the midst of a colony of the young currant worms and had already consumed several before it was taken in the act, Fig. 10 *b* represents one of their larvæ about half-grown, the fly is shown in Fig. 11. The female lace wing fly lays her eggs on long slender stalks, fig. 10 *a*, placing quite a group of them together; they are very pretty objects. It is supposed that these long stalks serve the purpose of keeping the unhatched eggs at a safe distance from the young larvæ first hatched who would, otherwise, probably eat them up. The perfect insect deposits these eggs quite rapidly. On the 18th of June, when out collecting with some friends, one of them captured a lace wing fly and shut it up in a small box. In a few moments after, having occasion to look at it, he found one egg deposited; after walking a few yards with it to show it to us, which could not have occupied him more than three or four minutes, the box was opened again when it was found that three more eggs had been deposited, we had no opportunity of watching the further deposition or maturing of these eggs. The lace wing fly larvæ are very voracious, and if sufficiently numerous would prove formidable foes to the currant worm.

Fig. 10.



a b

From about the 12th of May to the end of the season, the currant worms were very abundant. The earlier broods seem to confine their operations almost entirely to the gooseberry bushes, but after two or three weeks they attack the currant bushes with equal vigour. On the 16th of June, we noted the fact that the full grown larvæ in great numbers, others half grown or more and young colonies of the newly hatched larvæ were all to be found at that date on the same bushes. About the last of July, many colonies of these newly hatched larvæ were found almost entirely destroyed by some undiscovered foe; probably some beneficial insect. Many leaves were found with the rows of empty egg shells on them and with a few holes eaten in them, but with the greater part of their substance uninjured, and with but little or no injury to the leaves surrounding; here evidently the greater portion of the larvæ had been destroyed soon after hatching.

Fig. 11.

On the 10th of July, while emptying out a number of the perfect flies from a box, searching for the empty pupa case of an ichneumon fly found dead in the box, two pupæ of ventricosus were found. They were very pretty objects, about one quarter of an inch long, of a very pale and delicate whitish green colour, becoming yellowish green at each extremity; remarkably transparent and delicate looking. The eyes were black and prominent; the feet, antennæ and mouth parts all separately cased, with the same glossy transparent covering almost crystal-like. The wing cases were similar in appearance, but of a little deeper green, bent under and reaching to the first abdominal segment. The pupa seems to be incapable of movement, a slight quivering only of the limbs could be detected under the microscope when pressed on. The feet all terminated in rounded knobs with no visible claws.

The Currant Measuring Worm *Ellopia* (*Abraxis*), *ribearia*, Fitch.

This insect has also been very abundant during the past summer. As early as the third week in May, the young larvæ were found quite common on red currant, gooseberry and black currant, and by the first of June many of them had grown to an inch in length; judging from the numbers infesting the bushes, they appeared to prefer the black currant to either the red or the gooseberry. By the 15th of the month they were well grown, and appeared as shown in fig. 12, (after Riley). They are then nearly an inch and a quarter long, of a whitish colour with a number of black spots on each ring or segment; a wide yellow stripe down the back, and another of the same character along each side, the latter somewhat broken. The underside is white with a slight tinge of pink, also spotted with black, and with a wide yellow stripe down the middle.

Fig. 12.

The length of the chrysalis see fig. 12, is about half an inch; it is of a dark reddish brown colour, paler between the segments, appearing under a magnifying glass roughened with minute punctures and irregularities of surface; the abdominal segments are dotted with round punctures of varying sizes, while the terminal one is armed with two short sharp brown spines. By the 2nd or 3rd of July, fresh specimens of the moth fig. 13, were on the wing becoming much more abundant about the 6th, when they were observed flying in almost every direction about the bushes. The moth when its wings are expanded measures an inch or more across; the wings are of a pale yellowish colour with several dusky spots, varying in size and form, and more distinct in some specimens than in others; sometimes these spots are so arranged as to form one or two irregular bands across the wings. About the middle of July, some of these active specimens were captured, and one of the females, confined in a box by itself, laid a large number of eggs, 140 in all, between the 22nd and 23rd of July. These were laid loose in the box excepting 24 of them which were slightly attached to the sides. The egg when viewed through a microscope is a very beautiful object; its length is nearly $\frac{3}{100}$ths of an inch, width nearly $\frac{2}{100}$ths; in form it is an elongated oval, rather blunt at each end. Colour dull yellowish grey, sometimes with a bluish tinge with the surface honeycombed with regular depressions, the ridges bordering each cell having several bright minute whitish dots, which give the egg a very pretty and brilliant appearance when brought under the strong light of the condenser of the microscope. At the present date, December 1st, these eggs are still unchanged, excepting slightly in colour, owing to the developing larvæ showing through the semi-transparent shell in spots, the larvæ in all probability will not emerge until early spring. As there is only one brood of this insect with us during the year, it is never likely to prove very troublsome; a seasonable application of hellebore will in any case keep it within bounds.

Fig. 13.

THE WHITE-MARKED TUSSOCK CATERPILLAR, *Orgyia leucostigma.*

The orgyia caterpillar is always common in our section of Ontario. The clusters of eggs from which the larvæ are produced are quite numerous in winter on our fruit trees especially those of the apple, pear and plum, they are securely fastened to the tree along with a dead leaf or two by threads of silk.

Fig. 14.

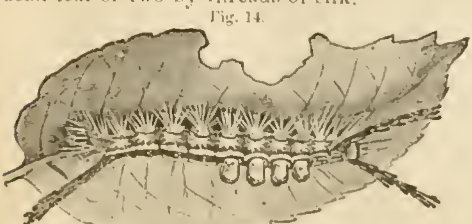
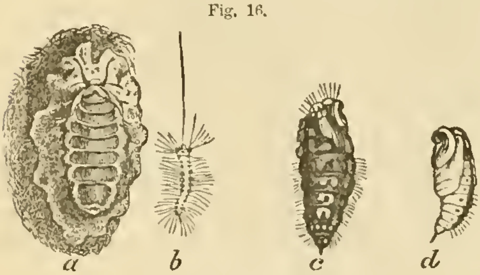


Fig 14, (after Riley), represents the full-grown caterpillar which, when about to change to a chrysalis, selects a leaf on which to undergo this important transformation, and this leaf in such a position that while the chrysalis is firmly attached to it on the one side, *it* is firmly secured by silken threads to the under side of a branch on the other, thus securing the leaf from falling to the ground in the Autumn. In about a fortnight after the change to chrysalis takes place, the moths begin to make their appearance. The male which comes forth from a chrysalis is not more than about half the size of that which produces the female, (*d* fig. 16 shows the chrysalis of the male, *c* that of the female), is a very pretty winged moth, see fig. 15, (after Riley). Its antennae are beautifully feathered or pectinate, and its wings are dark brown, with a white spot on each front wing near the inner hind angle. When at rest its outline is heart-shaped, and its long front feet heavily clothed with hairs and scales are thrust forward to their full length. Very different indeed in appearance is his mate; the female is wingless or furnished with but the merest rudiments of wings which no one would observe without the closest inspection, she is represented at fig 16 resting on the cocoon from which she rarely moves more than a few inches. There she waits the attendance of the male after which the process of egg depositing begins. Dr. Fitch says that the eggs are extruded in a continuous string which is folded and matted together so as to form an irregular mass which is glued to the top of the cocoon; on removing this mass of eggs from its place of attachment, the surface of the cocoon appears covered with fragments of a transparent gelatinous-looking substance, which has evidently been applied in a fluid state. The bottom layer of eggs will usually number one hundred or more, and their interstices are well filled with this same gelatinous material, which adheres so strongly to the eggs that when the nest is torn open, they cannot be separated without bringing away portions of this substance firmly attached. Another irregular layer of eggs is placed on this, then a third, and sometimes a fourth before the total number is exhausted, and through the whole of these the gelatinous matter is so placed as to secure every egg, not by its being imbedded in a solid mass, but surrounded by the material worked into a spongy or frothy state. Over all is a heavy layer of the same, with a nearly smooth greyish white surface, the whole number of eggs being so placed as to present a convex surface to the weather which effectually prevents the lodgment of any water on it.

Fig. 15.

Fig. 16.



Colours Yellow and Black.

Within this enclosure from 375 to 500 eggs are securely placed. We have counted the contents of several and 375 is the lowest and 500 the highest number we have found. The egg is nearly globular, flattened at the upper side, not perceptibly hollowed, with a dark point on the centre of the flattened portion surrounded by a dusky halo. Its surface is smooth under a magnifying power of 45 diameters, but when submitted to a higher power, appears lightly punctured with minute dots. Its colour is uniformly white to the unaided vision, but the microscope reveals a ring of dusky yellow surrounding it immediately below the flattened portion. Its diameter is $\frac{1}{35}$ of an inch.

A careless observer seeing a dead leaf here and there upon his trees might readily conceive that they were blown into the position they occupied by accident and retained there by threads of spiders' webs or something of that sort, but a closer examination will furnish food for thought, in the wise arrangements made by the parent moth, in providing for the safety of her future offspring, and at the same time may well excite alarm in the mind of the fruit grower when he perceives promise of the approaching birth of such a horde of hungry caterpillars as even one of these egg masses will produce.

Early in June these eggs begin to hatch and continue to hatch on different trees for several weeks. During the past season we found the larvæ about half an inch long on the 3rd of July, and by the 22nd, some specimens were nearly full grown. There must, however, have been earlier larvæ than these which escaped notice, for on the 29th of July we found a freshly hatched cluster of young larvæ belonging to the second brood. The cocoon had been made and the eggs laid between two young green leaves of a pear tree, the following description was taken the day after.

Length one eighth of an inch. Head, reddish brown slightly bilobed, dotted with black on the sides. Body above, yellowish green, semi-transparent, dotted and spotted with dark brown. Each segment or ring is provided with a transverse row of tubercles from which arise clusters of long spreading hairs. one pair of tubercles on the sides of the second segment much larger than any of the others and with a larger cluster of hairs; in each cluster there is one or more hairs. very long, longer in some instances than the entire body of the larva. there is a dark brown broken stripe along each side. Hairs mixed. brown and whitish. Changes take place in its appearance at each successive moult until finally it presents the appearance given in fig. 14. and is in adornment one of the most beautiful caterpillars we know of with its vermillion red head and collar. the graceful pencils of long black hairs at each extremity. and the cream coloured brushes or tufts along its back.

Nine different parasites have been found infesting this larvæ. These friendly helpers must do much towards keeping this destructive creature within reasonable limits. Of 34 cocoons lately taken at random from different trees, only ten were found with eggs attached and quite a large proportion of the remainder were infested with parasites. Hence when collecting these cocoons in winter none should be taken or destroyed. but those which have egg masses on them. as all the others will contain either useful parasites or else the empty, harmless male chrysalis. As the female never travels beyond her cocoon, it is clear that this insect can only spread by the wanderings of the caterpillar or the careless introduction of eggs on young trees, no doubt the latter has been the most prolific source of evil.

THE APPLE-TREE BLIGHT.

This strange disease, affecting the tips of the branches of apple and quince trees, has been very common during the past summer. and has extended over a large portion of the western part of Ontario. The first specimens we received this year were from Mr. James Dougall, of Windsor. He writes, on the 27th of June, as follows—"I send you to day, by express, some twigs and shoots of apple and quince trees. affected by what I presume is the twig borer. I have never been able to discover any insects or larvæ in the shoots. but possibly I may have been late in looking for them. The year before last this pest was very bad down the lake shore, about Ruthven, the orchards were browned with it. Last year it attacked my larger apple trees badly, and in the nursery rows some Alexander trees, which were five years old suffered, while the younger ones were not touched; this year it is worse than last. My quinces have been badly injured for the past three years."

On the same day we received another package from C. F. Treffry, of Hawtry, Ontario, with the following note—" I herewith enclose for your inspection some small branches from some of my apple trees. In passing through my orchard I was surprised to find three of my finest young trees affected as enclosed. I have watched closely for the insect which must have caused such damage, but without success; neither can I find anything in the Society's Report for 1873 which will give me any information respecting it."

This same disease affected the trees very much on the grounds of Mr. Charles Arnold, of Paris, and many orchards in that section of country were similarly injured. In our own location we observed it in one instance only, affecting a few fruit-bearing twigs on a quince tree. About Hamilton, and between that city and Dundas. we saw, in July, many trees which had been badly injured, and. on returning from New York, a few weeks later saw evidences of the same trouble in some of the apple orchards in the western portion of that state. Thus it will be seen that this disease has affected many trees in widely distant portions of our country, and probably has extended much further than we are at present aware of. We shall be glad to hear from our fruit-growing friends in reference to this matter.

The advent of this disease is shown by a sudden withering of the twigs and extremities of the branches, particularly the fruit bearing portions, and embracing the whole of the new growth. Soon the leaves appear as if scorched, and the wood of the affected portions becomes black. Here the trouble seems to end. and later in the season the tree partially recovers its vigour and throws out new shoots from below the base of the affected portion. The fact of the fruit branches being principally involved tells heavily on the crop for the year, and makes this disease a much more serious matter than it would otherwise be. The effects produced are so similar in appearance to the damage done, in some instances by the twig borers that we do not wonder at the prevailing opinion that the injury is in some way caused by insects. The most careful examination, however, fails to reveal the slightest evidence of insect work, and, like the mysterious pear tree blight, its origin and progress are at present involved in obscurity. From the fact of its affecting only the new and tender growth we should infer that some atmospheric agency is probably concerned in the production and propogation of this disease. At present we have no remedy to suggest.

ON SOME OF OUR COMMON INSECTS.

By W. Saunders.

The Cecropia Moth (*Attacus Cecropia*, Linn.)

Among the many beautiful and wonderful insects native to this country, there is none which excites yearly more wonder and astonishment than the cecropia moth. Its size is enormous, measuring when its wings are spread from five and a half to six and a half inches across, and sometimes even more while its beauty is proportionate to its size. The accompanying figure 17 (after Riley) is a faithful representation of this magnificent creature. Both front and hind wings are of a rich brown, the anterior pair greyish, shaded with red,

Fig. 17.

the posterior more uniformly brown ; near the middle of each of the wings there is a nearly kidney shaped white spot shaded more or less with red, and margined with black. A wavy dull red band crosses each of the wings, edged inside on the front wings more or less faintly with white, while on the hind pair the band is widely and clearly margined with the same color. The outer edges of the wings are of a pale silky brown in which on the anterior pair runs an irregular dull black line, which on the hind wings is replaced by a narrow, double broken band of the same hue. The front wings next to the shoulders are dull red, with a curved white and black band, varying much in distinctness in different specimens, and near their tips, there is an eyelike black spot with a bluish white crescent. The upper side of the body and the legs are dull red, with a wide band behind the head and the hinder edges of the segments of the abdomen white ; the under side of the body is also irregularly marked with white. The under surface of the wings is very much like the upper, but somewhat paler.

Cecropia was the ancient name of the City of Athens, and it has been a matter of surprise to some that Linnaeus should have given this name to our moth, Dr. Fitch throws light on this subject in the following words, "The great legislator of this department of human knowledge, as he is expressively styled by Latreille, it has been frequently remarked, was endowed with a genius which, but few of his disciples have inherited, for selecting names for natural objects, which are most appropriate and happy. The idea which was present in the mind of Linnaeus when he named this splendid moth, we think is sufficiently evident. The Athenians were the most polished and refined people of antiquity. The moths are the most delicate and elegant of insects; they were the Athenians of their race. Cecrops was the founder. the head of the Athenian people. When the names of men were bestowed upon cities, ships, or other objects regarded as being of the feminine, gender, classical usage changed these names to the feminine form. The moths (*Phalæna*) being feminine, and the name of Cecrops being more euphonious in this form, probably induced Linnæus to change it in the manner he did. The name thus implies this to be the leader, the head of the most elegant tribe of insects, or in other words the first of all insect kind. What name more appropriate can be invented for this sumptuous moth." The figure we have given is that of a male which differs from the female in having a smaller abdomen and larger and more deeply feathered antennæ or feelers.

During the winter months, when the apple trees are leafless the large cocoons of this moth may be found here and there, firmly bound to the twigs, they are also frequently found on currant bushes, and occasionally also on lilac, cherry, hazel, plum, blackberry, maple, willow and some other shrubs and trees; for this insect in its larval stage is a very general feeder. The cocoon, see fig. 18, (after Riley) is about three inches long, pod shaped and of a dirty brown colour, and is entirely constructed of silk, the fibres of which are very much stronger than those of the common silk worm *Bombyx mori*. The silk has been worked to a limited extent and manufactured into socks and other articles, which have been found very durable ; but a drawback to the advancement of this branch of industry lies in the fact that the caterpillars do not bear confinement well, and hence are not easily reared.

Fig. 18.

The exterior structure of the cocoon is very close and papery-like, but on cutting through this, we find the interior—surrounding the dark brown chrysalis—made up of loose fibres of strong yellow silk. This snug enclosure effectually protects the insect in its dormant state from the extremes of weather during the long wintry months When the time approaches for the escape of the moth, which is about the beginning of June, the internal dark brown chrysalis is ruptured by the struggles of the occupant, and the newly born moth begins to work its way out of the cocoon. As it is possessed of no cutting instrument of any kind, this would indeed be a hopeless task had not the all wise Creator made a special provision for this purpose, and to this end a fluid adapted for softening the fibres is furnished just at this juncture and secreted from about the mouth. On listening to the creature as it works its way through, you hear a scraping, tearing sound, which is made by the insect working with the claws on its fore-feet, tearing away the softened fibres and packing them on each side to make a channel for its escape. The place of exit is the smaller end of the cocoon, which is more loosely made than any other part and through which, after the internal obstacles are overcome, the passage is effected without much further trouble.

We have frequently watched their escape. First through the opening is thrust the anterior pair of bushy looking legs, the sharp claws of which fasten on the outside structure; then with an effort the head is drawn forward, suddenly displaying the beautiful feather-like antennæ; next, the thorax, on which is borne the other two pairs of legs, is liberated, and finally, the escape is completed by the withdrawal of the abdomen, through the orifice thus made. Queer looking creatures they are when they first put in an appearance, with their large, fat, juicy bodies, and tiny wings. When the wings are fully expanded they measure from five to six inches or more across, but when fresh from the chrysalis they are but very little larger than the wings of a bumble bee. The first necessity now for the welfare of the individual is to find a suitable location where the wings may be held in a good position for expanding, for without such favourable circumstance they would never attain a serviceable size. It is necessary that a position should be secured where the wings may hang down as they are expanding, for which purpose the under side of a twig is often selected; and here, securely suspended by the claws, the wings undergo in a short time the most marvellous growth it is possible to imagine. The whole process, from the time of the escape of the moth to its full maturity, seldom occupies more than from half an hour to an hour, and during this time the wings grow from the diminutive size already mentioned to their full measure and capacity.

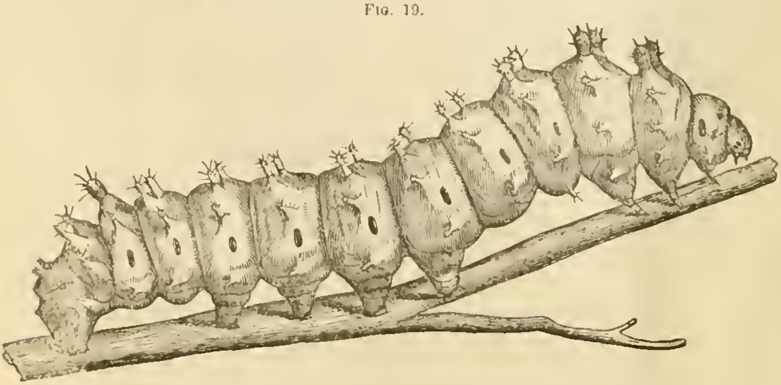
A wing clipped from the insect immediately after its escape, and examined under the microscope, reveals the fact that the thousands and tens of thousands of scales with which the wings are covered, and which afterwards assume such beautiful feather-like forms, are now nearly all threadlike and undeveloped. Impressed with this thought, the mind is fairly astonished at the almost incredible change wrought in so limited a time, for the growth embraces not only the extension of the surface of the wing, but the enlargement and maturity of every scale or feather on it, the individuals of which are but as dust to the naked eye. What a wonderful and intricate system of circulation and power of nutrition must be possessed to accomplish this marvellous result!

Soon after their exit these moths seek their mates, and after pairing, the female begins to deposits her eggs, a process which occupies some time, for the eggs are not laid in patches or groups, but singly; and are firmly fastened with a glutinous material to the under side of a leaf; and as it is seldom there are more than one or two laid on any single tree or bush, a considerable distance must be traversed by the parent in the transaction of this all important business.

The number of eggs which these moths lay is astonishing, we have known a single female to deposit within three days as many as 217. The eggs are about one-tenth of an inch long, nearly round and of a dull creamy white colour, with a reddish spot or streak near the centre, the duration of the egg stage is usually from about a week to ten days.

At the expiration of this period the larva eats its way out of the egg, the empty shell of which furnishes the young creature with its first meal. On its first appearance it is black, with little shining black knobs on its body, from which arise hairs of the same colour. Being furnished with a ravenous appetite its growth is very rapid; and from time to time its exterior coat or skin becomes too tight for its comfort, when it is ruptured and thrown off. At each of these changes or moultings, the caterpillar appears in an altered garb, gradually becoming more like the full grown larva represented by Fig. 19. It is very handsome. Its body is pale

Fig. 19.



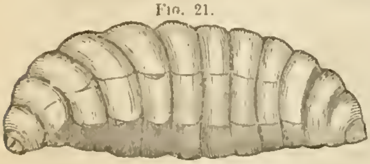
green, the large warts or tubercles on the top of the third and fourth segments are coral red, the remainder are yellow excepting those on the second and terminal segments, which, in common with the smaller tubercles along the sides, are blue. During its growth from the diminutive creature as it escapes from the egg to the monstrous-looking full grown specimen, it consumes an immense amount of vegetable food ; and especially as it approaches maturity is this voracious appetite apparent. Where one or two have been placed on a young apple tree, they will often strip it entirely bare before they have done with it, and thus prevent the proper ripening of the wood entailing damage to the tree, and, sometimes, endangering its life ; hence, during their season, they should be watched for and destroyed. During the winter months, their cocoons may be looked for, and removed in time to check their further spread.

The natural increase of this insect being so great, wise provisions have been made to keep it within bounds. Being such a conspicuous object it sometimes forms a dainty meal for the larger birds ; there are also enemies which attack the egg and young larvæ and besides these there are several parasites which live within the body of the caterpillar and destroy it before reaching maturity. One of the largest of these parasites is the long tailed Ophion (*Ophion macrurum*, Linn.) Fig. 20 (after Riley). This is a large yellowish brown Ichneumon fly, and is perhaps one of the commonest parasites affecting the cecropia. The female of this fly deposits, according to Mr. Trouvelot, from eight to ten eggs upon the skin of her victim. These eggs soon hatch into young larvæ which eat their way through the skin of the caterpillar, and at once begin to feed upon the fatty parts within. As only one of these parasitic larvæ can find food sufficient to mature, the rest either die from hunger or are devoured by the strongest survivor.

FIG. 20.

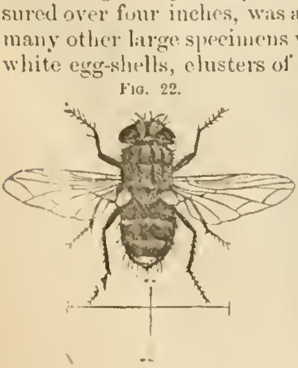
Mr. Riley, in *Am. Ent.*, Vol. II., says, " After the Cecropia Worm has formed its cocoon, the parasitic larva which had hitherto fed on the fatty portions of its victim, now attacks the vital parts, and when nothing but the empty skin of the worm is left spins its own cocoon, which is oblong oval, dark brown inclining to bronze, and spun so closely and compactly, that the inner layers when separated have the appearance of gold beater's skin. If we cut open one of these cocoons soon after it is completed, we shall find inside a large, fat, legless grub, Fig. 21, which sometimes undergoes its transformations and issues as a fly in the fall, but more generally waits until the following spring.

FIG. 21.



" The Ichneumon Fly, last mentioned, usually causes a dwarfed appearance of the worm which it infests, and parasitized cocoons can generally be distinguished from healthy ones by their smaller size. The larvæ of the Tachina Fly which we now introduce to our readers, as parasitic on the Cecropia Worm, seem to produce an exactly opposite effect, namely, an undue and unnatural growth of their victim. In the beginning of September, 1866, we received an enormous Cecropia Worm. It measured over four inches, was a full inch in diameter, and weighed nearly two ounces, but like many other large specimens which we have since seen, it was covered with small oval, opaque, white egg-shells, clusters of four or five occurring on the back of each segment, invariably deposited in a traverse direction. The skin of the worm was black, where the young parasites had hatched and penetrated. The large worm soon died and rotted, and in about twelve days a host of maggots gnawed their way through the putrid skin. These maggots averaged about one-half inch in length, and in form were like those of the common Blow-fly. The head was attenuated and retractile and furnished with two minute curved hooks, and the last segment was squarely cut off, slightly concave and with the usual two spiracles or breathing holes which this class of larvæ have at their tails. Their colour was of a translucent yellow, and they went into the ground and

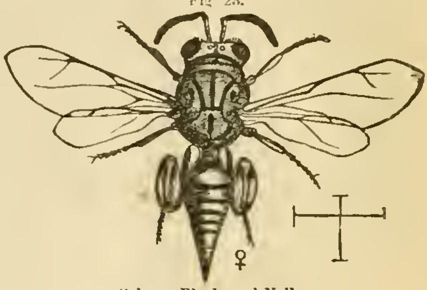
FIG. 22.



remained in the larva state all winter, contracted to pupæ in the April following, and the flies commenced to issue the last of May." This fly differs so little from the red tailed Tachina Fly (*Exorista militaris, Walsh*), see Fig 22, which infests the army worm that Mr. Riley is inclined to regard it as a variety of that species.

The Cecropia chalcis fly (*Chalcis Maria Riley*). We quote again from Mr. Riley.—" In May, 1869, we received from Mr. V. T. Chambers, of Covington, Ky., numerous specimens of the beautiful large chalcis fly figured herewith (Fig. 23), which he had taken from the cocoon of the Polyphemus moth, which is quite common and issues as early as the middle of February in that locality. He says, 'I was satisfied that the cocoon did not contain a living Polyphemus, and therefore opened it. It contained so little besides these insects and their exuviae as to suggest strongly the old idea that the caterpillar had been metamorphosed into them (as in a sense it had). There were 47 of them, of which 23 were females. As all the males and some of the females were dead when I opened the cocoon, I think it likely that the former never do emerge, and perhaps but few of the latter; otherwise Polyphemus would soon be exterminated.'

Fig 23.



Colours Black and Yellow.

" We can very well imagine that most of these chalcis flies would die in their efforts to escape from the tough cocoon of the Polyphemus, but it so happens that these same insects have been found by Mrs. Mary Treat, of Vineland, New Jersey, to prey upon the cecropia worm, from the cocoon of which they can much more easily escape.

Fig. 24.

" The Divorced Cryptus (*Cryptus nuncius*, Say,—*extrematis*, Cresson), another Ichneumon fly, infests the cecropia worm in great numbers, filling its cocoon so full of their own thin parchment-like cocoons that a transverse section (Fig. 24) bears considerable resemblance to a honey-comb. The flies issue in June, and the sexes differ sufficiently to have given rise to two species. We have bred seven females and twenty-nine males from a cocoon of the cecropia moth, all the males agreeing with the species described by Say as *nuncius*, and all the females agreeing with that described afterwards as *extrematis* by Mr. Cresson.

The Clouded Sulphur Butterfly (*Colias Philodice*, Godt).

The clouded sulphur is everywhere one of our commonest butterflies, abundant in its season, in fields and roadways, frequently congregating in groups on the borders of streams and springs, where, in hot weather, they seem to enjoy settling on the cool, moist ground. They are still more abundant in clover fields as the season advances.

Fig 25.

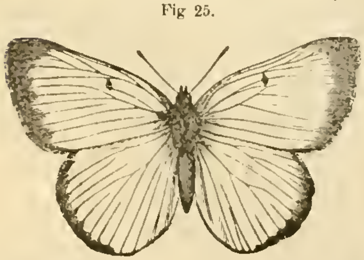
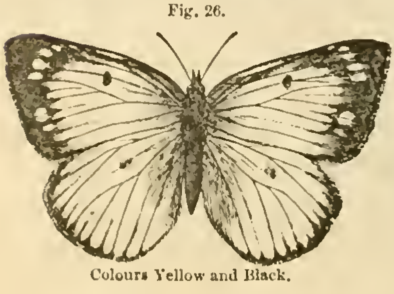


Fig. 26.



Colours Yellow and Black.

The female of this species differs somewhat in its markings from the male, as will be readily seen by reference to the figures, 25 representing the male, 26 the female. The ground colour of the wings in both sexes is bright yellow marked on the outer edge with a dark brown or blackish border, narrower in the male than it is in the female, while in the latter it encloses on the anterior wings a broken row of irregular yellow spots, there is also a spot of black placed near the front edge of the fore wings, about half way between the base and tip, varying in form and distinctness. The hind wings in both sexes are less heavily margined, and near the middle is a dull, pale orange spot. Both wings are dusky towards the base, and the fringes are pink.

On the under surface the yellow colour is less bright, while the dark margins are either entirely wanting or else represented by a dusky shade margined occasionally within by a few dull brownish dots. The spot on the forewings is distinct, but paler and usually centered with a small silvery eye. That on the hind wings is much more distinct than above, being composed of a bright silvery spot in the centre defined by a dark brown line which is in turn encircled with dull orange. Immediately above and a little towards the outer edge is a much smaller spot of the same character; there is also a reddish dot on the anterior edge, about the middle of the wing. The antennæ are pink, with the knobs at their tips of a darker shade; the body is dark above; paler at the sides and underneath.

The insect appears first on the wing about the middle of May, becoming more plentiful towards the latter end of the month, but the time of its greatest abundance is later in the season, after the appearance of the second brood, which is during the latter part of July and throughout August. In the second volume of the "Entomologist," p. 8, Mr. Bethune remarks as follows: "On the 3rd of August, a lovely, bright, warm morning, after an excessively wet night, I drove about ten miles along country roads; every few yards there was a patch of mud, the effects of the heavy rain, and at every patch of mud there were from half a dozen to twenty specimens of *Colias philodice*, at least one, I should think for every yard of distance I travelled. I must then have seen, at a very moderate computation, about ten thousand specimens of this butterfly."

The caterpillar of the Clouded Sulphur feeds on the cultivated pea, on clover, on the Blue Lupin, *Lupinus perennis*, and no doubt on many other plants belonging to the order *Leguminosæ*. The egg, which is a beautiful object, is about one twenty-third of an inch in length, tapering at each end, with twelve or fourteen raised longitudinal ribs, with smaller cross lines in the concave spaces between them. Its colour when first deposited is of a pale lemon yellow, which changes in three or four days to a pale red, then gradually to a bright red, and from that to dark brown just before the time of hatching. The duration of the egg stage is about seven days.

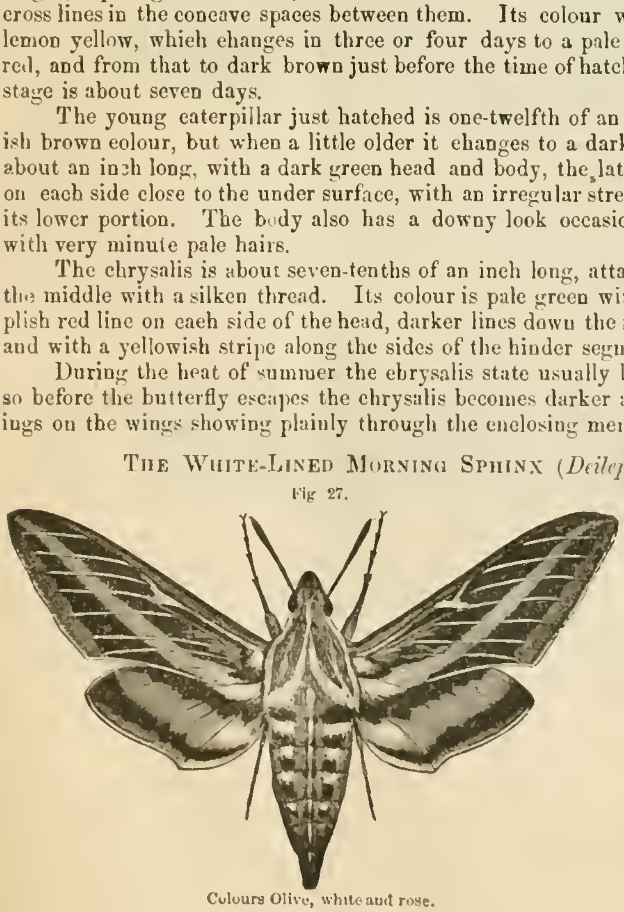
The young caterpillar just hatched is one-twelfth of an inch long and of a dull yellowish brown colour, but when a little older it changes to a dark green. When full grown it is about an inch long, with a dark green head and body, the latter with a yellowish white stripe on each side close to the under surface, with an irregular streak of bright red running through its lower portion. The body also has a downy look occasioned by its being thickly clothed with very minute pale hairs.

The chrysalis is about seven-tenths of an inch long, attached at its base, and girt across the middle with a silken thread. Its colour is pale green with a yellowish tinge, with a purplish red line on each side of the head, darker lines down the middle both in front and behind, and with a yellowish stripe along the sides of the hinder segments.

During the heat of summer the chrysalis state usually lasts about ten days. A day or so before the butterfly escapes the chrysalis becomes darker and semi-transparent, the markings on the wings showing plainly through the enclosing membrane.

The White-Lined Morning Sphinx (*Deilephila lineata*, Fabr.)

Fig 27.



Colours Olive, white and rose.

The white-lined morning sphinx is a tolerably common insect throughout Ontario. It is seen on the wing generally about twilight or later, although it has been met with occasionally in the day time. In its flight it much resembles the humming bird, hovering over flowers into which it inserts its long and slender tongue in search of the nectar there stored, which constitutes its food. In common with many other sphinx moths its structure is robust and its flight rapid and powerful: hence it is difficult to capture, and even when taken will often flutter with such force as to seriously damage the covering and structure of its beautiful wings. When its wings are fully spread they measure from three to three-and-a-half inches across, (see Fig. 27, after Riley). The ground colour is a rich greenish olive. On the fore wings there is a pale band about the middle, extending from near the base to the tip, and along the outer margin runs another band nearly equal in width, but darker and less distinct; the veins also are lined with white. The hind wings which are small, are nearly covered by a wide central rosy band, becoming paler as it approaches the body, the hinder edge is fringed with white. On the anterior portion of the body there are six longitudinal stripes or lines, while the hinder part is alternately spotted with white and black. The entire under surface is much paler and duller in colour than the upper.

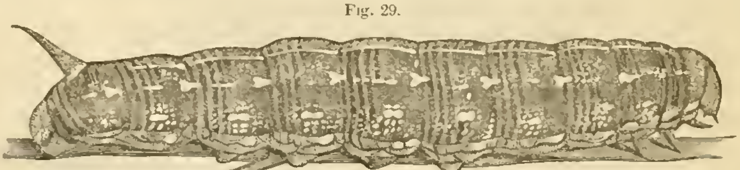
"The larva," Mr. Riley says, "feeds upon purslane, turnip, buckwheat, water melon, and even apple and grape leaves, upon any of which it may be found in the month of July. It descends into the ground, and within a smooth cavity, changes into a light brown chrysalis, from which the moth emerges during the month of September."

"The most common form of the larva is that given at Fig. 28. Its colour is yellowish green, with a prominent subdorsal row of elliptical spots, each spot consisting of two curved

Fig. 28.

black lines, enclosing superiorly a bright crimson space, and inferiorly a pale yellow line—the whole row of spots connected by a pale yellow stripe, edged above with black. In some specimens these eyelike spots are disconnected, and the space between the black crescents is of a uniform cream colour. The breathing holes are either surrounded with black or with black edged with yellow. The other form is black, and characterized chiefly by a yellow line along the back, and a series of pale yellow spots and darker yellow dots, as represented

Fig. 29.



in the illustration Fig. 29, even this dark form is subject to great variation, some specimens entirely lacking the line along the back, and having the spots of different shape."

"This insect has a wide range, as it occurs in the West Indies, Mexico and Canada, as well as throughout the United States. Feeding as it does, principally on plants of but little value, and being very commonly attacked by the larvæ of a Tachina fly, this insect has never become sufficiently common to be classed as injurious."

GRASSHOPPERS OR LOCUSTS.

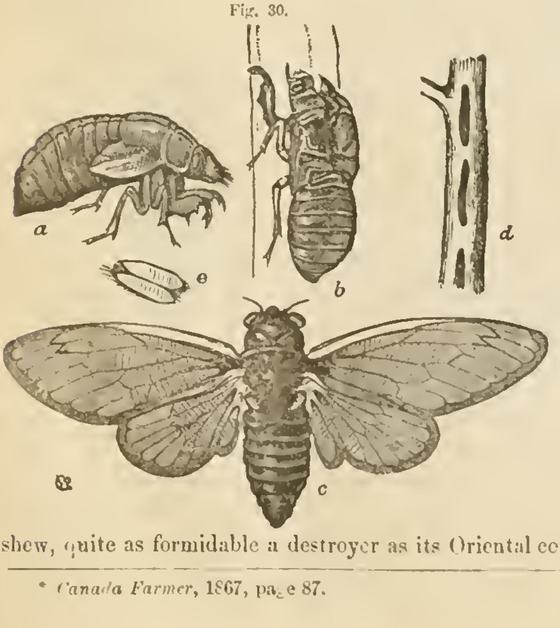
By the Rev. C. J. S. Bethune, M.A.

Few, probably, of our Canadian fellow-countrymen are aware that the terrible Locust, "the scourge of nations," as it has been fitly termed, about whose destructive powers they read such appalling accounts in books of Oriental travel, is one of the insect enemies that some of the denizens of our Dominion have to contend against. And yet it is too true—as the records of the past season in our North-west Province of Manitoba abundantly prove. The locusts (or grasshoppers, as they are incorrectly termed) have laid waste great tracts of fertile country, and have brought ruin and desolation to many an unhappy settler in that far off region.

It is much to be regretted—to quote our remarks made on a former occasion*—that so much confusion exists in the popular use of terms in Natural History, and particularly in entomology, in consequence of which very serious errors become matters of common faith, much mischief is allowed to go unheeded, and the innocent are oftentimes punished for the guilty. The term "bug," for instance, is almost universally applied in the neighbouring States, and very generally in this country, to every kind of insect, so that it is no uncommon thing to hear a beautiful butterfly or lovely moth designated by the odious name of "bug," whereas the appellation belongs exclusively to those foul-smelling sucking insects of the order *Hemiptera*, which feed upon the juices of plants, and in some cases upon the blood of other insects, of animals and man. Again, the larva of almost every kind of insect is called "*the* grub;" larvæ that burrow into the trunks of trees and timber, "*the* borer," and so on to any extent. The consequence is that what is a remedy for one grub or borer, or so called "bug," is indiscriminately made use of for the destruction of every other grub, or borer, or "bug," unmindful that the old proverb may be read in this way also—"What is one *insect's* meat is another's poison," and that the treatment that will exterminate one injurious insect is sometimes perfectly harmless in the case of another.

This confusion of terms is particularly unfortunate in the case of the insects that we are now treating of. Every one in this country is perfectly familiar with what is commonly called a "grasshopper," but how very few are aware that what they term a grasshopper, and see too often to think much about, is really the same kind of insect as the much dreaded, famine-producing Locust, that constituted one of the plagues of Egypt, and that is an object of so much terror wherever it prevails. A true locust it nevertheless is, and it were well, for many reasons, that our people became accustomed to call it by its right name. Our common species in this Province, while it does not possess the power of suddenly appearing in vast numbers and emigrating from place to place, occasionally becomes greatly multiplied and proves very destructive. The western locust (or grasshopper), however, differing but very slightly from our species, is, as we shall presently shew, quite as formidable a destroyer as its Oriental congener.

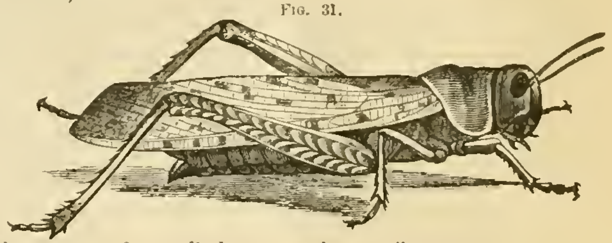
Fig. 30.



* *Canada Farmer*, 1867, page 87.

While the true American Locusts are commonly called grasshoppers, and the true grasshoppers are termed crickets, katydids, &c., another element of confusion is mingled with our insect nomenclature by the common practice of giving the name of locust to the cicada, a totally different insect belonging to an entirely different order. The accompanying illustration will shew the reader the difference between these three kinds of insects better than any written description. Figure 30 represents different stages in the life of the Cicada or so-called "Seventeen year Locust" (*C. Septem-decim* LINN). *a* is the pupa ; *b* the empty pupa case after the perfect insect has emerged from it ; *c*, the perfect or winged insect ; *d*, the perforations in a twig for the deposition of eggs ; *e*, the egg. Figure 32 represents a katydid or true grasshopper (*Cyrtophyllum concavum*, SAY); and Figure 31 a true locust or so-called grasshopper (*Caloptenus spretus*, UHLER).

Fig. 31.



A single glance at these illustrations will shew the reader, the main differences between the three kinds of insects that we have been referring to. We wish it, therefore, to be plainly understood that in the account that follows : we shall use the term "Locust" in reference to the devastating insect represented in Figure 31, which is so often called a "grasshopper."

Fig. 32.

History of the Locust in America.

From the various works that we have been able to consult we gather that visitations of locusts have occurred on a more or less extensive scale, from time to time, ever since the Central and Western portions of this Northern Continent have been occupied by Europeans. We have no difficulty, then, in believing that from time immemorial these destructive insects have played their important part in maintaining the balance of animal and vegetable life in accordance with the grand laws of the Omnipotent Creator. The earliest notice that we have found of a visitation of locusts refers back more than two centuries, to a period much anterior to the discovery of the Mississippi River by La Salle. In Gage's West Indies the following account is given of one of these visitations in Guatemala in the year 1632 :—

"The first year of my abiding there it pleased God to send one of the plagues of Egypt to that country, which was of locusts, which I had never seen till then. They were after the manner of our grasshoppers, but somewhat bigger, which did fly about in numbers so thick and infinite that they did truly cover the face of the sun, and hinder the shining forth of the beams of that bright planet. Where they lighted, either upon trees or standing corn, there was nothing expected but ruin, destruction and barrenness ; for the corn they devoured, the fruits of trees they ate and consumed, and hung so thick upon the branches that with their weight they tore them from the body. The highways were so covered with them that they startled the travelling mules with their fluttering about their heads and feet. My eyes were often struck with their wings as I rode along ; and much ado I had to see my way, what with a montero wherewith I was fain to cover my face, what with the flight of them which were still before my eyes. The farmers towards the South sea-coast cried out, for that their indigo, which was then in grass, was like to be eaten up ; from the *Ingenios* of sugar the like moan was made, that the young and tender sugar-canes would be destroyed ; but, above all, grievous was the cry of the husbandmen of the valley where I lived, who feared that their corn would in one night be swallowed up by that devouring legion. The care of the magistrates was that the towns of Indians should all go out into the fields with trumpets, and what other instruments they had, to make a noise and to affright them from those places which are most considerable and profitable to the commonweath; and strange it was to see how the loud noise of the Indians and sounding of the trumpets defended some fields from the fear and danger of them. Where they lighted in the mountains and highways, there they left behind them their young ones, which were found creeping upon the ground, ready to threaten such a second year's plague, if not prevented; wherefore all the towns were called, with spades, mattocks and shovels, to dig long trenches and therein to bury all the young ones. Thus, with much trouble to the poor Indians and their great pains (yet after much hurt and loss in many places) was that flying pestilence chased away out of the country to the South Sea, where it was thought to be consumed by the ocean, and to have found a grave in the waters, whilst the young ones found it in the land. Yet they were not all so buried, but that shortly some appeared, which, being not so many in number as before, were with the former diligence soon overcome."

About a century later than the date of the above account, the locusts are recorded to have laid waste, on several occasions, all the vegetation of Mexico and Yucatan, and to have produced famine and much consequent suffering among the people. To California, they appear to have been especially partial from the earliest times. The Jesuit Father Michael del Barco, who lived for thirty years in that country as a missionary among the heathen Indians, relates that from the arrival of the Jesuits in 1697 to the year 1722, they were free from any plague of locusts, but that in this year they caused fearful sufferings among the inhabitants. In 1746 and for three years following without intermission, they again invaded the land; after this they did not appear until 1753 and 1754; and finally, before the expulsion of the Jesuits, in 1765 and the two following years. Clavigero, in his History of California, gives a very interesting account of these several invasions, and describes the appearance and natural history of the insect with much minuteness; from his work we make the following extracts:—

"The female, at the latter part of July or early in August, lays a number of fine small eggs of a yellowish colour, in a string, united with a glutinous matter, which appears like a cord of fine silk. These are deposited together and dropped into a small hole which they make in the ground with a small apparatus attached to their tails. Each female lays from seventy to eighty eggs, and sometimes more.

"The birth of these new grasshoppers has no particular time, but is dependent upon the early or late appearance of the rains, but they generally hatch during the latter part of September or early in October. . . . . . Their life, from birth to death, lasts ten months, during which they cast their coats twice and change their colours five times. When the wings have become of sufficient strength and the body at its maturity, they then begin to ascend into the air and fly like birds, and commence their ravages in every direction, desolating the fields of every green thing. Their numbers become so extraordinary, that they soon form clouds in the atmosphere, of which the rays of the sun cast a shadow as they fly. They unite in masses of ten to twelve thousand, always following their conductors and flying in a direct line without falling behind, for they consume every growing thing before them. To whatever height their guides conduct them to obtain a sight of their food they follow, and as soon as growing crops or any verdure is sighted, instantly the swarm will alight and speedily devour and devastate the fields around to that extent, and with that promptitude, that when they are seen by a new swarm of their fellows, there is not anything more left to injure or consume.

"This lamentable insect plague is bad enough in old and cultivated countries, but in the miserable peninsula of California, where they eat up the crops, green trees, fruits, and pastures, they cause great mortality in the domestic animals of the missions, and with the effect of their ravages on the cereals and other garden productions cause great famines and sickness among the inhabitants and neophytes of the establishments. At one time immense multitudes of these voracious insects died, infecting the air dreadfully with the stench of their corruption and decay."

In Upper California, the Franciscan Missions of the early part of the present century, have suffered in a very similar manner. About the year 1827 or 1828, they ate up—we are told—nearly all the growing crops, and occasioned a great scarcity of wholesome food; again in

1834, they "destroyed all the crops of the rancheros and missions, with the exception of the wheat." In 1838, the field crops and gardens were again nearly destroyed. In 1846, there was another serious visitation, which extended over some of what are now termed the Western States, as well as California. In 1855, to pass over lesser visitations, there came one of the most terrible of all the recorded plagues of Locusts in California. As related by Mr. Taylor, of Monterey, (Smithsonian Report, 1858), between the middle of May and October, 1855, "these insects extended themselves over a space of the earth's surface, much greater than has ever before been noted. They covered the entire Territories of Washington and Oregon, and every valley of the State of California, ranging from the Pacific Ocean to the eastern base of the Sierra Nevada; the entire Territories of Utah and New Mexico; the immense grassy prairies lying on the eastern slopes of the Rocky Mountains; the dry mountain valleys of the Republic of Mexico, and the countries of Lower California and Central America, and also those portions of Texas which resemble, in physical characteristics, Utah and California. The records prove that the locusts extended themselves, in one year, over a surface comprised within thirty-eight degrees of latitude, and in the broadest part, eighteen degrees of longitude." The Sacramento newspapers of that year were filled with details of the plague; most accounts compared the swarms, when in flight, to dense snow-storms; they consumed everything before them—the foliage of trees, orchards, gardens, vineyards, fields of young grain, of crops and vegetables—everything was eaten up in a particular locality in a single day, leaving the ground a withered, blackened desert. That summer of 1855, was observed to be the hottest and driest that had been known for ten years."

During the next two years, 1856-7, the plague was almost entirely confined to the region lying east of the Rocky Mountains, and extending in places as far as the Mississippi River; throughout the States of Minnesota, Nebraska and Kansas, the locusts were especially destructive. Ten years later, in the summer of 1866, another noteworthy visitation took place throughout the same region. A correspondent of a Rock Island, Ill., paper (see *Practical Entomologist*, vol. ii., page 3), thus describes the plague in Nebraska: "The last day of August, near the middle of the afternoon, quite a number of grasshoppers were seen alighting, and that number rapidly increased till a little before sunset. The next morning they appeared much thicker, but were only so from having crawled more into the open air to sun themselves. About nine o'clock they began to come thicker and faster from a northerly direction, swarming in the air by myriads, and making a roar like suppressed distant thunder. By looking up to the sun they could be seen as high as the eye could discover an object so small, in appearance like a heavy snow storm. Each grasshopper very much like a very large flake, save that it passed by instead of falling. The number was beyond imagination, the air was literally full of them and continued so till late in the afternoon, countless millions passed on leaving other countless millions covering the earth and devouring the vegetation." Another writer from Kansas states that "Yesterday, September 10th, the locusts made their appearance here, and are devouring everything green. They almost darken the sun in their flight. I put in 65 acres of wheat in the last week of August, which looked fine, but it has nearly all disappeared; by to-morrow night there will not be a spear left. Early sown wheat will be totally destroyed." From the description given by another writer in Kansas, we may quote the following graphic account:—"There is something weird and unearthly in their appearance, as in vast hosts they scale walls, housetops and fences, clambering over each other with a creaking, clashing noise. Sometimes they march in even regular lines, like hosts of pigmy cavalry, but generally they rush over the ground in confused swarms. At times they rise high in the air and circle round like gnats in the sunshine. At such times, I think, they are caught by currents of our prevailing westerly winds and are thus distributed over vast tracts of country." The foregoing extracts will give our readers some little idea of the mode of appearance and the destructive powers of the locusts in the west. We might fill pages, a volume indeed, with similar accounts.

The next year 1867, and to some extent also in 1868 the locusts reappeared throughout the same region, and extended further to the eastward as well as westward. They proved more or less destructive in Western and Central Iowa, and in North Western Missouri, as well as almost all over Nebraska, Kansas, Texas and Utah. They have never, so far as we have been able to ascertain, passed to the eastward of the Mississippi River.

In 1869 and 1870, the ravages of the locusts seem to have been confined on this side of the Rocky Mountains, to portions of Nebraska, Colorado and Utah.

The Plague of Locusts in 1874.

Let us now turn to the terrible visitation of the present year, from the effects of which so many thousands are now suffering the privations of famine throughout immense tracts of country.

Last year (1873) the locusts or grasshoppers were stated to have inflicted considerable damage upon crops of various kinds in some of the Western States, principally Nebraska and Kansas; here and there also in Minnesota, Iowa and Dakota there were comparatively trifling visitations. But in the month of July of this year there began one of the most serious invasions that has ever occurred in the west. In point of numbers and in extent of area affected, the plague was probably no greater than on some previous occasions, notably that of 1855 that we have referred to above; the great difference, however, is caused by the fact that twenty years ago the country west of the Mississippi River was an almost uninhabited wilderness of prairie, while now it is traversed by a net work of railways, covered with populous towns and villages, and occupied to a very large extent by multitudes of industrious people. Twenty years ago the locusts affected the food supply, perhaps, of the buffalo, the Indian, and the scattered frontier settlers, but now their ravages cause destitution and misery in tens of thousands of homes.

Up to the beginning of July this year, all looked bright and fair for the western farmer. His crops of all kinds were, as a rule, growing luxuriantly; the prospect of a bountiful harvest was quite as good as usual. After that date, however, sooner or later in different localities, all these bright prospects were overclouded, in many instances utterly destroyed. The following extracts from various newspapers will abundantly tell the tale.

As early as the 19th of July a correspondent of the *Prairie Farmer* writes from Howard County, Nebraska: "Corn and potatoes were doing well until recently, when the grasshoppers [locusts] put in an appearance, and the result undoubtedly is, at the present moment, that there is not ten per cent. of these crops and of late oats left in this and the two neighbouring counties; and it is very doubtful if the countless millions of Vandals will leave a vestige of any green thing. The result must be almost certain starvation for new-comers, and must retard the development of this beautiful country for many years."

A lady correspondent of the same paper writes a few days later from Butler County, also in Nebraska:—"'The low-hung clounds have dropped their garnered fullness down.' But alas! and alack! they were not the long-looked-for rain clouds, but grasshoppers. As I told you before, they passed over on the 23rd, only a few alighting; but a strong south-west wind on the 24th brought back countless millions; and on the 25th their numbers were fearful to contemplate. They would rise in the air when the sun shone hot, but as it grew cooler they came down like the wolf on the fold. They settled like huge swarms of bees on every living thing. Fields of corn that had been untouched before were now stripped of tassel and blade. A field of early corn was being eaten so fast, that the girls went to save a few ears, instead of going to visit a sick schoolmate according to promise. Trees were so loaded with the pests, that those four and five feet high bent down till the tops touched the ground, and in some instances broke off; for three dreadful hours they dashed against the house like hail. So many came in at doors and windows that every aperture was closed; but not till they were so thick on the windows, that we were forced to make a business of slaying. The 25th of July will be remembered by the citizens of this and some other counties as the dark day, when desolation and devastation stared us in the face. * * * The wheat which was at first thought to be out of harm's way was cut off about one-fourth by the destroying angels. A statement in our county paper says the average will be about 8 or 9 bushels per acre. After the grasshoppers stopped their depredations, there were several damp cloudy days, that brought out new tassels and silks on the corn, but more than a week of hot, dry weather, with scorching winds checked its growth, so there will be none, excepting a very few fields that partially escaped. Turnips have been grown since the rain; and it is to be hoped there will yet be some potatoes; sweet potatoes were not hurt so badly as the common potato. Broom corn, cane and Hungarian grass were unscathed."

A writer from St. Paul, Minnesota, to the paper above mentioned, says that the locusts "have undoubtedly destroyed five hundred thousand bushels of wheat, and are likely to destroy another half million of bushels." Later on in the season the St. Paul *Press* publishes the following statement in reference to the plague of locusts in Minnesota:—"It is safe to estimate the tilled area in the ravaged district at 275,000 acres, and of the area in wheat in that district at 200,000 acres. Of this area, probably not less than 150,000 acres have been destroyed. This represents not less than 2,500,000 bushels of wheat devoured in the germ by the grasshoppers, or about one-twelth of the wheat crop of the state. Add to this area 50,000 acres of oats, at 33 bushels per acre, or 1,320,000 bushels in all, or one-twelfth of the oat crop of the state; 20,000 acres of corn, at 32 bushels per acre, 340,000 bushels, or one twelfth of the corn crop of the state, and perhaps 20,000 acres more in rye, buckwheat, barley, potatoes and other crops—and the full extent of the grasshopper havoc cannot be easily estimated."

Our readers may further judge of the extent of the calamity and sufferings consequent upon it, from the following Pastoral Letter, issued by the Bishop of Minnesota, and appointed to be read in all the Churches in his Diocese:—*To the Clergy and Congregations of the Diocese of Minnesota:* You are aware that several counties of the State have been desolated by locusts. In May I visited Martin county and saw the beginning of their ravages. I laid the facts before the Governor. The plague has increased. Many homes are desolated. They have the right to look to us for relief. They are our own flesh and blood. They are our brothers. They are God's children. The scourge is an awful one. It may be for *our* sins. It may be to try our faith in God. It may be to test our humanity.

I ask your prayers and your alms. I recommend that an offering shall be taken up on the last Sunday in July, and that a further special contribution of money and provisions shall also be taken at our Annual Harvest Home Festival.

Please send your offerings to Hon. Isaac Atwater, Minneapolis, who will send them to the Committee in St. Paul.

Praying God to bless you,
Your friend and Bishop,
H. B. WHIPPLE.

Extract from a Widow's letter in Brown County.

"I mortgaged my farm to get seed last Spring. All is lost. What to do I do not know. It would take a tear out of a stone to hear the people talk. I had a nice piece of barley almost ready to cut. There is nothing left but the straw, the heads lying thick on the ground. Dear Bishop, I am almost heart-broken, and nearly crazy, to think of the long, cold winter, and nothing to depend on. May God help us. May the Lord look to every orphan and widow, and put it in the hearts of His children to help."

"The widow must not plead in vain."

The Bishop also issued a form of prayer for relief from the plague of locusts, to be used in the Churches throughout his Diocese.

From the September "Report of the Department of Agriculture," at Washington, we cull the following note from Kansas:—"The late summer and fall crops have been almost entirely destroyed by grasshoppers. The common jumping grasshopper did much damage through the early part of the season, but about the middle of August clouds of the flying ones made their appearance over the county, devouring and destroying vast quantities of vegetation. Gardens were quickly eaten up, corn-fields were stripped of leaves, and in many cases the corn was entirely eaten off; fruit trees are left with naked branches, and in many cases the half-ripened fruit is left hanging on the trees, presenting a sickening sight of death and destruction.

In addition to the actual loss by devastation, the loss caused by discouragement will be greater. Years of patient waiting, hard work, and self-sacrifice have been destroyed in a few days, with no known remedy for protection—just as the fruits of labour were beginning to be realized, destruction came—and the question with many is, "Is it of any use to try again?"

Here is a field for the Department of Agriculture. Some method of protection or relief must be had against the destruction of this insect, or an immense tract of magnificent country will never be what it would without this curse. I am one of those who believe all such things may be controlled by some practical method; it only requires study, enterprise and means to learn how. This county (Doniphan) could well afford to pay $100,000 for a guarantee that no grasshoppers should ever trouble it again. I have learned that vegetation highly cultivated and growing vigorously is less liable to be destroyed than when on the decline or growing feebly. Thus it is we often see a single tree in an orchard eaten even to the bark, while others of the same variety are not damaged so much ; and upon examination it will be invariably found that those mostly eaten were diseased, or had their vitality in some way impaired. This thing was noticeable when the same kind of insects were here six or seven years ago. Of all fruit trees, apple and pear trees suffer the most, while peaches, plums and cherries suffer the least. They eat the leaves off the apples, and leave most of the apples on, but of the peaches they will eat the fruit and leave the foliage ; but in many instances, when vegetation is not plenty, I understand they clean all as they go, and I have seen instances of this kind. The damage to vineyards in this county is not so great. They do not seem to relish grapes, and are satisfied by eating off the stems and letting the bunches fall to the ground. There will not be enough corn in this county to feed what stock there is in the county as it should be fed."

The same report states that "the plague"—as it justly terms it—is reported in two counties in Wisconsin, seven in Minnesota, five in Iowa, four in Missouri, thirty in Kansas and seven in Nebraska. It adds that "the wide-spread destruction which they (the locusts) have caused in the north-west has not been adequately described. In many places large masses of people will probably suffer during the coming winter for the necessaries of life, their crops having been swept by this remorseless enemy."

The next Monthly Report—that for October—records the prevalence of the plague in two more counties in Minnesota, two more in Iowa, four more in Missouri, four more in Kansas, four more in Nebraska, three in Texas, two in Colorado, and one in California. The following letter from Kansas is recorded "to give some idea of its ravages :"—"The farmers in our county had their land for wheat prepared in good time, and in a better condition than I ever saw. On the 6th of September the grasshoppers made their appearance all over the county. Farmers became alarmed and did not sow any wheat. About the 18th to the 20th they appeared to go away. Farmers commenced sowing and got in about two-thirds of their crop. On the 28th and 29th they came the second time, filling the air, reminding one of a snow-storm in December. Some who had sown early had wheat up nice, but you cannot find a spear in any place. Wheat which was sown before the grasshoppers came the first time has been eaten down, until the grain has finally ceased to grow. I am candidly of the opinion that every acre which is sown to-day in this county will have to be sown again. There is no other chance for it, and the great trouble will be that so many of our farmers have sown all their seed and are not able to buy again. And what will they do? Some who have not been two years on their claims are leaving them and going over into Missouri and Arkansas to winter—to find something to live upon."

We might go on to an almost unlimited extent with similar descriptions of the wide-spread devastation caused by these insects, and the consternation they have produced throughout the west. Every agricultural newspaper and a large number of city papers have published throughout the past season similar records of ruin and suffering. To assist their brethren in the afflicted regions, large sums of money have been contributed both by State Governments and by individuals ; but it is greatly to be feared that the utmost liberality will hardly save from ruin, though it may relieve temporarily, many farmers who had recently settled on those hitherto attractive plains. Not only, it should be remembered, have they suffered from a dire plague of locusts, but they have also been the victims of a long-continued drought ; accompanied in some localities by a terrible hot wind, resembling the *sirocco* that blasts southern Europe with the dry heat of the African desert ; to add also to their series of calamities, the Chinch-bug* destroyed in many places these crops that the Locusts spared.

To illustrate the reality and intensity of the sufferings that we have alluded to, we shall give one extract only out of a large number that might be quoted. The writer of a letter to the *Prairie Farmer*, dated Kearney, Nebraska, November 16th, thus describes the condition of things in his neighbourhood :—"Your readers have been pretty fully posted as to the ravages of locusts over this entire region, the devastation extending from Central Minnesota to the southern limit of Kansas, the whole country being almost as utterly destroyed, so far as provisions are concerned, as if it had been swept by the scathing flames. I speak more understandingly of my own neighbourhood, and shall endeavour to state facts that may be firmly relied upon, and which can be verified if necessary, by the testimony of others in my own

* For a description of the Chinch-bug, see the report of the Entomological Society of Ontario, for 1871.

vicinity. The wheat crop, what there was of it, considering the dry weather, was good. But fully one-half of the settlers had no wheat at all; their sole dependence was corn and potatoes. In many instances the very uncertain product of prairie sod. Thus nearly half of our people were dependent solely upon the two above articles, both of which were almost entirely swept away by drought, bugs and locusts combined. *Every* family nearly, that was able to do so, having friends in Iowa and Missouri, have gone there to winter, some may return, others never will. Many proved upon their claims and have left the country forever. The number of actual homestead settlers is thus reduced fully one-half in my own neighbourhood, and of that one-half, not one family in ten have provisions, fuel or clothing to last them through the winter. Fully two-thirds have not food enough to last until the 1st of December. I find from conversation in Kearney, with settlers both north and south for a distance of thirty to fifty miles, that the same statement holds true over almost the entire region. Thus notwithstanding the *cry* of some of our papers that "we are not beggars," more than two-thirds of those now on their homesteads must either beg or starve. In less than thirty days there will be starvation and death unless these needs are promptly met.

"There is no corn, no oats, no feed of any kind for stock, except what is shipped in from a distance. There is no fuel except coal, at from $8 to $11 per ton. There is no work, no money. There is no seed corn, and in very many instances, no seeds of any kind for another year's planting. On the 13th inst., I met two of my neighbours. One has a family of six to provide for, three of them young children. Says he: 'I have just flour enough to last until Saturday night.' The other has a family of ten, four of whom are sick, and have been since September. One child, a bright boy of some four years, has lost the entire use of his limbs, and now has to have the care of a helpless babe. This man has flour for ten days. and potatoes that will enable him to get along for a week or two longer. Last winter this family of children were entirely without shoes or stockings, with clothing just sufficient to cover nakedness, and ragged at that. The writer of this article has flour for a week—fifty pounds—and pays for it in breaking one acre of prairie, thus giving three dollars in work for $1.20 worth of flour. He does not state this complainingly, being glad to get work to feed his five babies at any price. I merely give these three cases as a sample. While I give but three, there are many others all around me in fully as deplorable a situation. This want extends over the whole area of country, west, north and south, and the farther the settlement is from the supplies, the greater the wants and privations of the settlers."

The Plague of Locusts in Manitoba.

Thus far we have been describing the extent and the terrible results of this year's plague of Locusts in the Western States of the Union. We have now, unhappily, to record its occurrence in our own new Province of Manitoba, which adjoins the State of Minnesota, so frequently referred to above. From the following record of visitations previous to this year, it will be observed that they were, in almost all cases, simultaneous with those in the neighbouring States, that we have described in the earlier part of this paper. For this record we are indebted to the letter of the Winnipeg Correspondent of the Toronto *Globe*, which appeared in that paper on the 5th of August last:—

"Grasshoppers first appeared in Red River towards the end of July, 1818, six years after the commencement of the settlement. They covered the settlement belt, but did not utterly destroy the wheat crop, it being nearly ripe at the time. Barley and other crops were swept away. They deposited their eggs and disappeared, and the following spring the crop of young grasshoppers was immense. These departed before depositing their eggs, but devoured all vegetation on their route, thus destroying all the crops of 1819. Great numbers came in during the season of 1819 and deposited their eggs, so that in 1820 the crops were again all destroyed. Thus for three successive years were the crops in this country destroyed by these pests. They then disappeared for thirty six successive years, the next visitation being in 1857, when they visited the Assiniboine settlement, doing but little injury beyond depositing their eggs. The following season their progeny destroyed all the crops within their reach. In 1864 they again appeared in considerable numbers but did little injury to the wheat crop. The following year the young grasshoppers partially destroyed the crops, leaving many districts entirely untouched. The largest swarm ever known came in August, 1867, but the crops were so far advanced that season that they did but little injury. Their eggs produced such immense swarms the following spring that they destroyed everything that had been sown throughout the settlement, and famine ensued. In 1869 they again visited the country, but too late to do much harm. The season following, however, they destroyed most of the growing crops. In 1872 immense hordes of these winged pests again visited a part of the country about the beginning of August. The country west of Headingly escaped, and generally the wheat was not much injured, but they played sad havoc with the gardens. Nothing was sown the following spring throughout the infested district, but throughout the western settlements a large crop was grown and saved."

From the same source we have obtained the following particulars respecting the ravages of the Locust in different parts of the Province:—

"The South.—From West Lynne (Pembina) northward as far as Scratching River the oats and barley have been entirely destroyed, and the wheat partially.

"Palestine.—The latest reports from this settlement confirm the accounts that the settlement is laid waste.

"Manitoba Lake.—The shores of this lake are strewn three feet in many places with dead grasshoppers, the wind having driven them into the lake, where they were drowned and cast ashore.

"The Boyne Settlement.—They are very thick here, and have completely destroyed the oats and barley, and about half ruined the wheat.

"Portage la Prairie.—From Poplar Point to the Portage the fields are swarming with grasshoppers, which have devoured the crops. Scarcely anything has escaped.

"Rat Creek.—In this neighbourhood it is reported that the crops of Kenneth McKenzie, Hugh Grant and others, are being destroyed, and that the former had commenced cutting his oats and barley for fodder rather than let the pests take all.

"Rockwood.—The crops in this settlement have suffered severely. Oats and barley completely destroyed, and wheat badly injured.

"Woodland.—Most of the settlers in this neighbourhood are entirely cleaned out.

"County of Provencher.—All the crops along the Red River, from Pembina to Stinking River, have been eaten up, excepting, in some instances, a portion of the wheat and potatoes have escaped.

"Winnipeg.—The gardens in this city, and the oats and barley in the neighbourhood, are being destroyed. During the evenings, at the going down of the sun, they seek the board fences and sides of houses in such numbers that in many cases it is impossible to distinguish the colour of the houses, or the material of which they are built."

As yet we do not know whether the Locust ravages are wont to extend over the great fertile region to the north-west of Manitoba—that magnificent agricultural region drained by the Saskatchewan River; we hope, and we are strongly inclined to think, that the plague, if noticeable at all, is there trifling in character and moderate in extent. Should it be otherwise, should that "fertile belt" be as subject to these visitations as the States to the south of it unhappily are, it must prove a great hindrance to its rapid settlement. If, on the other hand, it possesses an immunity not shared in by the Western States, it will certainly draw from them, before many years are over, and as soon as railway facilities are afforded for transportation of goods and produce, a very large portion of those settlers who are now eaten out of house and home. We fully expect to see the tide of immigration which for a few years past has been setting so strongly towards the plains of Kansas and Nebraska, turned towards our own more highly-favoured, even though more northern regions of Assiniboine and Saskatchewan.

Description of the Insect.

Let us turn now to a description of the insect respecting whose powers of destruction we have heard so much. As we have already remarked, there is very little difference in appearance between our common "grasshopper" and the famine-producing Locust of the West. They both belong to the same genus (*Caloptenus*) of the family Acrydidæ and of the order of Orthoptera—straight-winged insects. The Acrydidæ, or Locusts, are distinguished from their kindred, the true grasshoppers, by the following characteristics:—The former have short antennæ (or feelers), never exceeding the body in length; the latter have very long thread-like antennæ. The tarsi, or feet, of the former are three-jointed; of the latter four-jointed. The female of the former has the tip of the abdomen furnished with four very short bony pieces, two of which curve upwards and two downwards (they may be observed in figures 33 aud 34); the female of the latter has a long curved, often sword-shaped, ovipositor. The former, again, live upon the ground; the latter for the most part on grass and trees.

All Orthopterous insects—including, of course, those we are now treating of—undergo what is termed an incomplete metamorphosis—that is to say, their larvæ and pupæ resemble all along the perfect insect, except that the wings are not fully developed and the size of the mature insect is not attained. To make our meaning clearer, we may mention that Lepidopterous insects (butterflies and moths) undergo a perfect or complete metamorphosis; as every one knows, the caterpillar, or larva, is totally different from the winged insect, while the chrysalis or pupa is entirely different from either. In food, habits and appearance, the insect undergoes a complete change at each metamorphosis. In the case of Locusts, on the contrary, one can hardly say with certainty when the larval state ends and that of the pupa begins; or when, again, the pupal condition merges into that of the perfect insect.

The genus *Caloptenus*, to which we are now confined, is represented almost all over the world. In North America eight different species have been described by entomologists, but we are inclined to think that some of these are little more than varieties of others. Three species only are prevalent in large numbers—viz., *C. spretus*, *C. femur-rubrum*, and *C. bivittatus;* the last mentioned does not occur in Canada, so far as we are aware, and is of small importance economically as compared with the other two. We are thus reduced to the two species that we spoke of at the outset: our common red-legged Locust, or "grasshopper" (*Caloptenus femur-rubrum* Burm.), represented in figure *b;* and the hateful Locust (*C. spretus* Uhler), figure *a*.

Fig. 33.

Fig. 34.

The reader will observe that there is but a very slight difference in appearance between the two species. The left hand, our common species, only differs, one may say, from its most destructive fellow on the right, by its having shorter wings. It is owing to this difference in length and expanse of wing that the one species is confined to the neighbourhood where it was born, while the other rises aloft into the air, and is literally "borne upon the wings of the wind" to regions far away from its place of birth.

As the Red-legged Locust must be so familiarly known by every one—during most summers, indeed, it is hardly possible to walk a few yards in the open air without startling numbers into flight—and as it is fairly represented in the above figure (*b*), we may content ourselves with quoting the following brief description by Dr. Harris. The insect is "grizzled with dirty olive and brown, a black spot extending from the eyes along the sides of the thorax; an oblique yellow line on each side of the body beneath the wings; a row of dusky, brown spots along the middle of the wing covers; and the hindmost shanks and feet blood-red, with black spines. The wings are transparent, with a very pale, greenish-yellow tint, next to the body, and are netted with brown lines. The hindmost thighs have two large spots on the upper side, and the extremity black; but are red below, and yellow on the inside. The appendages at the tip of the body in the male are of a long triangular form. Length from three quarters of an inch to an inch; expansion of the wings from 1¼ to 1⅝ of an inch."

The Hateful Locust (*C. Spretus*), figure *a*, can scarcely be distinguished in colour or general appearance from the foregoing species; the principal difference, as already stated, is in the length of the wings. In this species they are about one-third longer than the body of the insect; they are quite transparent with slightly dusky nerves, and when seen high up in the air against the sun, have the appearance of large snow-flakes. The eggs are deposited in the ground, in a cocoon-shaped mass, covered with a tough, glutinous secretion, and vary in number from fifty to a hundred. They are laid in the latter part of the summer and remain in their place of deposit until the following spring; usually they hatch out in March, making their appearance with the earliest vegetation of the locality. There is a good deal of difference of opinion with regard to the head-quarters of this insect; many writers affirm that all the swarms comes from the cañons of the Rocky Mountains; others again, and with more reason, we believe, hold that they breed throughout all the mountain valleys and plains of the west, but chiefly in those vast tracts of uninabited country, lying on the slopes of the Rocky

Mountains in Arizona and New Mexico; they breed also, there can be no doubt, in the regions that they invade, but owing to differences of climate, these broods do not always mature. They delight most in a very dry, hot atmosphere.

Like many other species of Orthoptera, the males produce sounds by means of an apparatus that may be "likened to a violin, their legs being the bows, and the projecting veins of their wing-covers the strings. When a locust begins to play, he bends the shank of one hind leg beneath the thigh, where it is lodged in a furrow designed to receive it, and then draws the leg briskly up and down several times against the projecting lateral edge and veins of the wing-cover. He does not play both fiddles together, but alternately, for a little time, first one and then the other, standing meanwhile upon the four anterior legs and the hind leg which is not otherwise employed." (Harris.) When in flight, the swarm produces a loud pattering sound, which as Dr. Thomas remarks, is probably due to the beating of the air by the wings, as it is not confined to the male sex. If any of our readers are curious upon the subject of insect music, they will find an interesting paper upon "the Songs of the Grasshoppers," by our much esteemed friend, Mr. Scudder, in the *American Naturalist* (vol. 9, page 113); in it not only is the apparatus described, but the notes are set to music, and no doubt can be sung by any accomplished vocalist!

Before closing this portion of our remarks, we would acknowledge our indebtedness, and call attention, to the admirable "Synopsis of the Acrididæ of North America," by the Rev. Cyrus Thomas, Ph.D., published by the Government of the United States as a portion of Dr. Hayden's Report on the U. S. Geological Survey of the Territories. It is magnificently printed in quarto form, and is a complete monograph of the family. We take this opportunity of thanking Dr. Hayden for his courtesy in favouring us with a copy.

MEANS OF REDUCING THE RAVAGES OF THE LOCUSTS.

When a species of insect comes in countless millions suddenly, without any forewarning, upon a locality hundreds of miles away, it may be, from its place of birth, and devours in a single day every green thing upon the surface of the country, it seems almost impossible to suggest any remedy. Something, however, may, we believe, be done, but any measure to be in the least degree efficacious must be adopted universally over a large area of country. Before considering any method of combatting the plague, we must mention one remedy that has been received by the press with some degree of amusement, though gravely propounded by the editors of the *American Naturalist*. After referring to the destitution in Minnesota and the application from its State authorities to the general government for aid, they put the question:—

"Why should not the grasshopper be eaten in turn?" Why not, indeed? For, as they state, "the grasshopper, or locust of the East, is universally eaten in portions of Africa and Western Asia, and pronounced a nutritious and palatable article of diet by Arab chiefs as well as Hottentot savages. They are eaten roasted whole, minus the legs, or roasted and powdered. We would recommend that experiments be made as to the best modes of preparing the locust for food. They should be thoroughly cooked to guard against parasitic worms. Not willing to urge the use of grasshoppers as food for others, without first eating them ourselves, we may say that we have found the grasshopper, first killed by boiling water, and then fried in butter, at least as palatable as many articles of food eaten by civilized people; and to people actually famishing, as is said to be the case in Minnesota, it will be worth their while to avail themselves of a food stuff which millions, perhaps, of people in other lands regard as wholesome."

In corroboration of this use of the locusts, we may add, that Dr. Livingstone speaks highly of the locust as an article of food in Africa, and considers them superior to shrimps. Honey, when it can be obtained, is often eaten with them, and, while improving the flavour, renders them more digestible. We need hardly remind our readers that this was the food of St. John the Baptist in the wilderness. The ancient historian, Herodotus, relates that locusts are used for food, being first dried in the sun, than reduced to powder, and drunk in milk. In his well-known work, on South Africa, Cumming states that "Locusts afford fattening and wholesome food to man, birds and all sorts of beasts; cows, horses, lions, jackals, hyœnas, antelopes, elephants, &c., devour them. Our hungry dogs made a fine feast on them. . . . . We roasted a quantity for ourselves and our dogs." Kirby and Spencet

(People's Edition, page 173,) state that, "as locusts are the greatest destroyers of food, so as some recompense, they furnish a considerable supply of it to numerous nations." After quoting a number of authorities for this statement, they add that "they are preferred by the Moors to pigeons; and a person may eat a plateful of two or three hundred without feeling any ill effects. They usually boil them in water half-an-hour (having thrown away the head, wings and legs.) then sprinkle them with salt and pepper, fry them, adding a little vinegar.' We trust that the editors of the *Naturalist* will try this recipe next summer! Among the food products of the North American Indian (Report of Agricultural Department, Washington, 1870,) we find enumerated grasshoppers or locusts, which are eaten by the Diggers of California and the Plains. They roast them in holes in the ground and mix them with powdered acorns; sometimes they make of them a soup or mush. Mr. Taylor, however, (Smithsonian Report, 1858,) referring to the same custom, declares that this kind of food is always found to sicken the Indians, and that this result is vouched for by the early settlers and the natives, and also by many travellers and voyagers who have visited California and the Rocky Mountain country, and by the Jesuits of Lower California. From these statements we may infer that the locusts on the western side of the Rocky Mountains, considered to be a distinct species from the *C. spretus* of the eastern side, are unwholesome, but it remains to be proved that a nutritious article of diet may not be obtained from the latter. Certainly, it is an experiment worth trying; if successful, we should have a double benefit—the lessening of the numbers of the locusts, and a supply of food wherewith to meet the famine that they have produced. Such a fate for the invaders would be true poetic justice.

In the Smithsonian Report for 1858, to which we have already referred, there is an interesting article, translated from the Russian of V. Motschulsky, in which much valuable information is afforded respecting the mode of dealing with locusts in Southern Russia and other neighbouring countries with regard to natural remedies. He states that "whole generations of them succumb to the climatic influence of those countries to which, impelled by hunger, they betake themselves. Winds and storms not unfrequently cast vast swarms of them into lakes and seas, and other millions perish in crossing rivers. Frogs, lizards and various birds, especially of the starling, blackbird, lark, crow, jackdaw, stork and other species devour them with great avidity. Domestic fowls, as geese, ducks, turkeys and chickens are exceedingly fond of such food." Among insects several species of ichneumons (Hymenoptera) destroy them both in the egg and larval states. He concludes that "of the eggs laid by the locusts about one tenth only succeed in passing through all the transformations of their existence, and with this tenth part alone it comes in contact with the husbandman. But even this is sufficiently great to furnish matter for reflection to every one who knows by experience what an attack of locusts is."

After describing a large number of artificial modes of contending against the locusts, some of which are quite useless, and others more or less successful, he draws up a number of general conclusions. Those at all applicable to North America we shall quote, with a few remarks upon them.

(*a*) "It is necessary to observe in the autumn, especially after a hot summer, where the locusts have deposited their eggs, and to accustom persons appointed for the purpose to do so." Much might, we think, be done in this way both by the State authorities in the west, by municipalities and by individuals.

(*b*) "As soon as the labours of tillage will permit, people should be sent out in the fall to collect the locusts' eggs, provided with instruments for turning up the ground. If the eggs are deposited where ploughs and harrows can pass these should be made use of. The egg-tubes of the locusts should be poured into sacks, and either measured or weighed, and a suitable award paid for the amount collected, so as to stimulate numbers to busy themselves in this useful labour." If a certain price per bushel or hundred-weight were offered for the egg-cases by the various local authorities in the regions affected, not only would the numbers of the locusts be greatly reduced, but remunerative employment would be afforded to those who have been suffering by their ravages. In many places the locusts deposit their eggs where they have just ravaged the fields, consequently the inhabitants will not have far to go in order to find the germs of the next year's trouble. It would be desirable, too, that well-equipped expeditions of competent persons should be sent out to explore the regions bordering on the Rocky Mountains, from which the swarms emanate in the first instance.

(*c*) "All the places where locusts' eggs are found should be ploughed over, if possible.

two or three times very late in the autumn. Special attention should also be given to bar-spots in the fields, where not unfrequently great quantities of egg-tubes may remain unobserved." This plan of deeply ploughing under the eggs of the grasshoppers, or of ploughing them up so as to expose them to all the changes of the weather, has been found very effective in Manitoba and other places.

(*d*) "Breeding large quantities of domestic fowls and training them to feed on young locusts, is exceedingly advantageous to the husbandman." Geese, chickens, turkeys and guinea-fowl are especially mentioned. This plan would be of very slight use as a protection against the migrating swarms of locusts, but it might be of some little value in places where they breed. It is well known that a large brood of turkeys is invaluable to a farmer where the common red-legged locust abounds.

(*e*) If the locusts settle anywhere in a thick mass, large numbers may be destroyed in the evening, when they are quiet, by means of heavy iron or wooden rollers drawn by horses or oxen. This method might be of some slight advantage if generally adopted, but usually, by nightfall, most of the damage is done.

A large number of other methods are mentioned, but they are entirely inapplicable to the vast and thinly populated regions of the west.

A remedy is much employed, on the other hand, in America which could not be made use of in Russia, viz., fire. It is only during dry and very hot weather that the invasions take place. When a swarm has once alighted and has commenced the work of destruction it is often practicable to set fire to the fields and crops in places and thus kill or drive away the destroyer. In this case the remedy is almost as bad as the disease, but yet it has been adopted in many instances with good results.

Noises made by trumpets, guns, cannons, &c., sometimes drive away a small body of locusts, but they are utterly useless when the invasion takes place on a large scale.

On the whole, it seems as if man can do but very little to ward off the attacks of this fearful scourge. Still it is proper that every effort should be made to find out the exact habits of the insect, and the particular localities from which it emanates; it is fitting, too, that no means should be left untried that affords any prospect of lessening the destruction that they occasion. The Arabian fable we cannot but feel, has much truth at the bottom of it; they represent a locust as saying to Mahomet, "We are the army of the Great God; we produce ninety-nine eggs, if the hundred were completed we should consume the whole earth and all that is in it." While the people of the West are in the hands of Providence to protect them from such mighty armies as these, they can best help themselves by going to the root of the evil—that is to say, by reducing to the utmost extent the numbers of eggs that are laid for future broods.

After all the accounts that we have given of these insects, we feel that nothing can equal in sublimity and correctness the description afforded by the Prophet Joel, ii. 2—11.

"A day of darkness and of gloominess, a day of clouds and thick darkness, as the morning spread upon the mountains: a great people and a strong; there hath not been ever the like, neither shall be any more after it, even to the years of many generations. A fire devoureth before them and behind them a flame burneth: the land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them. Like the noise of chariots on the tops of the mountains shall they leap, like the noise of a flame of fire that devoureth the stubble; as a strong people set in battle array. Before their face the people shall be much pained; all faces shall gather blackness. They shall run like mighty men; they shall climb the wall like men of war; and they shall march every one on his ways, and they shall not break their ranks, neither shall one thrust another, they shall walk every one in his path, and when they fall upon the sword they shall not be wounded. They shall run to and fro in the city, they shall run upon the wall, they shall climb up upon the houses, they shall enter in at the windows like a thief. The earth shall quake before them, the heavens shall tremble, the sun and the moon shall be dark, and the stars shall withdraw their shining, and the Lord shall utter His voice before His army, for His camp is very great, for He is strong that executeth His Word, for the day of the Lord is great and very terrible, and who can abide it?"

While the foregoing paper was passing through the printer's hands, we cut from the Albany *Country Gentleman*, the following official statement of the misery caused by the plague of

Locusts in the Western States, which fully corroborates any expressions that we have used above:—

"The Western Grasshoppers.—Commissioner-of-Agriculture Watts has issued a synopsis of information received concerning the extent of suffering from the grasshopper plague, which we copy, somewhat condensed:

"*First.*—The area of this visitation comprises a zone 200 to 225 miles wide, extending from the settlements of Southern Dakota, through Nebraska and Kansas, over 500 miles in length, and inclining to south. A few western counties of Iowa and Minnesota report injuries. The extent of territory visited by these insects in 1874 very considerably exceeds 100,000 square miles.

"*Second.*—The grasshopper district west of Missouri embraces population of Kansas, Nebraska and Southern Dakota, amounting to over 500,000 in 1870, with a large increment since. Including counties east of the Missouri in Iowa and Minnesota more or less affected by the plague, I think it not extravagant to assign 750,000 as the approximate population of these districts.

"*Third.*—In Kansas, cases of total destitution in 50 counties reported vary from 40 to 2,000; reports from counties not in this list show injuries as severe as in any others. The average of such cases 555 in each county. These do not include cases of partial destitution, which, in some counties are quite large, ranging from 26 to 1,000. The cases of total and partial destitution in these 30 counties amount to over 40,000, while in other counties there are, probably, cases unreported sufficient to swell the aggregate to 50,000 .In the more thinly populated counties of Nebraska and Dakota the number of such cases is, of course, smaller. Adding the cases east of Missouri, I do not think it out of the way to estimate the number of people affected by this pest at 75,000 to 100,000."

ON SOME INJURIOUS INSECTS.

By W. Saunders, London, Ontario.

The Codling Moth (*Carpocapsa pomonella*, Linn).
The Pear Tree Slug (*Selandria cerasi*, Peck).

The Codling Moth (*Carpocapsa pomonella*, Linn).

This is, indeed, one of the most troublesome insects with which we have to contend, and one of the most difficult to deal with, and, although of foreign introduction, has spread over the greater part of our country entailing a yearly loss on our apple crop which it would be difficult to over estimate. We shall briefly give the various features in its life history with a cut illustrating the insect as it appears in its various stages, and then detail such measures as have been suggested with a view to its destruction.

Fig. 35.

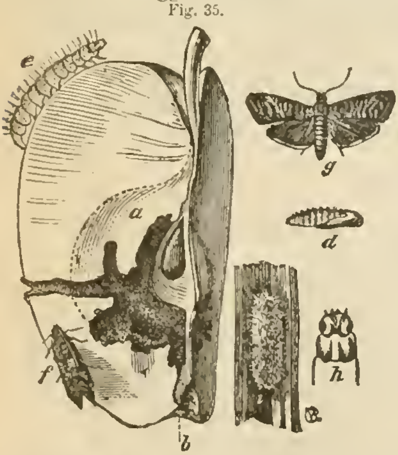


Fig. 35 represents a section of an apple which has been occupied by a codling worm—*b* shews the point of entrance of the young worm, the place of exit of the matured larva being shown at the left hand side of the figure; *e*, the full-grown worm: *h*, its head and first segment magnified; *i*, the cocoon; *d*, the pupa removed from the cocoon; *f*, the moth with wings closed; *g*, the same with wings expanded.

Soon after it leaves the fruit in the fall, the larva selects some secluded of nook or cranny, under loose bark of tree or other convenient hiding place, and there spins its tough papery-looking cocoon, and within this secure retreat it remains in the larval condition until early in spring, when, a few weeks before the final change takes place, it enters the chrysalis state. It seems strange that this tiny creature should be endowed with such a power of varying the length of its larval existence, that at this season the larva should remain so long unchanged, while, in the case of the earlier summer brood, the change to chrysalis takes place almost immediately after the spinning of the cocoon. About the time of the opening of the apple blossoms this insect bursts its prison house and appears as a winged moth. See Fig. 35, *g*.

The moth deposits her eggs singly, and usually in the calyx or eye, just as the young apple is forming. In about a week the larva is hatched, and at once the tiny worm begins to eat its way through the apple to the core. Its castings are commonly pushed out through the hole by which it has entered, which is from time to time enlarged for the purpose; these usually adhere to the apple, so that, before the worm is full grown, infested fruit may generally be detected by the mass of reddish-brown exuviæ protruding from the eye. Sometimes, as the larva approaches maturity, it eats a passage through the apple at the side, and out of this opening its castings are thrust, and here the mature worm escapes when full grown. The occupied apple generally falls prematurely to the ground, sometimes with the worm in it, but more commonly after the worm has escaped. The larvæ which leave the apples while still on the trees, either crawl down the branches to the trunk of the tree, or otherwise let themselves down by a fine silken thread, which they spin at will, to the ground; in either case, the greater portion of them take refuge under the rough loose bark on the trunk of the tree, and there spin their cocoons. The second brood of moths appear from about the twentieth to the last of July. We have taken them on the wing at night as early as the nineteenth, but specimens confined in breeding boxes, have not, as a rule, made their appearance until about the end of the month. In the winged state they seldom live more than a few days, and in this brief space they pair, and the female deposits her eggs for the second brood of larvæ, and, for this purpose, wisely shows a preference for the later apples. The codling moth also attacks the pear, in some localities, most disastrously for the crop; the fruit, however, seldom falls to the ground until some time after the worm has left.

Dr. Wm. Le Baron, State Entomologist, of Illinois, has devoted much time and attention to the study of the history and habits of this insect, and has published in his last annual report an excellent paper on this subject. Mr. Riley, of St. Louis, has also made observations and experiments on this same insect, which corroborate those of Dr. Le Baron, these are referred to in the fifth and sixth annual reports on the noxious, beneficial and other insects of the State of Missouri; from both these sources we shall glean and make free use of such facts as we think will interest our readers.

The number of eggs each moth is capable of laying will, probably, average not less than fifty, but these are not all matured at once, but may be found, by careful dissection of the body of the moth, in various stages of development. Hence they must be deposited successively, the period probably extending over a week or more.

Remedies.

This is an all important matter in which, in this instance, man must rely chiefly on his own efforts, for although, doubtless, a large number of the worms and chrysalids are annually destroyed by birds, and another limited portion by parasitic insects, still from the advantageous shelter afforded them by the apple, and the fact of their movements after leaving it being mostly in the night time, the codling worm enjoys much immunity from natural foes.

Dr. Le Baron divides this practical portion of the subject, as far as man's work is concerned, into four heads, and here we cannot do better than quote from his excellent paper:—

"1st. Destroying the insects in their winter quarters.

"2nd. Picking the wormy apples from the trees.

"3rd. Gathering the wormy apples from the ground, or letting swine and sheep have the range of the orchard.

"4th. Entrapping the worms in bands and other contrivances."

1st. *Destroying the insects in their winter quarters.*—When we consider that each female moth is capable of laying fifty eggs or more, and that every worm of the first brood ruins an apple, we can see the importance of destroying these insects before they leave their winter quarters. We have already mentioned that in the state of nature, these worms pass the winter in cocoons, concealed under the bark, or in the crevices of apple trees. The summer brood of worms, which remain but two weeks in the pupa state, sometimes content themselves with a very slight protection, but it is the nature of the insect to seek deep concealment, and the instinct of the second brood, which is to survive the winter, leads them to search for the deepest protection they can find. We, therefore, rarely find them under shallow and loose scales of bark, but very often in deep cracks and crevices, partially embedding themselves in the substance of the wood or bark. Any superficial scraping of the trees, or whitewashing, or other outward applications would not, therefore, be likely to reach many of them; and inasmuch as they may be hidden upon any part of the trunk or large branches, any attempt to discover them with the intention of digging them out would, evidently, be impracticable; but at the point where we become powerless the woodpeckers come to our aid. In their search for just such hidden worms as these, those busy foragers unite business with pleasure, and all through the wintry day the sharp rattle of their beaks may often be heard in the orchard, as with ear intent and sharpened beak, and appetite not less sharp, they pursue their hidden prey with unerring and fatal precision.

"A more efficacious way of destroying these worms as far as our own instrumentality is concerned, is to search for them about the barrels and bins in which fall and winter apples have been kept. I have heard of instances where the sideboards of the bins have been taken away from time to time, as the apples were removed and thrown one upon another, in which these boards became so fastened together by the webs of the worms between them, that a number of boards could be raised by taking hold of the upper one only. There can be no doubt that the destruction of the codling-worm at this stage of its existence, would be very effective, and that it has been by far too much neglected."

Our esteemed President, Rev. C. J. S. Bethune in his remarks on this subject in our report for 1870, says "a very favourite locality for these worms is the space between the hoops and staves of the barrels. We have found hundreds in such positions especially in the winter of 1868–9. Where this occurs it is by all means worth while to scald the barrels thoroughly outside as well as inside, as soon as they are emptied or even to burn them. When boxes or bins are made use of for storing the fruit, the worms are sure to find some crevices to suit them, which should be searched for, and treated as in the case of the barrels."

2nd. *Picking the wormy apples from the trees.*—We have stated above that the young worms, soon after they have entered the apple, begin to throw out their castings through the hole which they made in entering. As this hole must be originally almost microscopically minute, it is evident that they must enlarge the opening for this purpose. We further stated that a portion of the castings adhere to the rough and shrivelled calyx, forming a rust coloured mass, which is easily seen from the ground below. Some horticulturists have availed themselves of this circumstance for the purpose of removing the wormy apples from the trees before the worms have escaped. The plan is to beat off the wormy apples, or else pick them off by means of a wire hook attached to the end of a pole. These two methods can be very usefully combined by first jarring or beating off those apples which readily fall, and then going over the trees a second time with the pole and hook. The apples thus removed should of course be fed to swine, or otherwise treated so as to destroy the worms within. Too much value cannot be attached to these simple expedients, which in the case of a few choice trees, or even a small orchard, might almost be made to supercede the necessity of any other treatment."

"3rd. *Gathering the wormy wind-fall apples from the ground, or letting swine or sheep have the range of the orchard.*—This plan has been generally recommended as of very great importance. Its efficacy will depend, of course, upon the proportion of worms which fall to the ground in the apples, as compared with those which leave the apples whilst hanging upon the tree. Those which crawl down the branches spin up before reaching the ground, and those which let themselves down by a thread, would, for the most part, be detected only by birds or by domestic fowls, and as there is reason to believe that they usually perform this act in the night, even these must fail to capture them."

"With regard to those wind-falls which contain worms, it is necessary to gather them frequently, that is every day or every second day at farthest. The apples do not usually fall until the worms are nearly matured, and they leave them in the course of a few days. If you examine indiscriminately a large number of wind-fall apples lying under the trees, you will be surprised to find how few worms they contain, they evidently having left the fruit before it fell, or soon after."

"But the most important question in this connection is, what proportion of the worms leave the apples before they fall from the tree? I have endeavoured to arrive at an approximate estimate upon the subject by putting two or more bands upon the same tree, upon the presumption that the worms descending from above will spin up in the upper band, and those crawling up from the ground in the lower. The following tables numbered for the purpose of reference give the results of these experiments. The wind-fall apples were left in every case as they fell upon the ground.

"On the tenth of July, 1871, I put bands as follows, upon four trees, the ground underneath being bare, or free from grass or rubbish of any kind. One band was put about a foot from the ground, another about two feet higher on the trunk, and others on two or three of the larger branches, eight or ten feet from the ground. They were examined July 28th, eighteen days after they were put on."

No. 1.

Whole number of worms in all stages.............................. 120

Number of empty pupa cases	28	
Number of pupæ	127	
Number of enclosed but unchanged larvæ	55	
	—-	220

Number of all stages in lowest bands	94
Number of all stages in upper trunk bands	83
Number of all stages in bands on limbs	43

No. 2.

(Same trees examined August 11th, two weeks later.)

Number of pupa cases	16	
Number of pupæ	24	
Number of larvæ	15	
	—-	65

Of these there were in lowest bands 21, middle or upper trunk 13, and on limbs 31.

No. 3.

(Same trees August 25th, two weeks from last.)

Number of pupa cases	1	
Number of pupæ	4	
Number of larvæ unchanged	41	
	—	46

Distributed as follows, in lowest bands 24, middle or upper trunk 15, in bands on limbs 7.

No. 4.

(Same trees September 9th, fifteen days later. Found larvæ only.)

Number in lowest bands	33	
Number in middle bands	39	
Number in bands on limbs	9	
	—	81

No. 5.

(Same trees September 23rd, two weeks later. Larvæ only.)

Number in lowest bands	28	
Number in middle bands	22	
Number in bands on limbs	4	
	—	54

"On the fourth of July, 1872. I selected a smooth thrifty apple-tree, six inches in diameter, growing upon grass land, and well filled with apples, bearing many marks of being wormy, but remarkably tenacious, and consequently but few lying upon the ground. Put two bands upon the trunk, one a foot and a half above the other.

"Examined July 23rd, a moderate number of apples having in the meantime fallen upon the ground.

Whole number in the lower band	150	
Whole number in the upper band	110	
	——	260

"The bands in this experiment were made of carpet six inches wide, and long enough to go twice around the tree, making a very abundant covert for the worms. As might have been anticipated, in this case the greater part of the worms in the upper band were found in its upper half, indicating that the worms had reached it by descending from above ; and on the other hand, the greater part of the worms in the lower band were in its lower half, showing that they had come up from the ground. We say the greater part, but not all, implying that some worms in each case had passed over one band and gone on to the next."

The above tables furnish data for many interesting and practical deductions.

"First, as respects the question now under consideration, namely, what proportion of the worms leave the apples before they fall from the tree ; if we add together all the worms found in the highest and the lowest bands respectively, and divide those in the middle or upper trunk bands equally between the other two, we shall have 436 in the lower bands, and 290 in the upper, implying at first view that much the larger number came up from the ground. But there are several circumstances in these experiments which must be taken into account, and which will somewhat modify this conclusion. First, many of the limbs have no bands upon them, and the worms from these may be presumed to have found covert chiefly in the upper bands on the trunk. Second, two of the trees experimented upon were large rough trees, and a part of the worms undoubtedly spun up under the scales of bark on the limbs above the bands. And thirdly, we do not know what proportion of the worms may have let themselves down to the ground by threads, and thus found shelter under the lowest bands. Taking these circumstances into account, we shall perhaps arrive at an approximation sufficiently accurate for practical purposes, if we divide the whole number of worms equally between the upper and lower bands, from which we infer that about half the worms crawl down the tree, and the other half reach the ground either in the apples or by threads. We must infer from this as far as one series of experiments enables us to judge, that the gathering of windfall apples, either by ourselves or by the aid of domestic animals, enables us to destroy less than half of the codling worms.

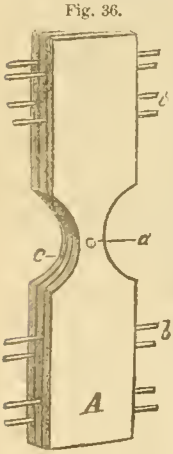
"The animals used for this purpose are hogs and sheep, the latter are more cleanly, and equally effective, but they are liable to damage young trees by gnawing the bark."

4th. *Entrapping the worms under bands,&c.*—Our own experience in a series of experiments, very similar to those above detailed, was much the same, excepting in the number of larvæ captured, which from five trees did not, at any one time, exceed 47, the distribution in the upper and lower bandages being nearly in the same proportion as that given by Dr. Le Baron. This method of entrapping the worms under bands is without doubt the most effective remedy yet devised, and if it were generally and persistently followed would effect a large yearly saving in the crop of this valuable fruit. It is of great importance that united effort should be made in this case, as the evil is an increasing one, and the yearly loss now entailed something enormous. With us we have known the full-grown larva to be found under bandages as early as the 4th of July, hence we think that their application should not be delayed later than the 1st. Indeed it would be wise to apply them a few days earlier than this. By referring to the first and second captures in Dr. Le Baron's first experiment, it will be observed that quite a number of empty pupa cases were found, 54 in all, showing that sufficient time had elapsed before examination to allow of the larvæ passing through the stage of chrysalis, and escaping as a perfect insect to continue its work of destruction. To prevent escapes of this sort we should recommend that the bandages be examined every ten days until the latter end of August. After this, worms of the second brood only will be found, and since these remain in the larval state until the following spring, the bands subsequently might be examined at leisure.

As to the material to be used for bandaging we have found old sacking, (which can often be obtained at trifling cost), to answer a very good purpose, cut into strips from six to eight inches wide, and long enough to go two or three times around the tree, and tied in the middle with a piece of stout twine. Strips of old carpet or cloth where they can be obtained, would, of course, prove equally good. In the excellent report of the Michigan Pomological Society, for 1873, we find that much interest is being excited throughout that State in reference to the codling moth, and many practical discussions are reported on the best means of fighting it, all however, agreeing in recommending the use of bandages. One apple grower recommends a bandage of common brown paper tied around the tree with a string ; another while recommending the paper thinks the string too much trouble, and advises the use of a tack to fasten the end of the bandage with. One advantage claimed for this material for bandaging is that birds readily find the hiding places of the larvæ, pierce through the thin covering and capture the worms, thus employing the efficient aid of our feathered friends in this useful work. One gentleman is reported to take no trouble to remove his paper bandages, merely securing them to the tree and allowing the birds to do the capturing, replacing the paper only when it is torn to shreds. Another prefers to use bands of cloth four inches wide, fastening the end with a tack, he usually finds all the worms by simply turning the edges of the cloth up and down without taking off the band. Still another thinks all strings and tacks a bother, and fastens the bandage quite securely by merely tucking the end under.

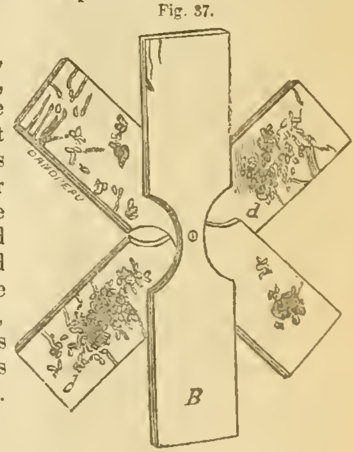
With reference to the economy of paper bandages, Mr. Riley in his fifth annual report, thus writes, "common straw paper 18 x 30 can be bought for 60 cents per bundle. Each bundle contains 240 sheets, and each sheet folded lengthwise thrice upon itself, will give us eight layers between two and three inches wide, and be of sufficient length to encircle most ordinary trees. It is easily drawn around the tree and fastened with a tack, and so cheap that when the time comes to destroy the worms, the bandages containing them may be detached, piled in a heap and burned, and new ones attached in their place. If eight bandages are used to each tree during the season the cost will be just two cents per tree."

Fig. 36.



Wier's shingle trap, (see Figs. 36 and 37, 36, the trap closed, 37, the same opened), has also been recommended, it is made usually of three pieces of old shingle about a foot long, and from four to six inches wide, fastened together and then nailed or screwed to the tree. In arranging the pieces the narrower ones should be placed next to the tree; it is also recommended to put a few bits of straw between the shingles so as to keep them slightly apart, experience, however, teaches that this trap is not so efficient or convenient as either of the bandages already referred to.

Fig. 37.



Brief Summary.

While all other available means tending to the lessening of the numbers of the codling moth worms should be unhesitatingly employed, the chief reliance should be placed on the bandages, use strips of cloth, old carpet or sacking where these can be had, but if these materials are not readily procurable use paper or cotton. Bandages should be from four to eight inches wide and either fastened with a string or with a tack at the end, and will be all the better if long enough to go twice around the tree; they should be fastened about half way up the trunk of the tree some time during the latter part of June, and be examined every ten days from the first of July until the last of August and at least once after the crop is secured. Care must be taken in unwinding the bandages to prevent the worms from escaping by dropping to the ground, which they readily do when their cocoons are thus torn asunder. A common clothes wringer, to pass the bandages through, is one of the readiest and surest methods of destroying the worms; and in this way the bandages can be rapidly handled and re-applied. Be careful to scrape the rough bark off old trees so that the worms may not find suitable hiding places either in descending or ascending the trunk until they reach the bandage; attend to these instructions regularly and thoroughly, and try and induce all your neighbours to follow your example and rest assured that good results will attend united effort.

Parasites recently discovered.

To Mr. Riley, of St. Louis, belongs the honour of being the first to discover true parasites affecting the codling moth worm, descriptions of which are given in his Fifth Annual Report (873). "Both of them are Ichneumon flies and the first may be called

"THE RING-LEGGED PIMPLA (*Pimpla annulipes*, BR).

FIG. 38.

"This is a black fly, varying considerably in size, the female sometimes measuring but ¼, at others fully ½ inch exclusive of ovipositor; the male somewhat smaller. The genus Pimpla was briefly characterized in my last report, p. 43, where it was shown that this same species attacks the walnut care bearer (*Acrobasis juglandis*, LEB). I annex a lateral outline of a female Pimpla, Fig. 38, the male has a more slender abdomen which is unarmed.

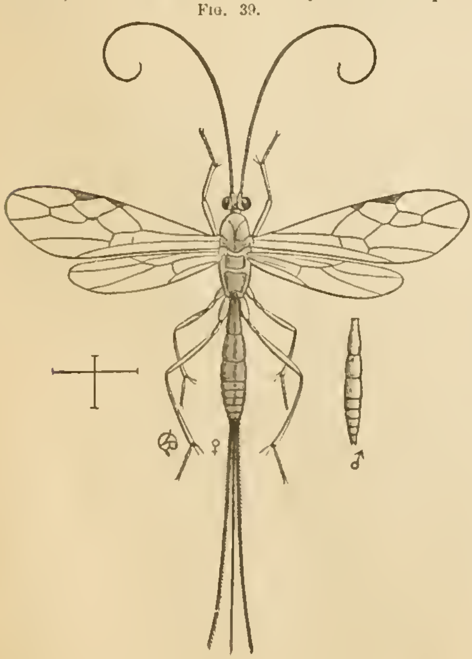
"PIMPLA ANNULIPES is black: the abdomen rough punctured above, with the borders of the joints polished and inclined to brown. The tegulæ are white, and the legs are reddish, with the exception of the middle and hind tibiæ, which are dusky—especially the hind pair—and have a broad white annulus, sometimes indistinct on the middle pair. The posterior tarsi are dusky, especially at tip. The palpi are pale yellow. Cresson says it may be distinguished from the other species of the genus, by the scutellum being black, the tegulæ white, and the anterior coxæ yellowish red.

"This fly eats its way through the chrysalis and the cocoon of the Codling Moth, without having previously made any cocoon of its own. It was quite abundant last summer as from one lot of *Carpocapsa* cocoons, I obtained 21 parasites—all of them females but one. It is a widely distributed and common species. The second parasite may be called the

"DELICATE LONG-STING (*Macrocentrus delicatus*, CRES).

"It has recently been described by Mr. E. T. Cresson (*Trans. Am. Ent. Soc.* iv., p. 178), and is a somewhat variable species, occurring throughout the Eastern, Middle and Western, States, and in Mexico. I subjoin a description drawn up from my bred specimens.

FIG. 39.



"Male. Length 0·25; expanse 0·45; inch. Slender, colour pale, polished, honey yellow; uniformly and sparsely pubescent; tinged with brown superiorly, the basal joint of abdomen and a medio-dorsal line on the other joints being quite brown. *Head*, with the eyes (except at disc), and a spot between ocelli, brown-black; palpi long and almost white; antennæ one-fourth longer than the whole body, about 48 joints, exclusive of bulbus, curled at tip, the ends of basal joints and the whole of joints dusky. *Thorax*, with the sutures well defined, and two small triangular black spots behind front tegulæ, the metathorax strongly trilobed; legs very long, pale honey yellow, with tips of tibiæ and tarsi faintly dusky; wings yellowish, hyaline and iridescent, with the veins luteous, and the stigma pale honey yellow.

"Female. Rather larger and with the abdomen somewhat paler, otherwise similarly marked. Ovipositor yellow, ⅕ longer than body, the sheaths quite pilose, and inclining to fusscou. Described from 2 females and 1 male.

"It is a graceful fly with very long antennæ and legs, and the female with a long ovipositor Fig. 39, "(the hair lines at the side of the figure show the natural size of the fly)." The colour is pale honey yellow inclining to brown above. The unfortunate apple-worm is probably pierced while yet in the fruit, as it always succumbs soon after forming its cocoon, and before changing to chrysalis ; while in the case of *Pimpla*, it is probably attacked either while leaving the fruit or after having spun its cocoon. The larva of the Delicate Long-sting forms, for itself, within the cocoon of its victim, a sufficiently tough, thin, oblong-oval, shiny, brown cocoon from which the perfect fly issues by cutting open a lid at one end.

"As both these parasites transform within the *Carpocapsa* cocoon, it is next to impossible and quite impracticable, to separate friend from foe in removing and destroying the contents of the bandages. But where it is desired to disseminate the parasites they may be bred by enclosing large numbers of *Carpocapsa* cocoons in some tight vessel."

On the 13th of August, 1873, we took a number of chrysalides of the Codling Moth under a bandage on an apple tree and among them there was one which was infested by Icheumons. The chrysalis when emptied was found to contain six of the parasitic larvæ of which the following description was taken. Length a little over one-tenth of an inch, body tapering almost to a point towards the head. Colour, dull, yellowish white with a tinge of yellow along the dorsal region, very transparent the internal organs showing plainly through. On each segment is a transverse row of short whitish spines, terminal segment encircled with stouter whitish spines. No proper feet or prolegs, but in moving, the mouth-parts attach first with a sucker-like disk and the hinder portions of the body are drawn gradually forward, different portions of the under surface bring furnished with small fleshy prominences which are attached and in turn withdrawn from the surface on which the larva is moving ; the principal points of attachment, however, seem to be the first and terminal segments, under the latter when viewed sideways, there appears a fleshy projection much larger than any of those on the other segments, and this projection expands into a flattened disk which holds the larva firmly to the place of attachment.

We did not succeed in rearing these larvæ ; after the chrysalis which contained them was broken open they, one after another died in spite of all our efforts towards their preservation. Whether this would have proved distinct from the species last described by Mr. Riley, and thus made a third true parasite on this pest we are unable at present to determine.

The Pear Tree Slug.

Selandria Cerasi. Peck.

In the year 1790 Prof. Peck wrote a pamphlet entitled "Natural History of the Slug Worm," which was printed in Boston the same year by order of the Massachusetts Agricultural Society, and which obtained the Society's premium of fifty dollars and a gold medal. This, as far as we have been able to learn, was the first published record relating to the ravages of this insect in America. Forty-two years later (in 1841) Dr. Harris published his valuable treatise "On some of the insects injurious to vegetation in Massachusetts," in which when treating of this insect he gives the substance of Prof. Peck's remarks in a condensed form, portions of which material we shall avail ourselves of without further acknowledgement. Although seventy-five years have passed since Prof. Peck's memoir was written, but very little has been added during the interval to our common stock of knowledge in reference to this pest. In the meantime, however, it has spread over the whole country, damaging more or less seriously the foliage of our pear, cherry, quince and plum trees every year.

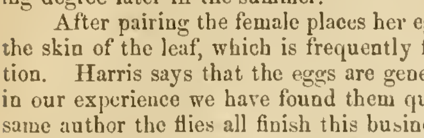
These insects pass the winter in the chrysalis state, the parent flies, the progenitors of the mischievous brood of slugs, appearing on the wing from about the third week in May until

Fig 40.

the middle of June. The fly (See Fig. 40) "is of a glossy black colour, excepting the first two pairs of legs, which are dirty yellow or clay coloured with blackish thighs, and the hind legs which are dull black with clay coloured knees. The wings are somewhat convex and rumpled or uneven on the upper side like the wings of the saw flies generally. They are transparent, reflecting the colours of the rainbow, and have a smoky tinge forming a cloud or broad band across the middle of the first pair ; the veins are brownish. The body of the female measures more than one-fifth of an inch in length, that of the male is smaller." Early in June these flies may be found resting in the early morning, or in the cool of the evening, on the upper or under side of the leaves of pear, cherry or plum trees, some seasons they are very plentiful, while at other times but few are met with. When jarring our plum trees for curculios at this season we usually find some on the sheets after jarring, they fall to the ground very much like the curculio does, and remain for a short time motionless; their structure, however, is not such as will permit of their disguising themselves as thoroughly as the "little turk" does, and hence they are easily detected. During the past season these flies were very numerous during the early part of June, and their progeny was destructive in a corresponding degree later in the summer.

After pairing the female places her eggs singly within little semicircular incisions through the skin of the leaf, which is frequently followed by some discolouration at the point of insertion. Harris says that the eggs are generally placed on the lower side of the leaves, whereas in our experience we have found them quite as often on the upper side. According to the same author the flies all finish this business of egg depositing and disappear within the space of three weeks. "The flies have not the timidity of many other insects, and are not easily disturbed while laying their eggs. On the fourteenth day afterwards the eggs begin to hatch, and the young slug worms (see those on leaf in Fig. 41) continue to come forth from the fifth of June to the 20th of July, according as the flies have appeared early or late in the spring."

Fig. 41.



"At first the slugs are white; but a slimy matter soon oozes out of their skin, and covers their backs with an olive-coloured sticky coat. They have twenty very short legs, or a pair under each segment of the body excepting the fourth and the last. When fully grown (See *a* Fig. 41) they are about nine-twentieths of an inch in length. The head which is of a dark chestnut colour is small, and is entirely concealed under the fore part of the body. They are largest before, and taper behind, and in form somewhat resemble minute tadpoles. They have the faculty of swelling out the fore part of the body, and generally rest with the tail a little turned up. These disgusting slugs live mostly on the upper side of the leaves of the pear and cherry trees, and eat away the substance thereof, leaving only the veins and the skin beneath untouched. Sometimes twenty or thirty of them may be seen on a single leaf; and in the year 1797 they were so abundant in some parts of Massachusetts that small trees were covered with them, and the foliage entirely destroyed, and even the air by passing through the trees, became charged with a very disagreeable and sickening odour, given out by these slimy creatures. The trees attacked by them are forced to throw out new leaves, during the heat of the summer, at the ends of the twigs and branches, and this unseasonable foliage which should not have appeared until the next spring, exhausts the vigour of the trees, and cuts off the prospect of fruit."

"The slug worms come to their growth in twenty-six days, during which period they cast their skins five times. Frequently as soon as the skin is shed, they are seen feeding upon it; but they never touch the last coat which remains stretched out upon the leaf. After this is cast off, they no longer retain their slimy appearance and olive colour, but have a clean yellow skin, entirely free from viscidity. They change also in form and become proportionally longer, and their head and the marks between the rings are plainly to be seen. In a few hours after this change they leave the trees, and, having crept or fallen to the ground, they burrow to the depth of from one inch to three or four inches, according to the nature of the soil. By moving their body the earth around them becomes pressed equally on all sides, and an oblong, oval cavity is thus formed, and is afterwards lined with a sticky glossy substance, to which the grains of earth closely adhere. Within these little earthen cells or cocoons the change to chrysalids takes place, and in sixteen days after the descent of the slug worms, finish their transformations, break open their cells, and crawl to the surface of the ground, where they appear in the fly form. These flies usually come forth between the middle of July and the 1st of August, and lay their eggs for a second brood of slug-worms. The latter come to their growth and go into the ground in September and October, and remain there till the following spring, when they are changed to flies and leave their winter quarters. It seems that all of them, however, do not finish their transformation at this time; some are found to remain unchanged in the ground till the following year; so that if all the slugs of the first hatch in any one year should happen to be destroyed, enough from a former brood would still remain in the earth to continue the species."

"The disgusting appearance and smell of these slug-worms do not protect them from the attacks of various enemies. Mice and other burrowing animals destroy many of them in their cocoons, and it is probable that birds also prey upon them when on the trees both in the slug and winged state. Professor Peck has described a minute ichneumon fly, stated by Mr. Westwood to be a species of Encyrtus, that stings the eggs of the slug fly, and deposits in each one a single egg of her own. From this in due time a little maggot is hatched, which lives in the shell of the slug-fly's egg, devours the contents, and afterwards is changed to a chrysalis, and then to a fly like its parents. Professor Peck found that great numbers of the eggs of the slug fly, especially of the second hatch, were rendered abortive by this atom of existence.

Sand, ashes, lime and hellebore have been recommended as remedies for this pest but the last mentioned is by far the most reliable. In 1870 we tried some experiments with these remedies, and reported in the CANADIAN ENTOMOLOGIST for September of that year, as follows :—

THE PEAR TREE SLUG.

This disgusting little larva, the progeny of a little blackish sawfly, has been very abundant during the past season and has been the subject of some notes and experiments. In the first place we noted that there were two broods in the season. The parents of the first brood, which pass the winter in the chrysalis state, appear on the wing about the second or third week in May, depositing eggs from which the slugs are hatched, becoming full grown from the middle to the end of June, then entering the chrysalis state underground ; the second brood of the flies make their appearance late in July. This year we noticed them at work depositing eggs on the 21st, the young slugs were abundant and about a quarter of an inch long on the eighth of August, and by the sixth of September many of them were full-grown. With us they were much more destructive to cherry trees than to pear, consuming the upper surface of the leaves, soon giving the trees a scorched and sickly aspect, and in many cases the foliage fell off, leaving the trees almost bare.

As soon as the slugs were observed at work in Spring, they were treated to a plentiful supply of dry sand, thrown up into the higher branches with a shovel, and shaken over the lower ones through a sieve, which stuck thickly to their slimy skins, completely covering them up. Thinking we must have mastered them by so free a use of this long trusted remedy, we took no further heed of them for some days, when to our surprise, they were found as numerous as ever. The next step was to test this sand remedy accurately to see what virtue there was in it. Several small branches of pear trees were selected and marked, on which there were six slugs, and these were well powdered over—entirely covered with dry sand ; on examining them the next morning it was found that they had shed the sand-covered skin and crawled out free and slimy again. The sand was applied a second and third time on the same insects with similar results ; and now being convinced that this remedy was of little value, they were treated to a dos of hellebore and water, which soon finished them. Ashes were now tried on another lot, the same way as the sand had been, with very similar results. It was also intended to try fresh air slacked-lime, which we believe would be effectual, but having none on hand just then, the experiment was postponed, and the opportunity of testing it lost for the season. We must not omit mention of an experiment with hellebore. On the 13th of August, at eight a.m., a branch of a cherry tree was plucked, on which there were sixty-four slugs ; the branch had only nine leaves, so that it may be readily imagined that they were thickly inhabited. A dose of hellebore and water was showered on them about the usual strength, an ounce to the pailful, when they soon manifested symptoms of uneasiness, twisting and jerking about in a curious manner ; many died during the day, and only six poor, sickly-looking specimens remained alive the following morning, and these soon after died.

During the past season these slug worms have been unusually abundant on our pear trees, in many cases destroying the foliage so thoroughly that they looked as if they had been scorched by a fire, every leaf in some instances dropping from the trees, so that for a time they were bare as in mid-winter. Nearly a thousand trees in the young pear orchards of the writer suffered severely. During the latter part of June and the early days of July we had no opportunity of inspecting these trees, and when we visited them on the 7th of July they were so much injured that we thought they could not be much worse, and as the slugs were then full-grown and fast disappearing and the application of a remedy to so many trees a matter of much labour nothing was attempted to remedy the evil then.

It was observed that some trees were remarkably exempt from the attacks of these slugs Clapp's favourite deserves to be especially mentioned on this account, its thick glossy leave s seemed to be uninviting, and when all around were seared, and browned, and withered trees of this variety wherever found were covered with a foliage rendered doubtly attractive and beautiful by the waste and dismal appearance of those about them. The following notes were taken at the time in reference to the relative damage inflicted on the different varieties of pear trees in those portions of the orchards most injured. Beurre Giffard most of the trees slightly, a few badly damaged. Ananas d'Ete, but slightly injured. Beurre d'Amanlis, same as Beurre Giffard. Beurre Goubault, entirely stripped. Brandywine, some stripped, others but little affected in the same row. Doyenne d'Ete, badly injured. Bartlett suffered very much, nearly all the trees being stripped. Edmunds injured badly, but not so much as Bartlett. Souvenir de Congress, nearly stripped. Kirtland, Dwarfs, not much affected. Standards, badly injured. Leech's Kingsessing, scarcely touched. Osbands Summer, badly damaged, not a leaf left on many of the trees. Rostiezer, some very badly injured, others not so much. Dearborns Seedling, nearly stripped. Tyson, badly affected. Ott's Seedling, not much injured Marechale de la Cour, nearly free. Beurre de Montgeron, Frederica Bremer, Abbott and Fleur de Niege, scarcely touched. Beurre Diel, some few trees very much injured, others not so badly. Gansel's Bergamot, stripped. Buffum and Beurre Superfin, scarcely injured. Sheldon, injured, but not badly. Beurre de Waterloo, scarcely touched. Beurre Amande, singularly free. Beurre St. Nicholas, Oswego Beurre and Golden Beurre, not much injured. Beurre de Paimpool, nearly stripped. It was intended to go over all the other varieties in a similar manner, but opportunity did not offer. In the course of another fortnight new leaves began to push out vigorously on the defoliated trees and within a month or six weeks all was green again.

In the meantime these mischief makers were preparing for a second descent, and we in turn were preparing to receive them; on the 29th of July, when going through the orchards in the afternoon, the new brood of flies were found in the greatest abundance, resting on the young leaves, or on those portions of green which still remained on the leaves partially eaten by the last brood, they were congregated, however, more especially on those trees where green leaves were most abundant. On disturbing them they would fall to the ground with the antennæ bent under their bodies, and the head bent forward. On half a dozen trees we caught about 60 specimens, and might have taken hundreds, they were so thickly spread that in many instances there were two and three on a single leaf. By the last week in August, the second brood of slugs were hatched; some very tiny creatures, others by this time half grown. Now, those trees which had previously escaped were all more or less covered, and would no doubt soon have been stripped, had not some measures been at once taken to destroy them. A raised platform was rigged up in a one horse cart in which was placed a barrel of water in which a pound of powdered hellebore had been mixed, and from the elevated stand this mixture was showered lightly on the trees from the rose of a watering pot. It was astonishing how quickly the trees were cleaned scarcely one could be found on a tree the morning after the application had been made, and ten pounds of hellebore with five or six days work of man and horse served to go over the whole ground, the work being completed in much less time than we had supposed it could.

THE GRAPE VINE PHYLLOXERA.

(*Phylloxera vastatrix*, PLANCHON.)

COMPILED BY THE REV. C. J. S. BETHUNE, M.A.

With the exception of the Colorado Potato Beetle, and the Locust of the Western States, of which we have given an account in another article, there is probably no insect that attracts more general attention at the present time than the destructive Grape-Vine Phylloxera (*P. vastatrix*, Planchon). To us in Canada it is but little known, but as its ravages may spread over our own vineyards at any time, and as it must be an object of interest to all vinegrowers, we think it proper to present to the readers of this Report an account of the insect and such other particulars as we are enabled to gather together. The fact of the rare occurrence of the insect in this country, and the consequent difficulties in the way of its study, is a sufficient reason, we trust, why we should offer a compilation from the writings of others, rather than attempt any original remarks of our own. Our quotations, unless otherwise specified, will be taken from the admirable paper on the Phylloxera, by our valued friend, Professor C. V. Riley, State Entomologist of Missouri, contained in his last Report (*Sixth Annual Report on the Insects of Missouri*, 1874, pages 30-87.) The estimation in which Mr. Riley's work in this respect is held in the great vine-growing countries of Europe, may be judged from the fact that, in the month of February last, he was presented with a very handsome gold medal by the Minister of Agriculture and Commerce of France, "in appreciation of his discoveries in Economic Entomology, and especially of his services rendered to French grape culture."

Though one form of the insect, the gall-inhabiting type, was noticed by Dr. Fitch, State Entomologist of New York, as long ago as 1856, very little attention was paid to it for some years. At length the serious disease of the grape-vine began to attract attention in France, and to cause so much alarm, that the authorities offered a prize of 20,000 francs for an effectual and practicable remedy. The disease was at first termed *pourridie*, or rotting—the roots becoming swollen and bloated, and finally wasting away. There were no end of surmises and theories as to cause, until Professor J. E. Planchon, of Montpellier, in July, 1868, announced that it was due to the puncture of a minute insect belonging to the plant-louse family (*Aphididæ*), and bearing a close resemblance to our gall-louse." The following January, Professor Westwood, of Oxford, England, announced that he considered both the gall and root-inhabiting types to be different forms of the same insect. Shortly after a French writer gave it as his opinion that the European insect was identical with the American species long before described by Dr. Fitch. "This opinion," says Mr. Riley, "gave an additional interest to this insect, and I succeeded, in 1870, in establishing the identity of the French gall-insect with ours. During the same year I also established the identity of the gall and root-inhabiting types, by showing that in the fall of the year the last brood of gall-lice betake themselves to the roots and hibernate thereon. In 1871, I visited France and studied their insect in the field; and in the fall of that year, after making more extended observations here, I was able to give absolute proof of the identity of the two insects, and to make other discoveries, which not only interested our friends abroad, but were of vital importance to our own grape-growers, especially in the Mississippi Valley. I have given every reason to believe that the failure in the European vine, (*Vitis vinifera*), when planted here, the partial failure of many hybrids with the European *vinifera*, and the deterioration and death of many of the more tender-rooted native varieties, are mainly owing to the injurious work of this insidious little root-louse. It had been at its destructive work for years, producing injury the true cause of which was never suspected until the publication of the article in my fourth Report. I also showed that some of our native varieties enjoyed relative immunity from the insects' attacks, and urged their use for stocks, as a means of re-establishing the blighted vineyards of Southern France."

"The disease continued to spread in Europe, and became so calamitous in the last-named country that the French Academy of Sciences appointed a standing Phylloxera Committee. It is also attracting some attention in Portugal, Austria and Germany, and even in England, where it affects hot-house grapes."

Natural History of the Insect.

The genus Phylloxera is characterized by having three-jointed antennæ, the third or terminal being much the longest, and by carrying its wings overlapping, flat on the back instead of roof-fashion. It belongs to the sub-order of whole-winged bugs (*Homoptera*), and forms a connecting link between two of its great families, the Plant-lice (*Aphididæ*) on the one hand, and the Bark-lice (*Coccidæ*) on the other. It is generally considered, however, to pertain to the former family, though some naturalists, with the not uncommon love of introducing new names and minute classifications, have desired to found a new family for this special insect.

Not the least interesting feature in the economy of the Phylloxera is the different phases or forms under which it presents itself. Among these forms are two constant types which have led many to suppose that we have to do with two species. The one type, which for convenience Mr. Riley terms *gallæcola*, lives in galls on the leaves; the other which he calls *radicicola*, lives on swellings of the roots. They may be tabulated thus:—

Type 1. Gallæcola (see Figure 43, *f*, *g*, *h*),
Type 2. Radicicola.
A, Degraded or wingless form (see Figure 44, *e*, *f*, *g*.)
B, Perfect or winged form (see Figure 45, *g*, *h*.)

"Type Gallæcola or Gall-inhabiting.—The gall or excrescence produced by this insect is simply a fleshy swelling of the under side of the leaf, more or less wrinkled and hairy, with a corresponding depression of the upper side, the margin of the cup being fuzzy, and drawn together so as to form a fimbriated mouth. It is usually cup-shaped, but sometimes greatly elongated or purse-shaped.

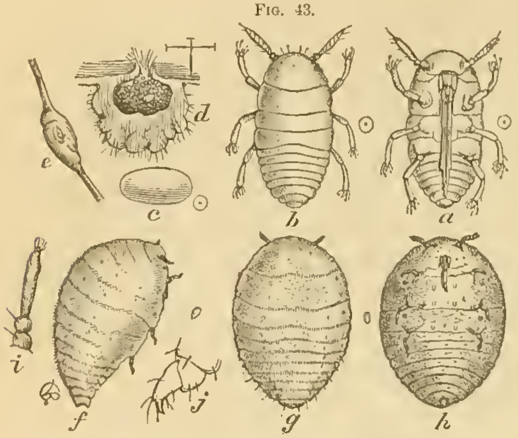
Soon after the first vine-leaves that put out in the spring have fully expanded, a few scattering galls may be found, mostly on the lower leaves, nearest the ground. These vernal galls are usually large, (of the size of an ordinary pea), and the normal green is often blushed with rose where exposed to the light of the sun. On carefully opening one of them (Fig. 43, *d*) we shall find the mother-louse diligently at work surrounding herself with pale yellow eggs of an elongate oval form, scarcely .01 inch long, and not quite half as thick (Fig. 43, *c*). She is about .04 inch long, generally spherical in shape, of a dull orange colour, and looks not unlike an immature seed of the common purslane. At times, by the elongation of the abdomen, the shape assumes, more or less perfectly, the pyriform. Her members are all dusky, and so short compared to her swollen body, that she appears very clumsy, and undoubtedly would be outside of her gall, which she never has occasion to quit, and which serves her alike as dwelling-house and coffin. More carefully examined, her skin is seen to be shagreened or minutely granulated and furnished with rows of minute hairs. The eggs begin to hatch when six or eight days old into active

Fig. 42.

Under side of Leaf covered with Galls.

little oval, hexapod beings, which differ from their mother in their bright yellow colour and more perfect legs and antennæ, the tarsi being furnished with long, pliant hairs, terminating in a more or less distinct globule. In hatching, the eggs split longitudinally from the anterior end, and the young louse whose pale yellow is in strong contrast with the more dusky colour of the egg-shell, escapes in the course of two minutes. Issuing from the mouth of the gall, these young lice scatter over the vine, most of them finding their way to the tender terminal leaves, where they settle in the downy bed which the tomentose nature of these leaves affords, and commence pumping up and appropriating the sap. The tongue-sheath is blunt and heavy, but the tongue proper—consisting of three brown, elastic and wiry filaments, which, united, make so fine a thread as scarcely to be visible with the strongest microscope—is sharp, and easily run under the parenchyma of the leaf. Its puncture causes a curious change in the tissues of the leaf, the growth being so stimulated that the under side bulges and thickens, while the down on the upper side increases in a circle around the louse, and finally hides and covers it as it recedes more and more within the deepening cavity. Sometimes the lice are so crowded that two occupy the same gall. If, from the premature death of the louse, or other cause, the gall becomes abortive before being completed, then the circle of thickened down or fuzz enlarges with the expansion of the leaf, and remains (Fig. 43, *c*) to tell the tale of the futile effort. Otherwise, in a few days the gall is formed, and the inheld louse, which, while eating its way into house and home, was also growing apace, begins a parthenogenetic maternity by the deposition of the fertile eggs, as her immediate parent had done before. She increases in bulk with pregnancy, and one egg follows another in quick succession, until the gall is crowded. The mother dies and shrivels, and the young, as they hatch, issue and found new galls. This process continues during the summer until the fifth or sixth generation. Every egg brings forth a fertile female, which soon becomes wonderfully prolific. The number of eggs found in a single gall averages about 200; yet it will sometimes reach as many as 500, and, if Dr. Shimer's observations can be relied on, it may even reach 5,000. I have never found any such number myself; but, even supposing there are but five generations during the year, and taking the lowest of the above figures, the immense prolificacy of the species becomes manifest. As summer advances they frequently completely cover the leaves with their galls, and settle on the tendrils, leaf-stalks and tender branches, where they also form knots and rounded excrescences (Fig. 43, *e*) much resembling those on the roots. In such a case, the vine loses its leaves prematurely, usually, however, the natural enemies of the louse seriously reduce its numbers by the time the vine ceases its growth in the fall, and the few remaining lice, finding no more succulent and suitable leaves, seek the roots. Thus by the end of September, the galls are mostly deserted, and those which are left are almost always infested with mildew, and eventually turn brown and decay. On the roots the young lice attach themselves singly or in little groups and thus hibernate. The male louse has never been seen, nor does the female ever acquire wings. Indeed, too much stress cannot be laid on the fact that *Gallæcola* occurs only as an agamic and apterous female form. It is but a transient summer state, not at all essential to the perpetuation of the species, and does, compared with the other type, but trifling damage. It has been found occasionally by Mr. Riley on all species of the grape-vine (*vinifera*, *riparia*, *æstivalis* and *Labrusca*) cultivated in the Eastern and Middle States, and on the wild *cordifolia*; but it flourishes only on the river-bank grape (*riparia*), and more especially on the Clinton and Taylor, with their close allies. Thus while legions of the root-inhabiting type (*radicicola*) are overrunning and devasting the vineyards of France, this one is almost unknown there except on such American varieties as it infests with us."

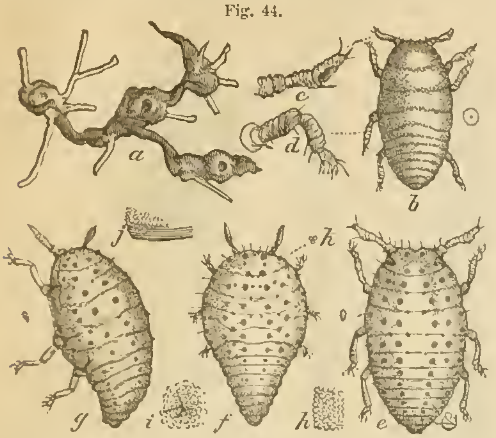
Fig. 43.



TYPE GALLÆCOLA:—*a*, *b*, newly-hatched larva, ventral and dorsal view; *c*, egg; *d*, section of gall; *e*, swelling of tendril; *f*, *g*, *h*, mother gall-louse—lateral, dorsal and ventral views; *i*, her antenna; *j*, her two jointed tarsus. Natural sizes indicated at sides.

"TYPE RADICICOLA OR ROOT-INHABITING.—We have seen that, in all probability, *gallœcola* exists only in the apterous, shagreened, non-tubercled, fecund female from. *Radicicola*, however, presents itself in two principal forms. The newly-hatched larvæ of this type are undistinguishable, in all essential characters, from those hatched in the galls, but in due time they shed the smooth larval skin, and acquire raised warts or tubercles; which at once distinguish them from *gallœcola*. In the development from this point the two forms are separable with sufficient ease: one (A) of a more dingy greenish yellow, with more swollen fore-body, and more tapering abdomen; the other (B) of a brighter yellow, with the lateral outline more perfectly oval, and with the abdomen more truncated at tip." *

Fig. 44.



TYPE RADICICOLA.—*a*, roots of Clinton vine, showing relation of swellings to leaf-galls, and power of resisting decomposition; *b*, larva as it appears when hibernating; *c*, *d*, antenna and leg of same; *e*, *f*, *g*, forms of more mature lice; *h*, granulations of skin; *i*, tubercle; *j*, transverse folds at borders of joints; *k*, simple eyes.

"The first or mother form (Fig. 44, *f*, *g*,) is the analogue of *gallœcola*, as it never acquires wings, and is occupied, from adolescence till death, with the laying of eggs. which are less numerous and somewhat larger than those found in the galls. I have counted in the spring as many as two hundred and sixty-five eggs in a cluster, and all evidently from one mother, who was yet very plump and still occupied in laying. As a rule, however, they are less numerous. With pregnancy this form becomes quite tumid and more or less pyriform, and is content to remain with scarcely any motion in the more secluded parts of the roots, such as the creases, sutures and depressions, which the knots afford. The skin is distinctly shagreened (Fig. 44, *h*,) as in *gallœcola*. The warts, though usually quite visible with a good lens, are at other times more or less obsolete, especially on the abdomen. The eyes, which were quite perfect in the larva, become more simple with each moult, until they consist. as in *gallœcola*, of but triple eyelets (Fig. 44, *k*,) and, in the general structure, this form becomes more degraded with maturity, wherein it shows the affinity of the species to the *Coccidæ*, the females of which, as they mature, generally lose all trace of the members they possessed when born."

"The second or more oval form (Fig. 44, *e*,) is destined to become winged. Its tubercles when once acquired, are always conspicuous; it is more active than the other, and its eyes increase rather than diminish in complexity with age. From the time it is one-third grown the little dusky wing-pads may be discovered, though less conspicuously than in the pupa state, which is soon after assumed. The pupæ (Fig- 45, *e*, *f*,) are still more active, and after feeding a short time, they make their way to the light of day, crawl over the ground and over the vines, and finally shed their last skin and assume the winged state. In their last moult the tubercled skin splits on the back, and is soon worked off, the body in the winged insect having neither tubercles nor granulations."

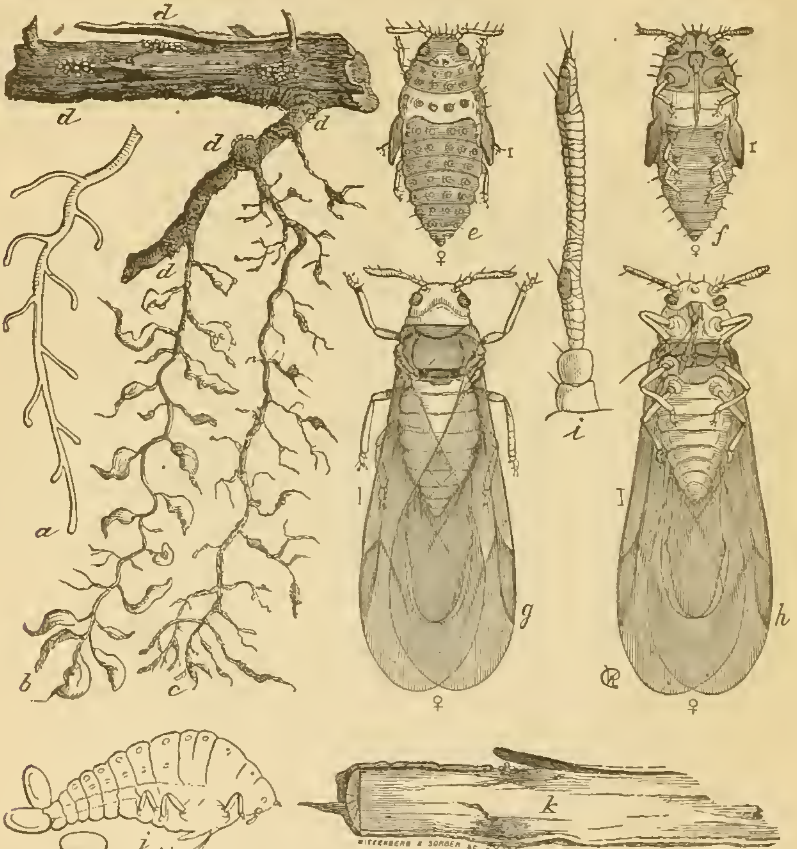
"The winged insects are most abundant in August and September, but may be found as early as the first of July, and until the vines cease growing in the fall. The majority of them are females, with the abdomen large and more or less elongate From two to five eggs may invariably be found in the abdomen of these, and are easily seen when the insect is held up to the light, or mounted in balsam or glycerine."

"As fall advances the winged individuals become more and more scarce, and as winter sets in only eggs, newly-hatched larvæ, and a few apterous egg-bearing mothers, are seen. These last die and disappear during the winter, which is mostly passed in the larva state, with here and there a few eggs. The larvæ thus hibernating (Fig. 44, *b*) become dingy, with the body and limbs more shagreened and the claws less perfect than when first hatched; and, of thousands examined, all bear the same appearance, and all are furnished with strong

* "It is not to be understood, in making these distinctions, that these differences of form are so constant that they can always be relied on; for the form of the body varies, so that the wingless mother may present the more perfect oval of that destined to become winged."

suckers. As soon as the ground thaws and the sap starts in the spring, these young lice work off their winter coat, and, growing apace, commence to deposit eggs. All, without exception, become mothers, and assume the degraded form (A) already described.

Fig. 45.



Type Radicicola :—*a*, shows a healthy root ; *b*, one on which the lice are working, representing the knots and swellings caused by their punctures ; *c*, a root that has been deserted by them, and where the rootlets have commenced to decay ; *d*, *d*, *d*, show how the lice are found on the larger roots ; *e*, female pupa, dorsal view ; *f*, same, ventral view ; *g*, winged female, dorsal view ; *h*, same, ventral view ; *i*, magnified antenna of winged insect ; *j*, side view of the wingless female, laying eggs on roots ; *k*, shows how the punctures of the lice cause the larger roots to rot.

"At this season of the year, with the exuberant juices of the plant, the swellings on the roots are large and succulent, and the lice plump to repletion. One generation of the mother form (A) follows another—fertility increasing with the increasing heat and luxuriance of summer—until at last the third or fourth has been reached before the winged form (B) makes its appearance in the latter part of June or early in July. Such are the main features which the development of the insect presents, to one who has studied it in the field as well as in the closet.

"Since I proved, in 1870 (adds Mr. Riley), the absolute identity of these two types by showing that the gall-lice become root-lice, the fact has been repeatedly substantiated by different observers. Yet, strange to say, no one has heretofore succeeded in making gall-lice of the young hatched on the roots, though I formerly supposed that Signoret had done so. It is, therefore, with much satisfaction that I record the fact of having succeeded this winter in obtaining galls on a young Clinton vine from young *radicicola*, and of thus establishing beyond peradventure, the specific interrelation and identity of the two types. I make this announcement with all the more pleasure, that for three years past, both on vines growing out-doors and in pots in-doors, I had in vain attempted to obtain the same result."

PRACTICAL CONSIDERATIONS.

"The more manifest and external Effects of the Phylloxera Disease.—The result which follows the puncture of the root-louse is an abnormal swelling, different in form, according to the particular part and texture of the root. These swellings, which are generally commenced at the tips of the rootlets, where there is excess of plasmatic and albuminous matter, eventually rot, and the lice forsake them and betake themselves to fresh ones —the living tissue being necessary to the existence of this as of all plant-lice. The decay affects the parts adjacent to the swellings, and on the more fibrous roots cuts off the supply of sap to all parts beyond. As these last decompose, the lice congregate on the larger ones, until at last the root system literally wastes away."

"During the first year of attack there are scarcely any outward manifestations of disease, though the fibrous roots, if examined, will be found covered with nodosities, particularly in the latter part of the growing season. The disease is then in its incipient stage. The second year all these fibrous roots vanish, and the lice not only prevent the formation of new ones, but, as just stated, settle on the larger roots, which they injure by causing hypertrophy of the parts punctured, which also eventually become disorganized and rot. At this stage the outward symptoms of the disease first become manifest, in a sickly, yellowish appearance of the leaf and a reduced growth of cane. As the roots continue to decay, these symptoms become more acute, until by about the third year the vine dies. Such is the course of the malady on vines of the species *vinifera*, when circumstances are favourable to the increase of the pest. When the vine is about dying, it is generally impossible to discover the cause of the death, the lice which had been so numerous the first and second years of invasion, having left for fresh pasturage."

Mode of Spreading.—The gall-lice can only spread by travelling, when newly-hatched from one vine to another; and, if this slow mode of progression were the only one which the species is capable of, the disease would be comparatively harmless. The root-lice, however not only travel under-ground along the interlocking roots of adjacent vines, but crawl actively over the surface of the ground, or wing their way from vine to vine and from vineyard to vineyard. Doubts have been repeatedly expressed by European writers as to the power of such a delicate and frail-winged fly to traverse the air to any great distance. On the 27th of September, 1873, the weather being quite warm and summer-like, with much moisture in the atmosphere, Mr. Riley witnessed the insect's power of flight. Some two hundred winged individuals, that he had confined, became very restless and active, vigorously vibrating their wings and beating about their glass cages. Upon opening the cages, the lice began to dart away and were out of sight in a twinkle. They have been caught in spider-webs in Europe, and captured by Mr. Riley on sheets of paper prepared with bird-lime and suspended in an infested vineyard; it is clear, then, that they can sustain flight for a considerable time under favourable conditions, and with the assistance of the wind, they may be wafted to great distances. These winged females are much more numerous in the fall of the year than has been supposed by Entomologists. Wherever they settle, the few eggs which each carries are sufficient to perpetuate the species, which, in the fullest sense, may be called contagious.

"Susceptibility of different Vines to the Disease.—As a means of coping with the Phylloxera disease, a knowledge of the relative susceptibility of different varieties to the attacks and injuries of the insect is of paramount importance. As is so frequently the case with injurious insects, and as we have a notable instance in the common Currant Aphis (*Aphis Ribesii)*, which badly affects the leaves of some of the Currants, but never touches the Gooseberry which belongs to the same genus. The Phylloxera shows a preference for and thrives best on certain species, and even discriminates between varieties; or, what amounts to the same thing, practically, some varieties resist its attacks and enjoy a relative immunity from its injuries. It would be useless, and certainly unnecessary here, to attempt to ascertain the reason why certain vines thus enjoy exemption while others so readily succumb; but in a broad way it may be stated that there is a relation between the susceptibility of the vine and the character of its roots—the slow-growing, more tender-wooded and consequently more tender-rooted varieties succumbing most readily; the more vigorous powers resisting best."

From Mr. Riley's synopsis of experiments and observations we gather the following statement respecting the different varieties of grape:—

European Vine (*Vitis vinifera*)—Rarely subject to leaf-gall, but it generally succumbs to the attacks of root lice after a few years.

River-bank Vine (*V. riparia*)—The Cornucopia, Alvey and Othello suffer very little or not at all from Leaf galls, but to a considerable extent from Root-lice. The Clinton and Taylor are very subject to the Leaf-galls, but from the great vitality of their roots they do not succumb to the attacks of the Root-lice. The Golden Clinton and Louisiana do not suffer much from either. The Marion a good deal affected by the former, but little by the latter. The Delaware suffers considerably from both.

Summer Grape (*V. æstivalis*)—The Cunningham, Norton's Virginia, and Rutlander suffer not at all from the Leaf-gall, and very little from the Root-lice. The Herbemont and Cynthiana suffer slightly from both.

Northern Fox Grape (*Labrusca*)—The Challenge, Dracut Amber, Israella, Martha, Northern Muscadine and Wilder, are not subject to the Leaf-gall, and only slightly to the root-lice. The Diana, Goethe, Hartford, Isabella, Ives, Maxatawney, North Carolina, Rebecca and Salem are also free from the Leaf-gall, but have the Root-lice more abundant and suffer more from its attacks. The Catawba and Iona do not suffer from the Leaf-gall, but are most subject to the Root-lice The Concord has the Leaf-galls but rarely, and does not suffer much from the Root-lice; the Creveling also is usually free from the former, but suffers much more from the latter.

Southern Fox Grape.—This species is entirely free from the Phylloxera in any form.

The above enumeration is founded principally upon Mr. Riley's observations in the central portion of Missouri; he has also examined many of the varieties in Kansas, Illinois, New Jersey, Pennsylvania and New York. The Arnold's hybrids, which he has examined, all suffer, he states, but some of them more than others.

Means of Coping with the Disease.—Grafting the more susceptible varieties on the roots of those that have a greater power of resistance, would probably counteract the disease to a great extent. This plan is now being tried on a large scale, but it will be necessary to wait a year or two before any positive conclusions can be obtained.

"In planting a new vineyard the greatest care should be taken not to introduce Phylloxera on the young plants, and a bath of weak lye or strong soap suds before planting will, perhaps, prove the best safeguard. Remembering that the lice are spreading over the ground from July till fall, and principally in the months of August and September, a thorough sprinkling of the surface with lime. ashes, sulphur, salt or other substance destructive to insect life, will, no doubt, have a beneficial effect in reducing their numbers and preventing their spread.

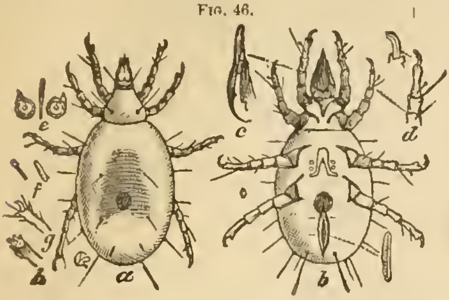
The insect has been found to thrive less and to be, therefore, less injurious in a sandy soil; while mixture of soot with the soil has had a beneficial effect in destroying the pest. It is, therefore, recommended for the more susceptible varieties, and that they be planted in trenches first prepared with a mixture of sand and soot. An addition of lime will also prove beneficial. There is every reason to believe that vines are rendered less susceptible to the disease by a system of pruning and training that will produce long canes and give them as nearly as possible their natural growth.

Natural Enemies.—There are a number of predaceous insects which serve to keep the leaf-lice in check; but as the injury is mostly done underground it will suffice to enumerate the principal of these in this connection. The most efficient is a black species of Fringe-wing or Thrips with white wings (*Thrips Phylloxeræ*). They are found in several different kinds of Phylloxera galls, and do more than any other species to keep the leaf inhabiting species within bounds."

The next most efficient aids in the destruction of the leaf-lice are the lace-winged flies (*Chrysopa*); the lady birds (*Coccinella*); certain Syrphus fly larvæ; a few true bugs and other insects.

The enemies known to attack the Phylloxera underground are, naturally enough, fewer in number. In one instance, Mr. Riley relates, I have found a Scymnus larva at the work six inches below the surface, and there is a Syrphus fly, whose larva lives under-ground and feeds both on the apple-tree root-louse and on this grape root-louse. Wonderful indeed is the instinct which teaches this blind larva to penetrate the soil in search of its prey ; for the egg must necessarily be laid at the surface. But though the underground enemies of its own class are few, I have discovered a mite which preys extensively upon this root-inhabiting type, and which renders efficient aid in keeping it in check in this country. This mite (*Tyroglyphus phylloxeræ*, Planchon & Riley, Fig. 46,) belongs to the same genus as the cheese and meal mites, and the species which infests preserved insects, and is such a pest in cabinets. As is the rule with mites, it is born with but six legs, but acquires eight after the first or second moults. It varies considerably in form, with age, and in studying it with a view of distinguishing it specifically from other described species, I have noticed all the different tarsal characters shown as *d*, *f*, *g* and *h*, (Fig. 46), and on which distinct genera have been founded. Mites present themselves in such different forms that the adolescent stages of the same species have been made to represent distinct families by authors who never studied the development of these beings. The species under consideration, when young, mostly contents itself with the altered sweets of the roots which rot from the punctures of Phylloxera, while when older it preys by preference on the lice themselves."

Fig. 46.



Phylloxera Mite, *a*, dorsal, *b*, ventral view of female, *c*, mouth-parts, *d*, *f*, *g*, *h*, forms of tarsal appendages, *e*, ventral tubercles of male.

" Direct Remedies.- The leaf-lice, which do not play such an important part in the disease as was at first supposed, may be controlled with sufficient ease by a little care in destroying the first galls which appear, and in pruning and destroying the terminal growth of infested vines later in the season. The root-lice are not so easily reached As the effort will be according to the exigency, we may very naturally look to France for a direct remedy, if ever one be discovered. But of all the innumerable plans, patented or non-patented, that have been proposed, of all the many substances that have been experimented with under the stimulus of a large national reward, no remedy has yet been discovered which gives entire satisfaction, or is applicable to all conditions of soil. Nor is it likely that such a remedy ever will be discovered.

" While, therefore, not very satisfactory results have followed the use of pure insecticides, the application of fertilizers intended to invigorate the vine, and at the same time injure the lice, has been more productive of good. Especially has this been the case with fertilizers rich in potassic salts and nitrogenous compounds, such as urine. Sulphuret of potassium dissolved in liquid-manure ; alkaline-sulphates, with copperas and rape seed ; potassic salts, with guano ; soot and cinders are, among other applications, most favourably mentioned.

Mr. Riley closes his very able Essay with the following remarks:—" We have in the history of the Grape Phylloxera, the singular spectacle of an indigenous American insect being studied, and its workings understood in a foreign land, before its presence in its most injurious form was even suspected in its native home. The Franco Prussian war, with all its fearful consequences to France, has passed away ; the five milliards of francs (one thousand million dollars) have been paid as indemnity to her victors, in so short a time that the civilized world looked on in wonder and astonishment. Yet this little Phylloxera, sent over doubtless in small numbers, by some American nurseryman, a few years since, continues its devastating work, and costs that unfortunate country millions of francs annually. The last German soldier has been removed – at terrible cost it is true—from French soil, but the Phylloxera army remains; and if another five milliard francs could extirpate the last individual of this liliputian insect host from her soil, " la belle France" would be cheaply rid of the enemy. Had the world, twenty years ago, possessed the knowledge we at present have of this insect and of its dangerous power, a few francs might have originally stayed its invasion of that great vine-growing and wine-making country. Needs there any more forcible illustration of the importance of economic entomology ! "

In confirmation of this statement, we read in the monthly report of the Department of Agriculture (Washington, August and September, 1874), that " the Prefect of the Department of the Rhone, in France, has published a decree directing the mayor of each Commune within his jurisdiction, upon the indication of the presence of the Phylloxera, to proceed at once to determine the limits of each local district infected by the insect. Every vine affected and all the roots within five meters are to be dug up and burned. This decisive measure has not escaped sharp criticism. To save the vine lands of the Rhone from destruction by this pest, it is now proposed to secure winter irrigation by a grand canal connected with that river. M. Dumont, *Ingénieur en chef des chaussés*, has developed, before a governmental commission, a scheme for the construction of such a canal, within four years, at a cost of 102,000,000 francs. This, it is supposed, will rescue from destruction over 60,000 acres of vine lands, yielding products worth 200,000,000 francs per annum and taxes amounting to 20,000,000 francs."

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

FOR THE YEAR 1875.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of the Canadian Entomologist;

REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope; Vice-President of the Entomological Society of Ontario;

AND

R. V. ROGERS,

Barrister, &c., Kingston, Ontario.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY HUNTER, ROSE & CO., 25 WELLINGTON STREET.
1876.

INDEX.

—o—

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1875.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario ; Editor of the Canadian Entomologist ;

REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope ; Vice-President of the Entomological Society of Ontario ;

AND

R. V. ROGERS,

Barrister, &c., Kingston, Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE YEAR 1875.

To the Honourable the Commissioner of Agriculture.

SIR,—I have the honour to submit for your consideration the Report of the Entomological Society of Ontario for the year 1875, in which you will find a detailed statement of the receipts and expenditures for the year, all of which have been duly audited. I also submit a list of the office-bearers elected for the year 1876.

In accordance with the provisions of the Statute, the annual meeting of the Society was held at the City of Ottawa, at the time of the Exhibition of the Agricultural and Arts Association, when the Reports of the officers were presented and approved of.

With the view of carrying out the design of the Department in endeavouring to advance the knowledge of practical entomology, especially in its bearings on Agriculture and Horticulture, the members of the Entomological Society submit herewith the Annual Report on some of the noxious, beneficial and common insects found throughout this Province.

The organ of the Society, *The Canadian Entomologist*, is still issued regularly on or about the 15th of each month, each number containing twenty pages 8vo. It has now nearly reached the close of its seventh volume, and fully sustains its reputation as a valuable scientific journal. Being almost entirely filled with original matter, it has during the past seven years been the means of disseminating a vast amount of scientific knowledge relating to Entomology, and thus doing much towards furthering the interests of this important department of natural history.

The pages of this Report will be found illustrated with a number of excellent woodcuts and electrotypes, many of which are entirely new, some having been especially engraved for this Report. The expensive character of this work has prevented us from illustrating as profusely as we would have wished, for we are persuaded that such figures add greatly to the usefulness and attractiveness of our Reports.

I have the honour to remain, Sir,

Your obedient servant,

J. H. McMechan,

Secretary-Treasurer Entomological Society of Ontario.

London, Ontario. November, 1875.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The fifth annual meeting of the above Society was held in the Court House, in the City of Ottawa, on the 22nd day of September, 1875, at 3 p.m. The reports of the officers were read, and a copy of the President's address promised to be placed at the disposal of the Printing Committee for publication.

The following officers for the ensuing year were then elected :—

President.—W. Saunders, London.

Vice President.—Rev. C. J. S. Bethune, M.A., Port Hope.

Secretary-Treasurer.—J. H. McMechan, London.

Council.—Wm. Couper, Montreal ; R. V. Rogers, Kingston ; J. Pettit, Grimsby ; J. M. Denton and E. Baynes Reed, London.

Editor of Entomologist.—W. Saunders.

Editing Committee.—Rev. C. J. S. Bethune, M.A. ; G. J. Bowles, Montreal ; E. Baynes Reed.

Library Committee.—W. Saunders, E. Baynes Reed, J. H. McMechan.

Committee on Centennial Exhibition.—W. Saunders, Rev. C. J. S. Bethune, J. H. McMechan.

Auditors.—G. Geddes, Chas. Chapman, London.

The Library Committee reported the purchase of a number of valuable books for the Society's Library during the past year.

FINANCIAL STATEMENT OF THE SECRETARY-TREASURER.

Receipts.

To Balance from previous year	$422 16
" Government Grant towards Illustrations for Report	100 00
" Annual Grant for 1875	750 00
" Members' Fees	127 05
" Sales of cork, pins, &c., to members	46 34
	$1,445 55

Disbursements.

By CANADIAN ENTOMOLOGIST, printing and paper................	$533 91
" Engravings for Report....................................	134 64
" Expenses of Report..	120 00
" Editor's salary..	100 00
" Secretary-Treasurer's salary..................................	50 00
" Expenses, sundry small..	26 53
" Rent..	80 00
" Insurance..	10 63
" Library..	107 51
" Advanced Centennial Fund..	50 00
" Balance on hand..	232 33
	$1,445 55

We certify the above as a correct statement of accounts for the year ending September 22nd, 1875, of the Treasurer of the Entomological Society of Ontario, as shown by the books and vouchers.

CHAS. CHAPMAN, } *Auditors.*
J. H. GRIFFITHS, }

REPORT OF THE COUNCIL.

At the close of this the fifth year of the existence of our Society, it is our pleasing duty to bear testimony to the fact that it still sustains its well earned reputation. A knowledge of insects and their habits, which it is the special object of our Society to advance, is now generally recognised as of great value to the farmer, fruit grower and others; and in view of the immense destruction insects entail, the money value of such knowledge, where it enables the cultivator of the soil to combat successfully the ravages of these formidable foes, is a matter of no small moment.

Branches of our Society are still in active existence in London, Kingston and Montreal, where they are doing much to advance the interests of our favourite study. The members of our Montreal branch have been particularly active during the past year, as will be seen from the Reports of their officers herewith submitted, and they have individually furnished many interesting papers for the Entomologist on the insects found in their district.

A request having been made that our Society should prepare a collection of Canadian insects for the Centennial Exhibition to be held in Philadelphia during the coming year, and a grant sufficient to cover a portion of the expense having been recommended, we are gratified to know that our members have entered most heartily into the work, and many of them have placed their entire collections at the disposal of the Committee appointed to make the selection of specimens. We doubt not but that this collection will be a most interesting feature in the Canadian Department of the Exhibition, and will be in every way worthy of our Society and country.

During the past year death has deprived us of one of our esteemed honorary members the first elected by this Society, and one who has generously donated to our Society's cabinets many objects of interest, and contributed to our Journal many valuable papers. We allude to the late Francis Walker, of the British Museum. One of our valued American contributors has also passed away, Mr. Philip L. Sprague, of Boston, Mass. Brief obituary notices of both will be found in the Report.

At the meeting of the Entomological Club of the American Association for the Advancement of Science, recently held at Detroit, our Society was represented by Mr. W. Saunders, Editor of the ENTOMOLOGIST. Many interesting facts in reference to insect life were elicited at the various meetings held by the Club, and some important conclusions arrived at affecting the welfare of Entomology. An account of these meetings will be given elsewhere

The publication of the organ of the Society, the CANADIAN ENTOMOLOGIST, is still vigorously maintained, and has now nearly reached the close of its seventh volume. Its regular issue and wide distribution throughout the scientific world makes it a valuable medium for the publication of scientific matter relating to insects, which, while of immediate interest to only a portion of our readers, is of great importance to those engaged in the study of the science of Entomology, and has also an important bearing on its future progress. Constant effort has also been made to present to our readers some practical information in reference to many of the commoner insect pests, with instructions as to how to recognize them, and as far as possible subdue them. It is gratifying to learn that our efforts in connection with our Journal are everywhere warmly appreciated by those who are best able to judge of its merits.

Submitted on behaf of the Council by

J. H. McMechan,

Secretary-Treasurer.

ANNUAL MEETING OF THE LONDON BRANCH.

The annual meeting of the London Branch of the Entomological Society of Ontario was held on the 21st of January, 1875, at the residence of Mr. A. Puddicombe.

After the usual routine business had been attended to, the following officers were elected for 1875: President, H. P. Bock; Vice-President, Gamble Geddes; Secretary-Treasurer, J. M. Denton; Curator, Chas. Chapman; Auditors, J. H. McMechan and J. H. Griffiths.

The Annual Report of the Secretary-Treasurer was read and adopted. This Report showed that the finances of the Branch were in a satisfactory state; that after meeting the current expenses of the year, there still remained a small balance to credit.

REPORT OF THE COUNCIL.

The Council of the London Branch of the Entomological Society of Ontario beg to submit the following Report:—

The monthly meetings of the members have been fairly kept up, and an increasing interest manifested by our more active members in Entomological matters. During the year some valuable additions have been made to our collections, and at our meetings we have had many interesting discussions on insect life and habits.

When the question of the preparation of a collection of insects by the Parent Society for the forthcoming Centennial Exhibition was first mooted, our members all expressed a hearty interest in the undertaking, and the following resolution was unanimously passed: "That the London Branch of the Entomological Society of Ontario, having heard of the proposal on the part of the Parent Society to prepare a collection of Canadian insects for the Centennial Exhibition to be held in Philadelphia in 1876, Resolved, That we heartily endorse the proposed scheme, and that we will willingly place any insects we may have in our individual collections at the disposal of any Committee which may be appointed for the purpose, and will do our best in every way towards making the collection one worthy of the Society of which we form a part." We doubt not but that our members will well redeem the pledge thus given.

It becomes our painful duty to record the death, during the past year, of one of our esteemed members, Mr. M. L. Morgan, who was Vice-President of our Branch in 1873. Although not an active working Entomologist, Mr. Morgan always took a lively interest in the affairs of the Society, and was ever ready, by his counsel and otherwise, to aid in furthering its welfare. His sudden removal has left a blank in our midst which will not be easily filled.

Submitted on behalf of the Council by

Gamble Geddes,

Secretary-Treasurer.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The second annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 4th, 1875, when the following officers were elected for the ensuing year :—

G. J. Bowles, President ; Alexander Gibb, Vice-President ; C. W. Pearson, Secretary-Treasurer ; G. B. Pearson, Curator ; W. Couper, M. Kollmar, T. B. Caulfield, Council.

The Reports of the Council and Secretary-Treasurer were read and adopted. The Branch is progressing steadily, and our list of membership is increasing. During the past year working expenses have all been paid, leaving a balance on hand ; a number of papers have been read, and the exhibitions of local and exotic rarities were exceedingly good. The Branch holds its meetings in the rooms of the Montreal Natural History Society, University Street. All business communications to be addressed to C. W. Pearson, the Burland Desbarats Company, Montreal, P. Q.

ANNUAL REPORT OF THE COUNCIL OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Your Council, in presenting their second Annual Report, have great pleasure in stating that the Branch has progressed steadily since its first meeting in August, 1873. During the past year eight new members were elected, making the total number of twenty, one of whom has since gone to Europe.

The papers read during the year are as follows :—

" Notes on the Larva of *Leucania pseudargyria* Guenеé," by F. B. Caulfield ; " On a Dipterous Insect Destroying the Roots of Cabbage," by Wm. Couper ; " Notes of Some Species of the Genus *Grapta*, found in the Vicinity of Montreal," by F. B. Caulfield ; " On Tineidæ," by Wm. Couper ; " On Tineidæ," by F. B. Caulfield ; " A List of the Bombycidæ of Quebec," by G. J. Bowles ; " On the Catocalidae Occurring in the Vicinity of Montreal," by C. W. Pearson ; " A List of the Diurnal Lepidoptera Occurring on the Island of Montreal," by F. B. Caulfield ; " On the Usefulness of Spiders," by J. G. Jack ; " A List of Sphingidae Occurring on the Island of Montreal," by F. B. Caulfield.

The monthly meetings were fairly attended, and the exhibitions of Entomological material conspicuously illustrated the energy of the members in accumulating rare insects from various localities. The Branch having decided to hold their meetings in future in the rooms of the Montreal Natural History Society, it was found necessary to change the night of meeting from the first Wednesday to the first Tuesday in each month, and in order to meet the extra outlay for rental, it was decided to make the subscription twenty-five cents a month, which the Council presume will suffice for present emergencies. On the 1st of last July the members proceeded to Chateauguay Basin for a field day. The members were the guests of Mr. R. Jack, of Hillside, who treated them with true hospitality.

Your Council have ordered *Psyche*, a useful Entomological publication issued in Cambridge, Mass.

A suggestion made by your Council last year, that note books should be carried by members, has, in this instance, been fruitful in producing valuable lists and data of the occurrence of insects in our neighbourhood, and we trust that some of our members will devote their leisure this season to the much-neglected orders of Hemiptera, Neuroptera and Diptera.

All of which is respectfully submitted.

G. J. Bowles.
Wm. Couper, Chairman. C. W. Pearson.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1875.

To the Members of the Entomological Society of Ontario :—

Gentlemen,—For the fifth year in succession I find myself called upon, as your President, to address a few words to you on the condition of our Society, and on the subject of Entomology in general.

With regard to the Society, you have already learnt, from the satisfactory Reports of the parent organization and its various branches, that it continues to go on prospering in a quiet, unostentatious way. While there has been no marked increase to our list of members during the past year, and no performance of any work of unusual importance, yet it is a matter of congratulation that we have no falling off, either in numbers or resources, to deplore. Much of the inactivity in Entomological matters that has been apparent in this country during the past year may no doubt be ascribed to the prevalent "hardness of the times," which has occasioned—even to those least affected by it—much anxiety of mind, conjoined very often with increased absorption in the cares of business, or in the labours necessary for obtaining a livelihood. As you are well aware, we have in Canada but very few persons of assured wealth who are able, as in older and richer countries, to devote their abundant leisure to literature, art or science. Consequently, the condition of things in the world about us deprives most of our members of the leisure, if not also of the inclination, requisite for the successful pursuit of Entomology in any of its various phases. Before another season opens upon us, however, we have reason to believe that the worst of the present financial storm will be over, and that renewed confidence and prosperity throughout the country will remove the gloom and dulness now oppressing almost every department of work among us. With a revival of business, we may assuredly look for a restoration of activity in scientific pursuits, and hope that our Society, in common with others of a kindred character, may be distinguished by large accessions to its numbers, and by increased work in all its departments.

Last year, at our annual meeting, I took the opportunity of calling your attention to many fields of Entomological labour that are now all but unexplored in this country. May I repeat that there is ample scope for the exertions of all our members, whether they care only to form collections of specimens, or prefer to devote their labours to the unfolding of the life histories, or the study of the classification of insects? There is plenty of work remaining to be done, even in the favourite orders of Lepidoptera and Coleoptera, to say nothing of the others that are not so generally studied or collected. It would be a valuable contribution to our store of knowledge were lists of the Canadian species of all orders of insects to be formed and presented to the Society for publication, and at the same time a revision made of those published some years ago.

But not only is there scientific work of this kind to be performed, which will require generations for its complete achievement; there comes before us at the present moment an extraordinary object for accomplishment during the approaching winter. I allude to the representation of the Society by means of a collection of Canadian insects at the approaching Centennial Exhibition at Philadelphia. You will all, I think, agree with us in the belief that it is a matter of great importance to the Society that it should be brought in this way before the notice of the world, and that it cannot but be of some benefit to the Dominion that its natural history, as well as its industrial resources, should be fully exhibited. The Council of the Agricultural and Arts Association have already, on our behalf, brought the matter before the Commissioners appointed by the Government, and we understand that a sum of money will be provided to aid us in the satisfactory performance of the work. To gather together a fitting collection of insects, and to prepare them for exhibition, is a task that will strain to the utmost all the resources of the Society. We have commenced the work, relying upon the cooperation of you all, and now we trust that every one will help us by the loan of specimens, and any other aid that can be afforded. The Society is committed to the task; let us see to it that there be no failure.

Before turning from matters immediately affecting our Society, I may mention that our periodical, THE CANADIAN ENTOMOLOGIST, continues to be maintained with undiminished efficiency and interest, being largely supported and contributed to by our Entomological brethren of the United States; and that the last Annual Report presented by the Society to the Legislature has been received with more than usual marks of favour by the Press, scientific, agricultural and political, not only in Canada and the neighbouring States, but also in England. We have been naturally gratified to observe that, in many instances, copious extracts have been made from its pages, and even a whole article reprinted in an English scientific magazine.

Having referred thus far to our Society, and the things that especially concern it, let me now say a few words regarding Entomological matters in general. At the annual meeting of the American Asso tion for the Advancement of Science, held in August last at Detroit, Michigan, the general Entomological Club, organized last year at Hartford, met for the first time. Its sessions, held daily throughout the week of meeting, were remarkably interesting. They were presided over by Dr. Le Conte, undoubtedly the greatest of living American Entomologists, and were attended by a great majority of the noted Entomologists of this continent. Our own Society was most efficiently represented by our able Editor, Mr. Saunders. I much regret that the pressure of business matters at home prevented me from accompanying him, as I fully intended to have done. As a complete report of the proceedings is being published in THE CANADIAN ENTOMOLOGIST, I need not detain you by any account of them here. Next year the meeting is to be held at Buffalo, N. Y.—a place even more convenient of access for Canadians than Detroit. We trust that a large number of our members will avail themselves of the opportunity—which may not occur again for many years to come—of attending the sessions, and making the personal acquaintance of our American brethren. From past experience I can assure them of a hearty welcome, while no one can doubt that more valuable information can be acquired in a few days, in an assemblage of this kind, than can be obtained in years of solitary work.

During the season that is now all but brought to a close, there has occurred nothing of a very startling or unexpected character. The Colorado Beetle has continued to extend his ravages throughout our country, but he has been met by such a determined and universal resistance that his work of devastation has been hardly appreciable; certainly in the central portion of this Province we have never had a finer crop of potatoes, both as regards quantity and quality. The Cabbage Butterfly (*Pieris rapæ*), to which I also referred last year, has been rapidly extending to the west, and has already become a common object in the neighbourhood of London. So closely, however, does its parasite (*Pteromalus puparum*) follow in its wake, that where a year ago it was most destructive to all its food-plants, it has this season wrought but a moderate amount of damage. The Locusts, or Grasshoppers, of the west (*Caloptenus spretus*) have continued to commit much havoc, though not by any means on the frightful scale of last year; there is every prospect that the destitution and suffering then occasioned by them will not be repeated to any very great extent this year. While there has been, upon the whole, a decided diminution in the amount of loss occasioned by noxious insects during the past year, we have, nevertheless, to record an increase in the numbers and consequent power for evil of several common species that are always more or less abundant. Among the most notable I may mention the Army Worm (*Leucania unipuncta*), which has wrought much damage in the maritime Provinces of the Dominion, as well as in some portions of the United States; the two species of Tent Caterpillars (*Clisiocampa Americana* and *Sylvatica*), which have been excessively abundant and destructive to fruit and forest trees in many parts of this Province; and the Pea Weevil (*Bruchus pisi*), which we much fear may soon become—unless measures are taken to prevent it—a source of great loss to our agriculturists. These I mention as having had a more than usual manifestation this year. But I need not detain you with any account of the ordinary work of our insect friends and foes, which are so familiar to every one in this country.

As I mentioned at the outset, you have done me the great honour of electing me your President for five years in succession. While I thank you most cordially for your kindness and consideration so repeatedly shown to me, I feel that it is only reasonable that I should now make way for some one else, who may be able to devote more time and energy to the interests of our Society, and be of more real use to it than I have latterly been capable of. I beg, therefore, to resign into your hands the office that you have so long honoured me with; at the same time, I desire to say that I shall continue always to have the welfare of the Society at heart, and that I shall ever be ready and willing to do all that lies in my power to advance its best interests.

Again offering you my respectful thanks,

I have the honour to be, Gentlemen,

Your obedient servant,

CHARLES J. S. BETHUNE.

Trinity College School,
Port Hope, September, 1875.

ANNUAL ADDRESS OF THE PRESIDENT OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Gentlemen,—Members of a young Society, especially those who are verily sincere, when they learn that their institution is progressing indeed, become imbued with a sense of pleasure, and I am gratified to state that the Entomologists (the majority of whom are young beginners) who meet in this city have made a worthy advancement in their investigations during the last year. At its inception, I had a doubt with regard to the attention which persons joining us would give to the study of our local insects, but such a thought has been dispelled from my mind. During the past twelve months ten papers were read, the greater portion of which, being the production of tyros in the science, exhibit, at least, an energy on their part to promote Entomology to the position for which this Branch Society was instituted. Affiliated with the Entomological Society of Ontario, whose headquarters are at London, Ontario, we receive the same benefits of membership, &c., as our western brethren composing the parent body. Our by-laws are suitably framed to meet the general work of the Branch, and the only future requisite will be a mere effort to prevent our Financial Secretary from grumbling. By so doing, and with punctual attendance, we will be enabled to continue our regular monthly meetings, and have greater pleasure when we meet mutually together in the pursuit of our favourite study. Bear in mind, however, that during the next year our cabinet must be attended to—it will be necessary that it should contain at least the nucleus of a general local collection, presenting a fair number of specimens of the several Orders of Insects. I maintain that if we possess a good classified collection of native insects it would be a great inducement for young beginners to join us. Books on Entomology are generally expensive, and only a few can be consulted studiously in regard to the noxious and beneficial insects of this country. Valuable Entomological literature issues annually from the pens of co-labourers in the United States; the greater portion of these are in the form of State Agricultural Reports, which seldom come to our hands. Our branch is simply in the chrysalis state, and in consequence of the metamorphoses not being complete, we are unable at present to produce some tangible matter in exchange; but I trust the day is not distant when some of our young beginners will be proud of their productions—as worthy of being read by the old heads in the science. However, I have thought that, from time to time, duplicate papers on Entomology may be received by the Parent Society in exchange for The Canadian Entomologist. These extra papers could be perused, and doubtless be of service to members of our branch, and the parent might, if it possesses such material, liberally share them between the three branches of its Society.

The Report of the Council informs you of the labour, &c., performed by members during the year. Possibly these labours will stand a fair criticism as emanating from a Society only in its second year, and the actual working members but young beginners. Old students should always bear leniently towards the tyro, especially when the latter seems anxious for information. He must be encouraged in this way. The low temperature which we experience in this latitude, during the greater portion of the year, may produce a kind of carelessness or lethargy in the young student of Entomology. This he should endeavour to avoid, and he can do so by devoting his leisure winter hours to the arrangement of his cabinet—that is to say, in reading, naming and classifying his specimens. He who admires the beauty and appreciates the value of Entomology will, with the return of lovely spring, refreshen his faculties as the objects of his research appear again before him.

We require more knowledge in connection with the distribution of insects, especially in regard to the Lepidoptera of Europe; I mean such species as are recorded as occurring in this portion of North America. Butterflies which are found distributed at this day throughout a great extent of this country, are recorded by the best of naturalists as having followed man from the Old World. Such species should be fully defined in order to prevent additional synonyma. "There is so great a similarity between our insect fauna and that of Southern Europe, that a knowledge of their species is often of great advantage in determining our own." The late Professor Agassiz states in his work on Lake Superior, that *Vanessa Antiopa*, "The Camberwell Beauty" of England, is one of these. That a few of the Diurnals are common to both continents I have no doubt, but in which of them did the species obtain their origin, or what is now termed their metropolis? My respected and talented friend Scudder, of Boston, in a late memoir on the genus *Pamphila*, says in his comments on *P. Manitoba*—a new but wide-spread species on this continent—that "the richness of this genus in America, and its extreme poverty in the Old World (where only a single species is known), lead to the presumption that the genus had its origin in our own country, and that temperate North America is its proper metropolis." I have examined and compared specimens of *Pamphila comma* of Europe, and *P. Manitoba* of America, and cannot discern the slightest difference in their forms and markings. Even in the forms of abdominal appendages there is but slight differences in these two forms. It may be further stated, as it has been by others, that *P. comma* was introduced into this country from Europe. Moreover, like other introduced species, it had perhaps to feed on a different food plant to that on which it fed in the Old World. This, in my opinion, produces at least external changes, and in connection with the wide spread of the form, we must as a natural result have varieties, the latter unfortunately being evidently considered species. The HESPERIDÆ intermix to some degree, and it is extremely difficult to trace the true form from its variety. Mr. Scudder is the chief authority on the HESPERIDÆ of the country, having made extensive research among this difficult class of butterflies; therefore he has greater facilities to prove differences between them, but I cannot look upon these two butterflies and discover the slightest deviation more than we find in the examination of a number of specimens of any particular species. A well-known European and American butterfly, *Vanessa Antiopa*, has a wide range and undoubtedly holds its metropolis on this continent. The colour of the wing-margins of this species has changed since its introduction into temperate America. All of us have seen the change which numbers of *Pieris rapæ* has gone through since its introduction into Canada, but after all it is nothing but the rape butterfly of Europe, slightly altered by change of food and climate, and it is just possible, by like influences, that the abdominal appendages of *P. rapæ* may in twenty years hence show differences in wide-spread varieties, as we have now shown to us in *Pamphila comma* of Europe, and *P. Manitoba* of Scudder. When *Pieris rapæ* came to us at Quebec, it changed and spread gradually, and although it lingers before the pressure of a parasite, yet it seems to hold against the enemy. This shows that there is something in this diversified climate favouring its spread which is southward and westward, and it is now a permanent insect of the United States. In these days there are so many ways by which insects are carried from place to place, that we cease to wonder when a strange species turns up in a locality wherein it was hitherto unknown.

It is a notorious fact, that almost all the insects which annoy our agriculturists and horticulturists came to us from the Old World. For instance, we have a saw-fly, which is found in our woodlands. It has lived there from time immemorial on wild gooseberries, and perhaps on the wild red currant, and we cannot find many instances of this species having attacked the domesticated gooseberry or currant to any extent. But the species introduced some twelve years ago from Europe has almost put a stop to the cultivation of the gooseberry and red currant throughout many parts of the United States and Canada. We have also a native onion-fly (*Ortalis arcuata*), which, although parasitic on the onion, does not appear to affect the crop generally, but the imported onion-fly (*Anthomyia ceparum*), an allied species, is a terrible pest to the onion-growers throughout the extent of the Dominion. Indeed, we have had an alarming number of insect foes imported into this country from the other side of the Atlantic. Another species of the latter genus has been destroying the cabbage in the neighbourhood of this city. This *Anthomyia* was also imported from Europe. The question may be asked, did these insects follow the introduction of certain plants from the same quarter? If *Antiopa* followed man to this country, its migration benefits the species, as the willows on which it feeds are far more abundant here than in Europe; but man has been instrumental in carrying noxious plants as well as insects, there being now distributed in America upwards of TWO HUNDRED AND THIRTY-THREE distinct species of plants from the Old World, all of which have run wild. It would seem that the climate of America is very conducive to the acclimatization and extension of European species. No doubt a number of North American insects have been, and will be from time to time, introduced into the Old World, but it appears that those already detected as coming from this country have not spread and become common there. These statements are made on the authority of British Entomologists and from the pen of C. V. Riley, the State Entomologist of Missouri, U.S., who accounts for the cause as follows:—"Since, then, it can be demonstrated by hard dry facts that American plants and insects do not become naturalized in the Old World with anything like the facility with which the plants and insects of the Old World are every day being naturalized in

America, there must be some cause or other for this singular state of things. What is that cause? It is, as we believe, a simple fact, which is pretty generally recognized now as true by modern naturalists, viz., that the plants and animals of America belong as a general rule to an old-fashioned creation, not so highly improved and developed as the more modernized creation which exists in Europe. In other words, although this is popularly known as the New World, it is in reality a much older world than that which we are accustomed to call the Old World. Consequently our plants and animals can no more stand their ground against European competitors imported from abroad, than the Red Indian has been able to stand his ground against the white Caucasian race. On the other hand, if by chance an American plant or an American animal finds its way into Europe, it can, as a general rule, no more stand its ground there against its European competitors than a colony of Red Indians could stand their ground in England, even if you gave them a whole county of land and an ample stock, tools and provisions to begin with. For throughout animated nature, as has been conclusively shown by Charles Darwin, there is a continual struggle for existence, the stronger and more favourably organized species overpowering and starving out from time to time their less vigorous and less favourably organized competitors. Hence it is as hopeless a task for a poor puny old-fashioned American bug to contend against a strong, energetic, highly developed European bug as it would be for a fleet of old-fashioned wooden ships to fight against a fleet of our modern iron-clads." Mr. Riley gives also another and perhaps the correct reason why the insects which are imported into this country multiply at a prodigious rate. . . It is that "whenever an injurious insect is introduced in our midst, as a general rule the particular parasite or parasites which kept it in check abroad are not introduced with it. Now, if what I have read are facts, and doubtless they are, it is evident that the Colorado Potato Beetle, even if it does reach any part of the Old World, will have a poor chance of extension, believing that that law which governs the struggle for existence will be brought to bear against it, as has been the case in regard to other introduced species from this country."

A few years hence will prove these statements—that is to say, if the Colorado Potato Beetle reaches Europe within that time. It was introduced into Canada in 1869; during the latter year it was first noticed near Point Edward, at the extreme south of Lake Huron, and opposite Detroit, near Windsor, at the south-western corner of St. Clair. Since then it has been making its way towards the Province of Quebec. It was last noticed on the eastern confines of Ontario, so that at its present rate of spreading, we may expect this most destructive insect in our neighbourhood at no distant day.

I now beg to return thanks for your attention to the welfare of the Branch, as well as for the kindness shown me while presiding over you since it was formed.

William Couper,
Montreal.

ADDRESS OF THE INCOMING PRESIDENT OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Gentlemen,—On assuming the duties of the office which you have so kindly conferred upon me, I wish to make a few remarks in the hope and with the object of furthering the interests of our Society, and stimulating us in the study of our science. The excellent address given at our last meeting by our retiring President was, in the parts relating to our Society, mainly retrospective in character, as befitted the occasion; but as we are now beginning another year's studies, I intend my remarks to be prospective—looking forward to what we may do during the present season, and endeavouring to point out some things which, I think, will help us on individually, and advance our studies as a whole.

To the statement that Entomology is a pleasing, nay, a fascinating pursuit, you will all readily agree. That it is also the means of healthful and innocent recreation, is also a truth to which your assent will be cordially given. And it is not only a pleasing study and a healthful recreation, but also a *science* requiring close and deep research in order to properly understand its secrets. I believe that as time goes on, and the study of insects is more and more pursued in a philosophical manner, it will be of great value in solving many of the problems relating to animal life, which now claim the attention of naturalists. It may even aid in elucidating some of the mysteries of past conditions of life in this planet, and supply data relative to the phenomena of species and varieties, which may be applied to the solution of this question with regard to higher forms of life. I think that the importance of our science in these respects is not sufficiently recognized by us; that we are content with merely getting our insects properly named, and rejoicing over a rare or a new species, while the removing of the insect races, their habits, instincts and co-relations, which might help in solving the questions before referred to, are passed over too carelessly. Now, though from our position in life we can devote to Entomology only leisure time, I think we ought to try and dive a little beneath the surface, and study the science, so far as our opportunities go, in a more thorough manner. Though we have not the time, nor the privilege of access to larger collections and libraries, which make us almost envy the position of many Entomologists in the United States, yet we may do something in our small way if we only set to work. The modern sciences have all been built up to their present high perfection on the inductive principle. Observation and experience have been the basis for advancement and theory, in contradistinction to the old system of theory first and observation afterwards. This inductive principle is the only solid foundation on which true knowledge can rest, and it is as applicable to Entomology as to any other science. In its economic aspect, or the study of insects and their hurtful or beneficial influence on cultivation, observation is of the first importance. And in the strictly scientific application of the pursuit, as in the study of species and varieties, the distribution of species, &c., all acquisitions to our knowledge must come from close and patient observation.

Now, I think we ought during the present season to pay more attention than we have hitherto done to the daily lives of our insect friends. A little thing, trifling though it may seem at the time, may give us a clue to something of greater importance, and the smallest insight into the habits, instincts or organization of an insect, when added to the observations of others, may lead at some future time to great results. Nothing is really little in the kingdom of nature; everything is under the wise and eternal laws of the Creator, and works for the end He designed, so that the smallest insect is worthy of our study, and may aid us in understanding something of the order, wisdom and skill which He has exerted in the creation and adaptation of the parts composing the wonderful system of life in which we find ourselves. Let us look then after little things, for as Smiles well observes, "Human knowledge itself is but an accumulation of little facts, made by successive generations of men; the little bits of knowledge and experience, carefully treasured up, growing at length into a mighty pyramid. Though many of these facts and observations may have seemed in the first instance to have but slight significance, they are all found to have their eventual uses, and to fit into their proper places. Indeed the close observation of little things is the secret of success in business, in art, in science, and in every pursuit in life."

I hope you will not think I am digressing, but I like to take and wish to give you an elevated ideal of our favourite study. If we consider any object we have in view a worthy and valuable one, we shall be the more likely to pursue it with assiduity and zeal; and while we regard Entomology as a pleasant recreation, let us not forget that it is a science bearing not only on the great interests of agriculture, but also, in conjunction with the other departments of Natural History, on questions at present causing agitation and discussion among the leading scientific men of the day.

Let our note-books then be kept ready, and whatever new thing we meet with during this year, in the life of our insect friends, be duly recorded. We shall at least be adding our little stone to build up the great Entomological pyramid.

Another thought which I wish to bring before you is, the advisability of extending our fields of operations. One of our principal objects is to learn something about the insects of the Island of Montreal. We cannot expect to learn *all* about them, or even to make a complete catalogue of their names, for some time to come, but we ought to remember that there are other orders represented here besides the Lepidoptera and Coleoptera. If we wish our Society to be symmetrical and well developed, we must study the other orders, otherwise we shall be a kind of monstrosity—an Entomological Society with a fair knowledge of the butterflies, moths and beetles of the Island, but utterly ignorant of its remaining and not less interesting insect inhabitants. To make a beginning, let us take all kinds, and then the possession of the specimens will incite us to find out their names and history. And if there was a good collection in the hands of the Society, say of Hymenoptera, I have no doubt, but that some member would be courageous enough to undertake the work and the pleasure of studying them up.

We are not doing ourselves justice in neglecting these other orders to such a degree, and I am sure (if you will allow me to venture on a joke) that if the insects themselves could only estimate our labours at their true value, we should have them protesting against being ignored in such a summary way. Besides, these orders are really of equal value with those we already study. Packard places the Hymenoptera at the head of the insect tribes, and I believe with good reason. They outnumber many of the other divisions, and far surpass all of them in the degree of perfection of their instincts. Many of the Neuroptera I consider not inferior to the Lepidoptera in beauty, and their more humble compatriots, the Hemiptera and Orthoptera, though more sober in their tints, and fewer in number, enjoy the unenviable reputation of being more injurious to cultivated plants than perhaps any of the others. Here then is a field still unexplored by us, full of objects of beauty and interest. Let us enter, and while extending our own knowledge, do our best to make the list of our Montreal insects complete.

Apart from these general recommendations, I wish to mention one or two things which should particularly engage our attention. They are included under the first recommendation I have made, namely, that of close and patient observation of insect life; but as they are of especial interest to us, I speak of them separately.

We all know that *Pieris rapæ* sometimes produces yellow males, and in fewer instances yellow females. Now, our worthy friend, Mr. Caulfield, has asserted that he fed certain larvæ of this species on mignonette, which larvæ became at last yellow imagines. The experiment is worthy of another trial, and if we each tried, and the assertion of Mr. Caulfield turns out to be well founded, the fact would go a long way to establish the theory that the colours of insects are influenced by the food plants of the larvæ.

Another fact we might be able to give to Entomological science this year. The Caterpillar of *Samia Columbia* has not been described, and I should like some member of our Society to have the honour of first describing it. The food plant is supposed to be a shrub growing in marshy ground—*Rhodora Canadensis* ; but I feel certain that like its cousins, Polyphemeus and Cecropia, the larva feeds on several distinct species of plants. I once had the larva, and know that it somewhat resembles that of Cecropia, having red tubercles on the fore part of the body, but different in number and situation to those of the latter. I give this as a hint to aid you in your researches. There is still another point which ought to interest us this year. I expect that the Potato Beetle will make its appearance in our midst before the close of the season. We must be on the look-out, and have the credit of giving the public the first intimation of its coming. If it does not come this year, it surely will next, for the Ottawa papers have announced its arrival in that neighbourhood, only one hundred and twenty miles away.

There are several very interesting topics now being discussed among Entomologists in America, in which discussion we should try to have a share. The question of the dimorphism of insects,—the question of the Graptas, in which Mr. Edwards is so deeply engaged—the question of different forms of larva in the same species, as that of Datana Ministra—the question of the distinguishing of the sexes in the larva state—and many others, are very interesting in themselves, and perhaps intimate to us (though without proving Darwinism, in which I, for one, do not believe), the way in which new species are elaborated in the grand processes of nature.

Before closing my remarks, I would like to glance at the state of our science in Canada and the United States. It is advancing in every respect. In Canada it is still in what we might call the *practical* stage—the knowledge we have is being applied, as far as possible, to the promotion of agricultural interests. But in this respect there is a great advance beyond what Canadian Entomology was a few years ago The annual reports issued by our Society for the Ontario Government are of very great value to the people, and tend, though practical in themselves, to the growth of the more philosophical departments of the science. Our journal has grown from the little four page serial of a few years ago, to be an excellent periodical, and maintains a high reputation everywhere. It is to be regretted that the diligent pursuit of business, so necessary among young people like Canadians, should interfere so much with the pursuit of Natural History among them. Our fellow-entomologists in Canada can only give their leisure to the study, and this alone prevents them from taking an equal position with those of the United States. I very much wish to see some Canadian gentleman of talent and leisure take up the study, or some Professor of our numerous colleges.

In the United States, the entomologists are doing good work in their different departments, and while the task of naming and describing is being rapidly prosecuted, some of them have leisure even to aim at changing the arrangement and nomenclature of the science. All honour to them for their industry and zeal, though some of their projects are too revolutionary, even for the present changeful age. Still I believe that even Mr. Scudder's system will be adopted at last, though, perhaps, very much modified in form. The great objection to it is the unearthing and bringing to the front of the names and classification of Hubner and other old authors who have been unnoticed if not forgotten for many years, and supplanting with these names those with which we have been familiar, and which have been given by entomologists who may be called the fathers of the science in America. The "law of priority," as it is called, is being enforced to its utmost limit—too far, in my estimation—and the result must be a discussion which will bring about a settlement of the question. Some years will doubtless pass before this end is gained ; in the meantime I like to keep to the old familiar names, which seem to me like the names of old friends.

In the department of Physiological Entomology, Dr. Packard is carrying on investigations of great interest, into the nervous system of insects, which must result in the real advancement of the science, and a great increase in our knowledge of a most wonderful and attractive subject.

And now, gentlemen, I thank you for the honour you have done me in electing me your President. I hope and believe that this year will be a prosperous one in our history, and that we shall reap both mental and physical benefit from our studies.

G. J. Bowles,
Montreal.

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

According to previous announcement, the first meeting of this Club was held in the rooms of the Detroit Scientific Association, on the 10th of August, 1875, at 2.30 p.m., Dr. J. L. Leconte, President, in the chair ; Prof. C. V. Riley, Secrerary. The attendance was large, including S. H. Scudder, Esq., Cambridge, Mass., Vice-President, and Messrs. A. R. Grote, Buffalo, N.Y. ; W. Saunders, London, Ont. ; B. P. Mann and E. P. Austin, of Cambridge, Mass. ; Prof. E. S. Morse, Salem, Mass.; J. A. Lintner, Albany, N.Y. ; E. A. Schwarz, H. G. Hubbard, and B. Walker, of Detroit ; Dr. A. E. Dalrymple and Dr. J. G. Morris, Baltimore, Md. ; Prof. A. J. Cook, Lansing, Mich. ; Dr. Hoy, Racine, Wisconsin ; Clinton Roosevelt and Geo. Dimmock, Springfield, Mass. ; B. D. Sanders, J. C. Holmes, and Wm. Provis, Detroit ; J. T. Ison, Cleveland, Ohio; and others.

President Leconte, in a few opening remarks, stated the objects had in view in the formation of this Club. They were chiefly to cultivate closer personal relations among those interested in Entomological pursuits, many of whom were widely separated by distance, to exchange views and record observations, and to exhibit specimens of interest. He hoped that the meetings would not only be fruitful in these respects, but that, seeing the importance of Entomology in its relation to agriculture, some good to the country might flow from the deliberations.

Mr. Wm. Saunders mentioned the fact of the unusual scarcity of insects of the Saw-fly family (*Tenthredinidæ*) throughout western Ontario, especially those destructive to fruit, naming the Gooseberry Saw-fly (*Nematus ventricosus*) and the Pear Tree Slug (*Selandria cerasi*). Both these insects, although enormously abundant and destructive in 1874, had been quite scarce in 1875. He called for suggestions as to the cause, his own impression being hat this diminution had been caused by the severity of the late winter and spring.

Prof. Cook, of Lansing, Mich., had not observed any remarkable scarcity of these species in his neighbourhood.

Prof. Riley had remarked their almost entire absence in some localities, and their comparative abundance in others.

Mr. A. R. Grote exhibited specimens of *Agrotis islandica* from the top of the White Mountains and from Labrador.

A lengthy discussion on nomenclature ensued, and was participated in by many of the members present, it being generally conceded that some action should be taken by the Club, looking to the adoption of some rules or suggestions which might guide the Entomologists of the country on this perplexing question. On motion, Messrs. Scudder, Riley and Saunders were appointed a committee to take the matter of nomenclature into consideration and present it at a future meeting in such form as to offer opportunity for more definite discussion.

Mr. Scudder spoke favourably of *Psyche*, the organ of the Cambridge Entomological Club, and urged that members subscribe for it on account of its excellent bibliographical record.

Mr. Mann called attention to the difficulty of getting hold of State Reports, and thought there should be some system adopted by which these Reports could be placed on sale, so that Entomologists who desired to do so might purchase them.

Mr. Saunders thought that if some plan could be devised whereby the valuable facts and suggestions contained in these various Reports could be brought together, condensed into one volume, and made available to agriculturists as well as entomologists, that much good would result from it.

The President suggested that such a work might well be done by the general government, and would be much more valuable than the volume it now sends out.

On motion, it was resolved that this Club request the American Association for the Advancement of Science to take such action as seems best calculated to secure the placing of State Reports upon scientific subjects in the library of the Association. The Secretary was instructed to bring this subject before the Association.

Dr. Morris referred to the scarcity of Sphingidae about Baltimore during the present season, an experience which was corroborated by other members present. Mr. Austin had found all insects unusually scarce about the White Mountains, where he had been collecting for the past two years. Mr. Riley thought the very severe and late winter and the unusually rainy summer in part explained the fact.

Mr. Scudder offered some remarks on the great abundance of the Army Worm (*Leucania unipuncta*) in portions of Massachusetts, as an exception to the general rule of scarcity of insect life; he had made a calculation from the number counted in a square foot, that in a field near Cambridge there must have been as many as two million worms to the acre. Other members offered similar experience in reference to this species. Mr. Riley stated that the Army Worm generally abounds during a very wet summer following a very dry year.

Mr. Lintner referred to the great scarcity of *Orgyia leucostigma* as in striking contrast to its abundance last year in Albany.

The election of officers then took place, resulting in the re-election of Dr. John L. Leconte as President, Samuel H. Scudder, Vice-President, and C. V. Riley, Secretary.

Mr. Riley read a paper on "Locusts as Food," in which he gave his own experience in cooking and eating them. On one occasion he ate nothing else for a whole day. He found them to have an agreeable nutty flavour, and especially recommended them deprived of their legs and wing cases, and fried in butter, and also spoke very highly of a soup made from them. He referred to John the Baptist, who had often been pitied for the scantiness of his fare, locusts and wild honey; Mr. Riley thought he had been well provided for. The writer regarded it as absurd that parties should actually die of starvation, as some had done in the districts where this locust plague had prevailed, while surrounded by such an abundance of nutritious and palatable food.

The meeting then adjourned, subject to the call of the President.

On Tuesday evening, the Cambridge Entomological Club held a meeting, when all interested in Entomology were invited to be present. W. Saunders, of London, Ont., was called to the chair. After the usual routine business had been disposed of, Mr. George Dimmock read a paper on the recent excursion of the Cambridge Club to the White Mountains, where the members had spent some two weeks in collecting. The experiences related were of a very interesting character showing that the party, besides accomplishing much useful work, had thoroughly enjoyed their trip. Mr. Austin, who had been one of the party, exhibited a large collection of insects made during the past two years among the White Mountains, embracing many very interesting species, and offered some remarks on their habits.

Messrs. Cook, Lintner, Morris and Riley were elected members of the Club.

Mr. Grote presented some instructive facts in relation to the identity of some of the White Mountain moths with those of Labrador. Mr. Riley inquired whether many *Caloptenus* had been found on Mount Washington, and expressed an opinion that a race of *spretus* had been found there.

Mr. Saunders inquired of the Michigan friends whether *Pieris rapæ* had been found in the State. Prof. Cook stated that it had not yet appeared in Michigan; he remarked that *protodice* was much more numerous than *oleracea*. Mr. Riley stated that *protodice* was most abundant throughout Illinois and Missouri. Mr. Ison, of Cleveland, stated that *rapæ* appeared in his neighbourhood for the first time last spring; at first it was found along the lake shore, but before the season closed it was abundant throughout the greater part of the district over which his observation had extended. Mr. Ison said that with them the larva seemed to prefer mignonette to cabbage. In reply to a question as to the correctness of the views advanced by some Entomologists in regard to the colour of the imago being affected by this food plant, Mr Lintner said that he had, from among 500 or 600 specimens fed on cabbage. found a number of the yellow variety. Mr. Riley stated that the larva of *protodice* was also partial to mignonette.

Danais archippus formed the next topic of discussion. Mr. Cook had found the larva this season peculiarly infested by several parasites. Mr. Riley had seen Tachina flies bred from *archippus*. Mr. Saunders had reared, on one occasion, a large number of small Hymenopterous parasites from a chrysalis. He also asked the members if any explanation could be given of the reason why this species assembled occasionally in immense swarms and migrated thus from place to place, and referred to instances of such swarming. Mr. Ison referred to an immense swarm which passed over Cleveland three years ago. In this instance it appeared as if they had crossed the lake from Canada; they were seen in immense numbers for three or four days. *Archippus* was said to occur in Australia, where it also occasionally swarms.

References were made by Mr. Grote to several rare captures of Lepidoptera in the vicinity of Buffalo. Among others he had taken *Thecla ocellifera*, which is also found in the West Indies. Mr. Saunders stated that he had again reared a specimen of *Thecla strigosa* from thorn, and referred to the capture of specimens of *P. thoas* and *P. marcellus* at North Ridge, Ont., by Mr. F. C. Lowe, of Dunnville. Mr. Cook said that *thoas* had been found this year at Lansing, that it occurred there to his knowledge some three years ago, and that last season it was quite common, the larva feeding on prickly ash. Mr. Riley stated that the larvæ of *philenor* feed on a creeping plant very closely allied to Aristolochia. Mr. Ison has found *philenor* scarce about Cleveland during the last five or six years, but *marcellus* rather common; the larva of the latter feeds on pawpaw. One of the Detroit members remarked that there were pawpaw bushes growing within a few miles of Detroit.

A discussion on sugaring for Noctuæ was next in order. Mr. Ison reported excellent success with this method at Cleveland; he preferred adding a little rum to the usual mixture of beer and molasses or coarse sugar. Mr. Lintner greatly interested the members in relating his wonderful success in sugaring. He produced a tabulated list of Noctuidæ captured or observed at sugar at Schenectady, N. Y., commencing with July 7th, giving the results of sixteen evenings in that month, and four evenings in August.

Seventy-eight species of Noctuæ are recorded, and opposite each species observed or collected is placed a check in a column bearing the day of the month at its head. Four species were observed on each evening, viz.:—*Hadena arctica, Hydroecia sera, Homopyralis tactus* and *Asopia costalis*. Of the first two, hundreds could have been collected on a single evening. *Hadena lignicolor* was unobserved on only one evening; *Erastria carneola* on only two evenings; *Catocala ultronia* and *Hadena devastator* on only three evenings.

The following species were common:—*A. herbida, A. haruspica, A. plecta, Orthodes infirma, Pseudothyatira expultrix, Hydroecia nictitans, Amphipyra pyramidoides* and *Erastria nigritula*. Of *Catocala ultronia* about *seventy* examples in fine condition were captured; of *Catocala nuptula*, of which not a single example had ever before been taken by Mr. L., thirty-six were collected; and of *Catocala parta* sixteen examples had been secured, all in perfect condition. Specimens of *Catocala Meskei, C. serena, C. Briseis, C. Clintonii, C. polygona* and *C. similis* had also been obtained.

Mr. L. has become quite enthusiastic over the success which he has met thus far, in the number of rare species collected, and particularly in the perfect condition in which the larger portion of them are obtained. It is his purpose to continue his collecting in this method, and also the tabulation of the results. The table, when completed at the end of the season, will probably be published in the New York State Museum Report. We are sure that it will prove a valuable contribution to that part of the natural history of our moths which relates to the number and duration of their several broods.

Mr. Mann exhibited specimens of the wood of *Agave Americanum*, which, when cut of the proper thickness, may be used as a substitute for cork. This wood is remarkably light and porous, and pins may with great ease be firmly pushed into its substance. It grows in Brazil, and can be obtained from Mr. Mann at a lower price than cork. In proof of the suitability of this material for the purpose named, Mr. Mann stated that Wallace preserved all his specimens collected in the East Indies in boxes made with pieces of this wood pinned together with thorns.

At a late hour this most enjoyable meeting was brought to a close.

On Thursday afternoon a large proportion of the members of the Club joined in an excursion to some good collecting grounds in the neighbourhood of Fort Wayne, the party being under the direction of Mr. Hubbard, of Detroit. A very pleasant and profitable time was thus spent, and many interesting specimens captured. In addition to the advantage enjoyed of closer social intercourse between the "brethren of the net," this occasion afforded an opportunity for the mutual exchange of practical ideas in regard to collecting insects which no in-door meeting could have afforded. It seemed as if every member had *some* original idea of his own either in reference to capturing or carrying specimens, the advantages of which were freely urged and as freely discussed with much profit. After thoroughly enjoying themselves for several hours, the members returned at nightfall well satisfied with the afternoon's sport.

On Friday morning a second meeting of the Entomological Club was held at the rooms of the Detroit Scientific Association. In the absence of the President, Mr. Lintner was called to the chair.

The Committee on Nomenclature reported as follows :—

"The Committee appointed at the last meeting of the Entomological Club to consider whether any immediate action is advisable on the part of the Club to aid in establishing uniformity in zoological nomenclature, finding that the Committee of the General Association intends to report during the present session, and deeming it best to await this Report before making any definite proposition, would at the present time recommend that the Club appoint a committee of five to prepare and present to the Club at its next annual meeting a compendium of the views of the leading Entomologists of the country upon points which, in their judgment, require elucidation, and also to present a series of resolutions touching such points, in order that intelligent discussion may be had upon them, and some general agreement, if possible, arrived at.

(Signed) "Samuel H. Scudder.
"C. V. Riley.
"Wm. Saunders."

On motion, the Report was adopted, and the appointment of the Committee left with the President, who subsequently nominated the following gentlemen :—Messrs. Scudder, Saunders, Grote, Riley and Leconte.

An interesting discussion then took place in reference to the various methods of pronunciation followed by Entomologists when speaking of insect names, which culminated in the following resolution, which was carried unanimously :

"Resolved, That in view of the desirability of securing uniformity among Entomologists in the pronunciation of the names of insects, Mr. O. S. Westcott, of Chicago, be requested to prepare such an accentuated list for publication in the Canadian Entomologist."

Mr. Westcott very kindly promised to give his attention to this matter at an early date. We shall hail the advent of this list with much satisfaction ; it is a work greatly needed, and coming from the hands of one who is in every way well fitted to do it justice, we feel sure that it will command general assent.

The next subject of discussion was on certain offensive names which have been proposed for insects, in which most of the members took part. The following resolution was unanimously adopted :—

" Resolved, That in view of the fact that certain names have of late been proposed for insects which are offensive and unwarrantable, that the Committee on Nomenclature be requested to present at the meeting next year a list of such names as should be ignored, so that the Club may take action in reference to them."

Some explanations were then offered in regard to a valuable discovery lately made by Mr. George Dimmock, of Springfield, Mass., of a ready method of removing the scales from the wings of Lepidopterous insects, so as to display the vein structure. Mr. Dimmock had kindly shown the admirable working of his process to a number of Entomologists at his room the evening previous, when all present were struck with the great practical value of the discovery. After full explanations to those present who had not seen the working of the process, it was resolved, " That the thanks of the members of the Entomological Club be given to Mr. Dimmock for his valuable discovery in reference to a ready method of denuding the wings of insects."

This process of Mr. Dimmock's formed the subject of a paper read before the American Association, and which will be published, we believe, in an early number of *Psyche*. It may thus be briefly explained : All the materials necessary are a little alcohol, a saturated aqueous solution of chloride of lime, a phial of pure muriatic acid and another of sulphuric acid The wings are first moistened with alcohol, then transferred to the solution of chloride of lime, to which a little of the sulphuric acid has been added. After immersion for a few moments, the colouring matter of the scales rapidly disappears. This result may be hastened by taking the wings out of the chloride of lime solution and immersing for a moment in the muriatic acid, diluted with twice its weight of water, and then returning them again to the former solution. This alternation may be repeated as often as required. By this means any quantity of wings of Lepidoptera may be safely and entirely denuded with little or no trouble.

The denuded wings were neatly mounted by Mr. Dimmock on white cards, to which they had been gummed. An interesting collection, illustrating the nerve structure of many of the genera of moths, was exhibited by him, to the great gratification of all present.

In the compilation of these memoranda in regard to the meetings of the Entomological Club, we are greatly indebted to the Secretary, Prof. C. V. Riley, who very kindly placed his notes at our disposal; also to Mr. B. P. Mann, of Cambridge, who did us similar service.

During the course of the Sessions of the Association, a valuable and practical paper was read by Dr. J. L. Leconte, retiring President of the Association, on various methods of subduing insects injurious to agriculture. This question being one of immense importance to the country generally, and especially to the agriculturist, elicited much discussion, and finally it was resolved to memorialize the Senate and House of Representatives of the United States in reference to the carrying out of some of the suggestions made by the learned author of this paper. We append a copy of the paper, as well as one of the memorial, all of which we commend to the careful consideration of our readers.

METHODS OF SUBDUING INSECTS INJURIOUS TO AGRICULTURE.

BY JOHN L. LECONTE, M.D., PHILADELPHIA.

(*Read before the American Association for the Advancement of Science, at Detroit, Aug. 10th.*)

In accordance with the predictions made at the time of its first appearance in the immediate Mississippi Valley, the Colorado Potato Beetle continues to extend its area of distribution. It has during the last and present seasons reached the Atlantic coast of the Middle States, and is preparing an invasion in mass of the maritime parts of New England, which will soon be overrun with the same ease with which it has conquered the Western and Middle States. Meanwhile the farmers are anxiously inquiring for means of destroying the invader. Materials destructive to the insects, and said not to be injurious to the plant or the soil, have been recommended almost without number; but, with the exception of Paris green, they have either been very insufficiently tried or found inoperative. That compound of arsenic and copper, therefore, remains naturally the favourite, notwithstanding its dangerous qualities and the possible deleterious effect it may produce on the fields after long use.

Entomologists and other scientific men are often asked : "Why do you not give us another remedy against this destructive insect? Are you baffled, with all your boasted progress in learning, by the invasion of a wretched little bug?" No, my friends, we are not baffled by the wretched little bug ; but in our endeavours to teach you how to dispose of it in such a manner as to protect your crops, we are embarassed by your own failure to grasp the magnitude of the problem which you have set us to solve. Had you indeed comprehended the warnings given by my lamented friend B. D. Walsh, on the first injurious appearance of the insect, and since repeated by many Entomologists, you would have insisted several years ago that the subject should be investigated with a power of inquiry proportioned to its importance, and you would have received such information as might, with proper and well-directed industry on your part, have prevented much loss.

However, I do not wish to speak of the past ; it is gone, and its errors cannot be undone. Let us rather inquire what shall be done in the future.

The first thing, then, is to cease calling upon science for a remedy, when science and empiricism have probably already given you many remedies, concerning the application of which I will have a word to say by-and-by. Science can help you and will help you only when you have begun to help yourselves. How, then, can we begin to help ourselves? I hear you ask. First, then, there should be a Scientific Commission, selected by competent scientific authority for their merit and not for their political influence. Politicians have had too much control over our agricultural interests, as you all have reason to remember with regret. This Commission should be sufficiently large to subdivide the subjects committed to them in such manner as to thoroughly investigate the habits and times of appearance in different districts of the great agricultural pests, the effect upon them of all the cheaper materials which have been or may be judiciously suggested as destroying agents, and the proper times and manner of applying them. The members of the Commission should also receive sufficient compensation to warrant them in giving as much time and labour to this investigation as may be required, even to the temporary abandonment, if necessary, of their other scientific or secular pursuits. No such task can be properly performed and completed by the solitary labours of State Entomologists underpaid and overburdened with work. Only by association of several such careful observers and investigators can a worthy, useful result be obtained for the suppression of several of the most formidable pests.

2. This information being procured, should be tabulated as far as possible, or at least reduced to a compact form for easy reference, and widely published in newspapers and also in pamphlet form.

3. By the distribution of this information and by appeals through the newspapers and agricultural journals, as well as by addresses at meetings of farmers and others interested in agriculture, it must be impressed upon the public mind that all individual efforts for the suppression of these pests are frequently futile. Only combined and consentaneous action over large tracts of country will be effective.

Now, while I am prepared to believe that when these facts are made known to the farmers they will immediately see the importance of the suggestion for unanimous and simultaneous advance upon the enemy, yet without legislative aid it will be quite impossible to secure the organization requisite for an effective onslaught. It will therefore be necessary for the citizens interested to command their representatives, either in State Legislatures or in National Congress, to prepare proper laws for the destruction of these pests at stated times, to be determined and recommended by the Scientific Commission. These laws will be not only cheerfully obeyed by every intelligent farmer, but I know that the farmers as a class will be glad to have such laws enacted and enforced with penalties for their neglect. Those disposed to help themselves and each other can only thus be protected against an ignorant and indolent neighbour, whose thriftlessness would other wise make of his potato patch, his cotton field or his plum orchard a nuisance nursery from which no industry could protect the surrounding farms.

Thus, then, the organization necessary for a successful campaign against our insect enemies must be authoritatively demanded by you. Under less free forms of government the plan which I have suggested would probably have long ago been perfected by the rulers. Even the fear of the extension of the Colorado Potato Beetle to Europe has excited in several countries almost as much discussion and confusion of counsel as an apprehended revolution.

The fact is, that these incursions and ravages of hostile insects represent a condition of *war*. It is only by a *quasi*-military organization and appropriate weapons suited to the nature of the enemy that they can be conquered. Without recognition of this fact nothing can be done against them, and we must bow our heads and exclaim with the pious Mohammedan fatalist, "It is the will of God."

Three subjects yet remain to be considered—the materials to be used, the time of making the attack in force, and the weapons to be employed.

1. The materials may be either vegetable or mineral, or merely human labour intelligently and persistently applied. The latter is the only effective means of contending against some insects, but in all cases it is a necessary adjunct to the remedies used. These remedies are very numerous, and until a careful investigation is made of the large number already suggested, no proper indications can be given except that those least injurious to man should be preferred, even at greater cost of money and labour; and that those which kill the insect by contact with its body are likely to prove more effectual than those which destroy by poisoning its food. It may be here observed that the form of apparatus in these two cases must be quite different. In the latter, any contrivance which will sprinkle a fluid or dust a powder on the exposed or upper surface of the leaves will be sufficient; in the former, in which the poison kills by contact with the insect, it must be able to reach the enemy wherever sheltered.

2. The time of attack must naturally be when the enemy is least able to resist. To quote again from the excellent memoir of Motschulsky, "the most effective and at the same time the easiest mode of opposing the development of the locusts is the crushing out of the young broods when collected in swarms in the place where they are hatched. Consequently the most important thing is to know the nesting place of these destructive pests. In order to discover them and to point out the course to be pursued, * * it might be well to send skilful persons * * to make the necessary researches, and these, with the assistance of the local authorities, might seek out the places where the insects abound, and establish the necessary regulations for their destruction." (l. c. p. 228.) In the case of the cotton moth it is plain that the attack should be made upon the earliest broods, which are said to appear in the extreme southern part of the country, and from which the migratory swarms which travel northward are supposed to be developed; also, that the attack must be directed against the caterpillars rather than the perfect insects.

The Colorado Potato Beetle may also be attacked with greatest success in the larval state. The integuments are then soft, and the appetite more voracious, so that whether the poison by contact or the poison by food be used, it will have a more certain effect than upon the perfect insect, which is protected against the former by the hard chitinous surface, and against the latter by preoccupation in reproductive duties.

You will be prepared to admit the importance of the recommendation above made, that the times for making the attack should be directed by the Scientific Commission after full examination of the habits of the insects and the dates of their appearance in their various stages of development. These dates will vary in different districts, and without a carefully tabulated calendar of the necessary facts, no system of combined effort, such as I believe to be essential, can be planned.

The apparatus to be used must of course vary greatly with the habits of the insects to be attacked. In the case of the plum curculio, canvas frames propelled on a kind of wheelbarrow, with a ram to concuss the trunk of the tree, is probably the best instrument yet devised. The insect will fall into the net when the tree is struck, and may be easily destroyed when a sufficient mass has been collected. For the cotton moth and the potato beetle the apparatus for poisoning the leaves upon which they feed may be any simple sprinkler or dusting box, according as liquid or solid poison is employed. But for direct application to the insect itself, we must use means by which a fine spray will be driven with force sufficient to envelop the whole plant, or the surface of the ground upon which the insects are assembled, in a mist of poisonous liquid. Such an instrument is the atomizer, which has the additional advantage over the sprinkler that it consumes less liquid. The first application of the atomizer for the destruction of insects was made by me several years ago; and in the *American Naturalist* for August, 1869, I published a short paper recommending its use with certain poisonous liquids for the disinfection and preservation of insect cabinets. I have seen its frequent use with great success.

When the question of locusts became of importance last year, and the Colorado potato beetle began to be very troublesome in the Atlantic States, I spoke with several commercial friends and others about the propriety of making atomizers of large size for the destruction of these pests. In consequence of delay in the measures they thought necessary to command the attention and security of a manufacturer, no progress has yet been made for introducing such a contrivance into general use. Meanwhile a small apparatus, consisting of an atomizer, a tank of fluid supported on the back, and a pair of bellows fixed at the side of the operator, has been independently introduced by a manufacturing establishment in Philadelphia, and I have been told is somewhat of a favourite. It will doubtless be useful to a limited extent, and is not patented, I believe.

For small arms, this or a somewhat larger and more complete instrument will answer, but in the war against insect pests in which I have endeavoured to interest you, we must have heavy ordnance as well as weapons for hand use. Large compound atomizer tubes, with five, ten, twenty, or, in fact, an indefinite number of orifices for producing the spray, can be made, connected with large tanks of fluid, and worked by a powerful current of air from a revolving fan, driven by man, horse or steam power, according to the size of the instrument. When of sufficiently large size, the machine can be mounted on wheels and transported wherever it would be required for use. Before such instruments as these an invading army of caterpillars, or even a recently hatched swarm of locusts, would be annihilated. A comparatively small number of men would be required to work a battery of this kind of field artillery, and it would be found immensely effective.

The organization recommended can be effected only by the strong appeal of the people where agricultural interests dominate, for proper instruction from the Government and proper protection by legislative power. We have game laws to protect our useful wild animals; thistle laws to guard against extension of noxious weeds. Why not have insect laws for destruction of agricultural pests?

Farmers of the West, are you willing to exert yourselves to procure this result? The prize is a rich one—it is no less than immunity from an annual destruction of property quadruple or sextuple that of the great Chicago conflagration.

Copy of Memorial.

To the Honourable the Senate and the House of Representatives of the United States.

The subscribers to this Memorial respectfully represent to your Honourable bodies:

That they recognize in the invasion of grasshoppers, or more properly locusts, which during the past season have reduced to starvation many thousands of the inhabitants of the Western States and Territories, and especially of Minnesota, Nebraska, and Kansas, a great national calamity, calling for more efficient measures than those now available to prevent a recurrence of similar disasters.

They have reason to believe, from the reiterated cautions given by men of science, that a more careful study of the habits, rapidity of extension, and injuries caused by the few species of insects most destructive to agriculture would lead to useful suggestions by which proper means can be devised for the repression of these pests.

The agricultural industries are shown by all statistics to be greater in importance and value than all the other interests of the nation combined.

The labour required for the full investigation of the complex problems involved in the protection against natural enemies of these vast interests can only be had by the employment of the best men of science, who are usually not found in the service of the Government, but who for a great national purpose would give their closest attention to any subject which might be committed to them.

Such objects as the locust, which has caused recently a destruction of food estimated at from $40,000,000 to $50,000,000; the Colorado potato-beetle, which, in accordance with the predictions of Entomologists of repute, has extended from the Rocky Mountains to the Atlantic, and has invaded the neighbouring Dominion; the Chinche bug, so destructive to cereals in the Valley of the Mississippi; the army worm and the cotton worms which destroy whole crops, certainly require the strongest measures that can be adopted by the Government for their suppression.

It was estimated by Mr. B. D. Walsh, that in 1861 the injury caused by insects in the State of Illinois alone amounted to $20,000,000. The destruction must be now much greater.

By the same authority it was stated that "the annual damage done by insects in the United States cannot be less than $300,000,000.

The appropriations made by a State, however liberal, must ever fail to procure such investigations as your memorialists pray for: the enemies are national, and must be dealt with by national authority, as much as an invading army of foreigners, hostile to our civilization. Unless repressed by intelligent means applied over its whole area of distribution, the insect, with its free powers of movement in its adult state, is not controlled.

Your Memorialists would be glad to believe that the information needed upon these most important subjects could be afforded by the Department of Agriculture. Unfortunately such is not the case, nor can it be until the Department is under scientific advice. There remain, therefore, but two modes of procuring for the Government and the people proper counsel for defence against agricultural pests.

The first is the reorganization of the Department upon a scientific basis, under the control of men whose learning and fitness for the position are acknowledged both abroad and at home. The second alternative is the appointment of a Commission of five persons, —to wit, three entomologists, one chemist, and one botanist, eminent in their respective branches of science—to be chosen by the Council of the National Academy of Science, and approved by the Secretary of the Treasury, with such salaries as your Honourable bodies would consider adequate for the responsible work required of them, and with such additional appropriation as might be needed for clerical assistance. The duty of this Commission would be to investigate the causes which affect injuriously agricultural interests, and to suggest the best means of diminishing the losses.

The results of such investigations should be embodied in brief Reports containing practical instructions and made accessible at a small price, or by personal education to every farmer in the country.

It is believed by your Memorialists that the granting of their prayer by the creation of such a Commission would do more for advancing Agriculture than can ever be expected from the Department, and be in the end most economical. If such a Commission were appointed for a definite term (say five or seven years), it would at the end of that time save in part, or perhaps wholly, the annual expenses of the Department of Agriculture, and would lessen greatly the destruction of agricultural products, by tending to the rapid extermination of all these great pests.

It could be safely promised that the work of such a Commission would be of equal value and dignity with that of other Scientific Commissions of the Government; such as the Coast Survey, Geological Survey, Commission of Fisheries, and Signal Bureau, and would be as strictly practical as either.

And your Memorialists, as in duty bound, will ever pray, &c.

OUR DECEASED MEMBERS.

FRANCIS WALKER.

The sad intelligence of the death of that distinguished Entomologist, Francis Walker, of London, England, will, we know, bring grief to the hearts of all those who have been favoured with the acquaintance or correspondence of that genial-hearted man. His continued and disinterested kindness towards all those with whom he had to do has endeared him to many. Although we never had the pleasure of a personal acquaintance with the deceased, yet to ourselves personally, as well as to our Society, he has always been among the truest and kindest friends we have had, ever ready to do us any service in his power. His death leaves a void in our circle which it will be hard to fill. The following brief sketch of his career and his unceasing labours, written by one who knew him well, will be read with interest:

It has become my painful duty to record that Francis Walker, the most voluminous and most industrious writer on Entomology this country has ever produced, expired at his residence, Elm Hall, Wanstead, on the 5th of October, 1874, sincerely lamented by all who enjoyed the pleasure and advantage of his friendship. He was the seventh son, and the tenth and youngest child of Mr. John Walker, a gentleman of independent fortune, residing at Arno's Grove, Southgate, where the subject of this memoir was born on the 31st of July, 1809. Mr. Walker—the father—had a decided taste for science, especially Natural History; he was a fellow of the Royal and Horticultural Societies, and vice-president of the Linnæan, so that his son's almost boyish propensity for studies, in which he afterwards became so eminent, seems to have been inherited rather than acquired.

Mr. Walker's decided talent for observing noteworthy facts in Entomology was first exhibited at home, when as a mere child his attention was attracted by the butterflies, which, in the fruit season, came to feed on the ripe plums and apricots in his father's gardens; *Vanessa C-Album* is especially mentioned; and *Limenitis Sibylla*, another species no longer found in the vicinity of London, was then common at Southgate.

In 1816 Mr. Walker's parents were staying with their family at Geneva, then the centre of a literary *coterie*, in which they met, among other celebrities, Lord Byron, Madame de Stael, and the naturalists De Saussure and Vernet. They spent more than a year at Geneva and Vevey, and in 1818 proceeded to Lucerne, from which place Francis, then a boy nine years of age, made the ascent of Mont Pilatus, in company with his elder brother Henry; their object, in addition to the ever delightful one of mountain-climbing, being the collecting of butterflies. The family afterwards visited Neuwied, and returned to Arno's Grove in 1820.

In 1830 the two brothers, Henry and Francis, again visited the Continent, and now it was purely an Entomological tour, the late Mr. Curtis, the well-known author of "British Entomology," being their companion. This party collected most assiduously in the island of Jersey, and afterwards at Fontainebleau, Montpellier, Lyons, Nantes, Vaucluse, &c., the French Satyridæ, of which they formed very fine collections, being their principal object.

Mr. Walker's career as an author commenced in 1832. He contributed to the first number of the "Entomological Magazine," the introductory chapter of his "Monographia Chalciditum," a work on the minute parasitic Hymenoptera—a tribe of insects which he ever afterwards studied with the most assiduous attention, and one on which he immediately became the leading authority. He was then only twenty-three years of age: but his writings exhibited a depth of research and maturity of judgment which have rarely been excelled, and which abundantly evince the time and talent he had already devoted to these insects. It is worthy of notice that he now descended from the largest and most showy to the smallest and least conspicuous of insects, doubtless feeling that whereas among the magnificent butterflies there was but little opportunity for the discovery of novelties, among the Chalcidites everything was new—everything required that minute, patient and laborious investigation in which he seemed so especially to delight. Only two authors, Dalman and Spinola, had preceded him in devoting their attention to the structure of these atoms of creation; and even these two had described comparatively a very small number of species.

In 1834 Mr. Walker, somewhat reluctantly, consented to undertake the editorial management of the "Entomological Magazine," and resigned the office the following year, yet continued a constant contributor to its pages. The same year he visited Lapland, in company with two of our most distinguished botanists; and in this extreme north of Europe, and especially at Alten and Hammerfest, he assiduously collected insects, more particularly the northern Diptera, the Satyridæ among Lepidoptera, and the Chalcididæ amongst Hymenoptera. During this journey we have the first and only notice of his prowess as a sportsman; he shot wild grouse and ptarmigan; and on one solitary occasion was accessory to the death of a reindeer; but as other rifles besides his own were simultaneously discharged, it is difficult to say whose was the effective bullet. I am glad to be able to record that Mr. Walker declined to give the poor creature the *coup de grâce*, and, for this especial purpose, resigned to another his *couteau de chasse*.

In May, 1840, he married Mary Elizabeth, the eldest daughter of Mr. Ford, of Ellell Hall, near Lancaster, and spent the summer on the Continent, again collecting in Switzerland with his customary assiduity.

In 1848 he explored the Isle of Thanet, the following year the Isle of Wight, and succeeding years, 1850 and 1851, he visited Geneva and Interlachen; and during the former year commenced his great work on Diptera. This formed part of a projected series of works on British insects, to be called "Insecta Britannica," a project in which the late Mr. Spence took a deep interest.

During the year 1851 was published the first volume of the "Diptera." This work is printed in 8vo., and contained 314 pages; the second volume appeared in 1853, and contained 298 pages; and the third volume in 1856, and contained 352 pages. Thus the entire work comprised nearly 1,000 pages of closely-printed descriptions.

Another tour on the Continent occupied a considerable portion of 1857, Mr. Walker visiting Calais, Rouen, Paris, Strasbourg, Baden-Baden, Heidelberg, Wiesbaden, Frankfort, Mayence, Cologne, Brussels, Aix-la-Chapelle and Antwerp. During the journey he collected in the Black Forest; and this is the only scene of his scientific labours, during the tour, of which I have any intelligence.

The summer of 1860 was devoted to a thorough exploration of the Channel Islands. Dr. Bowerbank was his companion during a portion of the time, and, as a consequence, the sponges of these islands were a main object of research—the Gouliot caves in Sark, so celebrated for their marine productions, were a great attraction to both naturalists.

In 1861 Mr. Walker's excursions were chiefly confined to North Devon; he visited Linton, Clovelly, Ilfracombe, Bideford, and Barnstaple; and now his attention seems to have been again chiefly occupied with Lepidoptera, at the scarcity of which he was greatly disappointed, having expected, from the extensive woods, to have found moths particularly abundant.

In 1863 he toured the English lakes; and, in the spring of 1865, North Wales and Ireland; and in the autumn he again visited Paris, Geneva, Lucerne, Interlachen, and Altdorf, ascending the Righi, Mont Pilatus and the Mürren, and proceeding to Kandersteg, the Oeschinen See, and the Gemmi Pass.

In 1867 we find him again in France and Switzerland, ascending the Col de Voza, and examining the Jardin of the Mer de Glace; thence over the Tête Noir to Martigny, Sion, and the Great St. Bernard; returning by St. Maurice and the Villeneuve to Geneva.

In 1869 he made the tour of the Isle of Man, and returned by Holyhead; in 1870 he paid another visit to Llanberis, as well as to all the more beautiful scenery in North Wales, crossing over to Ireland, and touring that island from south to north; and in 1871, he examined entomologically the Scilly Islands, and the districts of the Lizard and the Land's End.

In 1872 he turned his attention to Italy, visiting Rome, Piza, Lucca, Florence, Naples, Sorrento, Capri, Milan, and Venice, as well as the Lakes of Como and Maggiore.

And, finally, in the present year, he had again proceeded as far as Aberystwith, on his way to Ireland, when his intention was frustrated by illness, which terminated fatally on the 5th of October. He died in the most perfect peace of body and of mind. For many years Mr. Walker was a member of the Linnæan and Entomological Societies of London, but resigned his membership in both some time before the close of his life.

In might be excusable in a man of such incessant bodily activity—so locomotive by inclination, so devoted to the study of Nature in all her aspects, so diligent a collector of the objects of his favourite study—had he allowed his pen to rest while his hands were engaged in forming and arranging his collections. But this was not the case with Mr. Walker, as his Catalogues of the National Collection abundantly testify. Of the Lepidoptera Heterocera, alone, Mr. Walker catalogued and described upwards of twenty-three thousand species; in addition to which he prepared similar catalogues, although perhaps not to the same extent, of the Diptera, Orthoptera, Homoptera, Neuroptera, and part of the Hymenoptera : such an amount of labour, as is testified by these catalogues, has seldom, if ever, been accomplished by one individual. But this statement by no means represents the whole of his literary labours. He contributed shorter or longer papers to the Transactions of learned societies, and to the periodicals of the day, especially to the "Zoologist" and "Entomologist;" by the indexes of the latter I find he sent thirteen communications to the first volume, three to the second, one to the fourth, thirteen to the fifth, and forty-three to the sixth ; during the present year his writings appear in every number. I intended to catalogue these and his other labours, to give some idea of the number of pages, number of species and dates of each ; but I can scarcely now venture to look forward to the accomplishment of this labour of love.

A word remains to be spoken of the man, apart from the scientific and accomplished naturalist. Throughout my long life I have never met with any one who possessed more correct, more diversified, or more general information, or who imparted that information to others with greater readiness and kindness ; I have never met with any one more unassuming, more utterly unselfish, more uniformly kind and considerate to all with whom he came in contact. It is no ordinary happiness to have enjoyed the friendship of such a man for nearly half a century.—*Edward Newman, in The Entomologist.*

PHILIP L. SPRAGUE.

Mr. Philip L. Sprague died at Montpelier, Vermont, his native place, on the 6th day of August last, in the forty-fifth year of his age. He was elected a member of our Society in 1860.

About 1862 he commenced the study of Entomology in the Vermont State Cabinet of Natural History, displaying a marked taste for the Lepidoptera, and during the intervals of his business made considerable progress in biological investigations, as well as in the technology of the science. Circumstances soon induced him to direct his attention chiefly to the Coleoptera, and here his assiduity in making collections, his accuracy in the determination of species, and his studies in the microscopic anatomy of this order, gave his opinions weight among naturalists. His keen appreciation of the labours of his predecessors, and his love of neatness and method, evinced themselves in all he did.

At the time of his death he had been for some months a valuable assistant and member of the Boston Society of Natural History, where many of his works remain to speak for themselves. Among his associates there he was distinguished for his geniality of manner and never-failing readiness to assist younger students. At the time of his death his fame and foreign correspondence were somewhat extended, and he was actively engaged in the preparation of materials for an illustrative cabinet of the Natural History of his native State. He had published from time to time in the *Canadian Entomologist* and the Proceedings of the Natural History Society carefully elaborated results of his work, and contributed to various other periodicals devoted to his favourite branch of investigation. His fine private cabinet of insects, principally of the Coleopterous Order, in accordance with his expressed determination, form a part of the Museum of the Society to which he was attached, and is in itself no mean monument to his memory.

ON CANKER WORMS.

BY W. SAUNDERS, LONDON, ONT.

Late in the fall, when many of the leaves have fallen and severe frosts have cut everything tender, and all nature begins to look bleak and cheerless, a walk in the woods on a sunny afternoon is not without its charms. Here and there slender, delicate, silky-winged moths may be seen flitting about, apparently in a somewhat aimless manner, enjoying the genial sunshine. On capturing one, and examining it closely, we find it to be a very handsome and delicately-marked moth, with wing structure so thin as to be almost transparent, and one is naturally led to inquire how it is that so frail a creature should select so frosty and bleak a season in which to appear among us. In reply to this reasonable inquiry it may be said that appearances are deceptive; that delicate as the structure of this moth appears to be, it is nevertheless one of the hardiest of its race, requiring, indeed, some considerable degree of cold for its perfection. These moths are the product of the Canker Worm, and the winged specimens are all males.

During the last few years several valuable papers have been published on the insects known as Canker Worms, in which has been detailed much hitherto unknown in connection with their life history. Prominent among these is a paper by C. V. Riley, St. Louis, Mo., in his Second Report on the Noxious Insects of the State of Missouri, and a recent paper of his in the Transactions of the St. Louis Academy of Science; also an article by B. P. Mann, in the Proceedings of the Boston Society of Natural History, and another by H. K Morrison, in the 6th volume of the *Canadian Entomologist.* In the following summary of what is known respecting these insects we shall make free use of these, as well as previous writings, without further acknowledgment.

In 1795, Prof. W. D. Peck wrote his " Natural History of the Canker Worm." This paper was awarded a prize by the Massachusetts Society for Promoting Agriculture, and was published in their Proceedings. At this early period all the insects passing under this name were supposed to be one and the same species; but later and more careful observation has led to a modification of this view, and it is now universally admitted that there are two distinct species possessing similar habits, and having many points of resemblance—one producing the perfect insect in the fall, the other partly in the fall and partly in the spring, the former species being known under the name of *Anisopteryx pometaria*, the latter as *A. Vernata*. The latter species will first claim our attention.

Anisopteryx Vernata.

Fig. 1

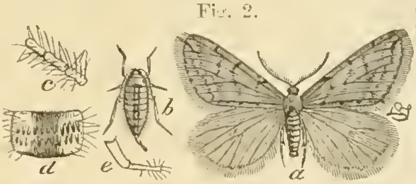
At *b* fig. 1 we have a representation of the egg of this species on an enlarged scale, the natural size being shown in the small cluster adjoining. In form it is not unlike a miniature hen's egg, but is of a very delicate texture and pearly lustre, with irregular impressions on its surface. The eggs are laid in masses, without any regularity or order in their arrangement, often as many as a hundred together, and secreted in the crevices of the bark of the trees infested. The eggs are usually hatched between the first and middle of May, about the time when the young leaves of the apple tree begin to push from the bud. The little canker worms, on making their escape from the egg, cluster upon and consume the tender leaves, and on the approach of cold or wet weather creep for shelter into the bosom of the expanding bud or into the opening flowers. The newly-hatched caterpillar is of a dark olive green or brown colour, with a black shining head, and a horny plate of the same colour on the second segment. When full grown they measure about an inch in length, and present the appearance shown at *a*, fig. 1 : in the same figure *c* represents a side view, and *d* a back view of one of the joints or segments of the body, enlarged so as to show their markings. These caterpillars are called "loopers," because they loop their bodies when in motion.

The colour of the body of the larva varies from greenish yellow to dusky or even dark brown. The head is mottled and spotted, and has two pale transverse lines in front; the body is longitudinally striped with many narrow pale lines; along the sides the body becomes deeper in colour, and down the middle of the back are some blackish spots. When not eating they remain stretched out at full length, and resting on their fore and hind legs under the leaves.

When full grown they leave the trees, either by creeping down the trunk or by letting themselves down by silken threads from the branches. When thus suspended in great numbers, as is frequently the case, under the limbs of trees overhanging roads and sidewalks, they become a great annoyance, especially to over-sensitive pedestrians, and are also often swept off by passing vehicles, and in this manner conveyed to other places. Having reached the ground, they soon begin to burrow into it, and having penetrated from two to six inches, a simple earthen cell is formed by compressing the earth, and lining it with a few silken threads; this makes but a fragile home for the chrysalis, and is easily broken to pieces.

The chrysalis, which is about five lines long, and one-and-a-half in diameter, is of a pale, greyish-brown colour, with a greenish tint on the wing-sheaths in the male; that of the female is more robust than the male, and both are sparingly pitted with shallow dots over their surface. Sometimes the chrysalis produces the perfect insect late in the autumn; in other cases it remains quiescent during the fall and winter months, emerging during the first warm days of early spring.

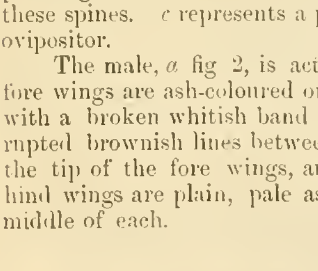
Fig. 2.



The female moths of both species of canker worm are wingless, and present a very odd, spider-like appearance (see *b*, fig. 2, and *b*, fig 4), but with none of the activity of that predacious race with a body distended with eggs, she drags her weary way along in a most ungainly manner, until she reaches the base of a suitable tree, up which she climbs, and there awaits the arrival of the male. The abdomen of the female as well as that of the male of this species *vernata*, *b* fig.2, have upon the hinder margin of each of the seven rings of the abdomen two transverse rows of stiff, reddish spines, pointing backwards. At *d* fig. 2, we have represented a joint of the abdomen showing these spines. *c* represents a portion of the antenna of the female, and *e* her retractile ovipositor.

The male, *a* fig 2, is active, although a delicate and slender-looking creature. Its fore wings are ash-coloured or brownish grey, of a silky, semi-transparent appearance, with a broken whitish band crossing the wings near the outer margin, and three interrupted brownish lines between that and the base. There is an oblique black dash near the tip of the fore wings, and a nearly continuous black line before the fringe. The hind wings are plain, pale ash-coloured, or very light gray, with a dusky dot about the middle of each.

Anisopteryx pometaria.



This species, although, as already remarked, closely resembling the preceding species, has many points of difference. The eggs—see *a* and *b*, fig. 3—are flattened above, have a central puncture and a brown circle near the border, and are laid side by side in regular and compact masses, *c* fig. 3, and are usually deposited in exposed situations.

The newly hatched caterpillar is pale olive green, with the head, and horny covering of the upper part of the second segment of a very pale hue. The full grown caterpillar, *f* fig. 3, is also differently marked; *e* represents a side view of a single joint of the mature caterpillar enlarged; the longitudinal lines are fewer in number, but broader and more distinct.

The chrysalis is much tougher than that of the former species, being formed of densely spun silk of a buff colour, interwoven on the outside with particles of earth.

Fig. 4.

In the male moth, *a* fig. 4, the antennæ have a greater number of joints, there being fifty or more in this species, whereas in *vernata* there are not quite forty. The wings are less transparent but more glossy, the fore wings brownish gray but of a darker hue than in the other species, and are crossed by two more regular whitish bands, the outer one enlarging near the apex, where it forms a large pale spot. The hind wings are grayish brown, with a faint central blackish dot, and usually a more or less distinct white band crossing them.

The female, also, has a correspondingly greater number of joints in her antennæ; the abdomen in both sexes is without spines, and that of the female terminates bluntly and is without an ovipositor. In fig. 4 *b* represents the female moth, *d* a segment of her abdomen, and *c* a portion of one of the antennæ.

Where the canker worms are numerous they are very destructive to apple trees, but are by no means confined in their operations to this particular tree; they also attack the plum, the cherry the elm and a variety of other trees. In most localities where they occur they multiply rapidly, often enormously, and do an amount of damage corresponding with their numbers. The very young worms on the trees are seldom noticed, but as they acquire age and increasing voracity the riddled and seared appearance of the foliage speaks unmistakably of their presence. In the New England States they have been a terrible pest for many years, and are now becoming plentiful in portions of Ontario particularly in some parts of the Niagara district.

Remedies.

In order to attack an enemy with success it is very essential that we know his vulnerable points. In the case of these insects, since the females are without wings, if they can be prevented from crawling up the trees to deposit their eggs a great point will be gained. Various measures have been recommended and employed to secure this end, and these remedies usually belong to one of two classes: first, those which prevent the ascension of the moth by entangling her feet and holding her there or by drowning her; and second, those which endeavour to accomplish the same end by preventing her from getting a foothold, and causing her repeatedly to fall to the ground until she becomes exhausted and dies.

The first class of remedies are probably the most effectual, and tar, applied either directly around the body of the tree or on strips of old canvas or stiff paper, is probably one of the cheapest and best of these. Refuse sorghum molasses, printers' ink or slow drying varnishes have also been recommended for use in the same manner. Tin, lead and rubber troughs to contain oil, belts of cotton wool, &c., also belong to this class of remedies, and have all been used with more or less success. In the use of any of the first named sticky substances it should be borne in mind that they must be kept sticky by frequent renewal of the surface in all mild weather or the application will be useless; they should also be applied as early as the latter part of October and kept on until the leaves are well expanded in the following spring. It must also be remembered that some of the moths, defeated in their attempts to climb the tree, will deposit their eggs near the ground or anywhere, in fact, below the application, and that the tiny young worms hatched from them will pass without difficulty through a very slight crevice; hence, whether troughs or bandages are used, precautions must be taken to fill up all the irregularities of surface in the rough bark of the trees, so that no openings be left through which they may pass. Cotton wool answers well in many cases for this purpose.

The second class of remedies consist of various ingenious designs for collars of metal, wood or glass fastened around the tree, and sloping downwards like an inverted funnel. These, although they prevent the moths from ascending the trees, offer little or no obstacle to the ascension of the young caterpillar; hence they often fail of success. The remedies belonging to the first class are then the surest and best; and although it must be admitted that it involves much time and labour to renew from time to time, for so long a period, the tar or other sticky application, so as to make it an effectual bar to the ascent of the insect, as well as a trap for its unwary feet, still it will doubtless pay well wherever the canker worm abounds, to give this matter the attention requisite to make it a success. The limited powers of motion possessed by the female necessarily restrict it within a narrow circle; hence it is very local in its attacks, sometimes abounding in one orchard and scarcely known in another a short distance off; it follows that when once it has obtained a footing and is neglected it must multiply prodigiously.

Fig. 5.

The canker worms moreover have natural enemies which prey upon them. A small mite (*Nothras ovivorus*) has been observed devouring its eggs, and doubtless some of the active little birds which winter with us do good service in the same direction. Two species of four-winged flies and one species of two-winged fly are known to be parasitic on these worms, and to destroy numbers of them; some of the ground beetles also feed on them, particularly the copper-spotted carab (*Calosoma calidum*) (fig 5), and its ally with the golden green wing cases and beautiful varied hued body (*Calosoma scrutator*) (fig. 6). These active beetles may often be seen mounting the trunks of the trees and carrying off such soft-bodied worms. A species of wasp (*Eumenes fraterna*) is also said by Harris to store her cells with canker worms as food for her young, often gathering 18 or 20 of them for a single cell.

Fig. 6.

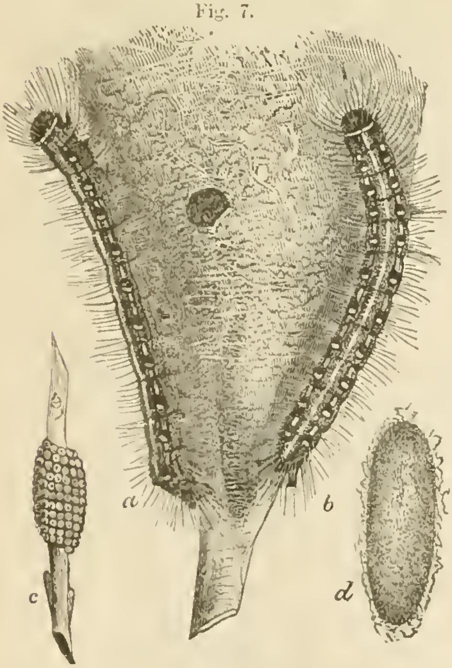
NOTES OF THE YEAR.

By W. Saunders, London, Ont.

During the past summer there has been an unusual scarcity of insect life. Whether this is to be attributed to the extreme severity of the winter, or to the very dry summer which preceded it, we are unable to determine; possibly both may have had something to do with the result. Our usually common butterflies were seldom seen during the summer, and those nocturnal visitors, the moths, as compared with the abundance of average years, were "few and far between." The same scarcity has been noted among our insect pests—the plagues of the gardener and fruit-grower. Some, which have been abundant for many years past, were notably scarce, viz.:

The Tent Caterpillar (*Clisiocampa Americana*), Harris.

Fig. 7.



Some years ago, the caterpillars of this species were enormously abundant. They were to be seen in almost every orchard, stripping the apple, cherry and plum trees of their foliage, and playing similar pranks among our thorn bushes, wild cherry trees, and other trees and shrubs in our woods and along our roadsides. Everyone must be familiar with the white web-nests of this caterpillar. They have, however, been lessening in numbers in the western portion of Ontario for several years past, until now their presence is scarcely felt as an annoyance. The lessening of this evil is doubtless due partly to the vigilance of our farmers and fruit-growers; for while with us this insect has been decreasing, in many parts of Lower Canada, where the cold of winter is much more intense than with us, the destruction of trees by this tent caterpillar is bitterly complained of, and they remain as abundant or more abundant than ever; and the same remarks will apply to some of the eastern sections of our own Province. We trust, also, that some portion of the credit of our almost exemption from this pest may be due to the information scattered broadcast from year to year in our Annual Reports, by which our farmers and fruit-growers have been instructed how to contend with this and various other insect enemies in the most advantageous manner.

A cluster of the eggs from which these caterpillars hatch are shown at *c*, fig. 7. They are generally deposited during the month of July upon the smaller twigs of our fruit trees, each one containing upwards of 200 eggs, sometimes more, all enclosed in an oval ring-like cluster, firmly cemented together and coated with a varnish which is alike uninjured by sun or rain. About the time when the buds begin to burst, these caterpillars hatch, and at once begin to spin for themselves a web or covering, in which they can take refuge from their enemies, or shelter from inclement weather. The web is spun in concert, each one doing his own part in the construction of this convenient home for the little community.

They have their regular times for feeding, issuing from the orifice of their tent in processional order, usually once in the forenoon and once in the afternoon. In about six weeks they become full grown, and then present the appearance shown at *a* and *b*, fig. 7; *a* shows a side view and *b* a back view of the same caterpillar. The body is black, about two inches long, with a white stripe down the back. On each side of this central stripe there are a number of short irregular longitudinal yellow lines. On the sides are paler lines, with spots and streaks of pale blue. The under side of the body is nearly black.

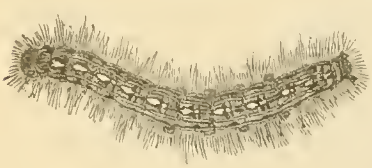
As these caterpillars approach maturity, they lose their social habits, and, leaving their friends and kindred, they wander about singly in all directions. The main object of this dispersion seems to be the finding of separate and secure retreats, in which to pass the chrysalis stage of their existence—in crevices in the rough bark of trees, on the lower edges of boards where they are nailed to the posts of fences, in holes in the posts, and in a variety of other situations of a similar character, where they will be sheltered from the weather. Here their cocoons are spun, and within the enclosure the larva changes to a chrysalis. The cocoon is oval, of a pale yellow colour (see *d*, fig. 7), and in its construction the silk is mixed with a pasty substance which, when dry, becomes powdery, and is partly removed from the surface of the cocoons by handling. The chrysalis, which lies within the cocoon, is about three-fourths of an inch long, and of a pale brown colour.

At the expiration of two or three weeks the moths escape from the cocoons. They are of a dull reddish colour, varying in depth of shade, with two straight whitish stripes, which extend across the fore wings obliquely, dividing the wing into three nearly equal portions. The females sometimes have the two stripes closer together; in the males they are less variable. The hind wings are nearly of the same colour as the front ones, but without any stripes. In both, the under surface is very similar to the upper, and the wings when expanded measure from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches or more.

The moths usually appear early in July, when, on sultry evenings, they come thumping against the lighted windows of our houses, and if they gain access, they fly about the lights in the room with great rapidity, and in the wildest and most bewildered manner, striking violently against any and every object which opposes their progress. A few days after their appearance on the wing they pair, and then the females begin to deposit their eggs on the twigs of our fruit trees, in the belt-like masses we have already referred to.

Another and a very similar species is known as the "Forest Tent Caterpillar" (*Clisiocampa sylvatica*), so called because it is frequently found on forest trees, although it is also very destructive to the apple. The eggs are laid in the same manner as the last species named, and in masses about the same size; the caterpillars, too, resemble each other, but may be at once distinguished by the peculiar markings down the back. In the former species the white forms a continuous and prominent stripe; in this one the stripe is replaced by a row of white spots (see fig. 8). There are other minor points of difference, but this one character is invariable, and will enable any one to separate the species without difficulty. Some few years ago the western section of Ontario was overrun by this caterpillar, whole orchards having been completely defoliated as if a fire had passed over them, and the trees greatly damaged thereby; but the vigilance of our farmers, aided by the natural enemies of these insects, has been successful in reducing their numbers so considerably that they have ceased to be a source of much anxiety. These caterpillars usually select the side of a tree on which to spin their web, rather than a fork of one of the limbs, and when nearly full grown scatter as in the case of the other species, and wander about singly in search of suitable locations in which to spin their cocoons. These latter are scarcely distinguishable from that already described; the moths also may easily be confounded with those of *Americana*, but they are usually somewhat smaller in size and paler in colour, while the oblique lines on the anterior wings are dark in place of nearly white.

Fig. 8.



This insect in the larva state is attacked by the same species of ground beetles as are described in the article on canker worms; they are also subject to the attacks of several species of parasites, which thin the ranks of the enemy most thoroughly. As far as man's agency is concerned, they are most effectually fought in the egg state; by looking carefully over one's trees during the winter season, the egg masses are readily detected, when they should be removed and destroyed. A second examination of the trees should be made in spring, when the young foliage begins to push forth; then any clusters which have escaped observation will be found to have hatched, when the young larvæ in their small web should be carefully collected and destroyed.

The English Cabbage Butterfly (*Pieris Rapæ*).

This destructive pest is rapidly spreading westward. During the past season it has appeared for the first time in London and the neighbourhood, and will probably reach the western limits of the Province before the end of the summer of 1876. A description of this insect was given in our Society's Report for the year 1871; but since that Report is not now within reach of many of our members, for their benefit we will again give a brief summary of the history of this insect, describing its appearance in the various stages of its existence.

It was brought to Quebec from Europe most probably in the egg state on cabbage leaves, about the year 1857 or 1858, its advent being chronicled by an entomologist in Quebec, in 1859, when the first specimens were captured. In 1863 the insect had become very abundant about Quebec, and was supposed at that time to have extended some 40 or 50 miles east and west of the city, but probably it had spread further, for in the summer of 1866 we found it very common about Chicoutimi, at the head of navigation on the Saguenay River, and during that same year the butterfly was taken in Vermont and New Hampshire, and by the end of 1870 had overspread a large portion of the middle States. Every year since its introduction the area occupied by it has been extended in every direction, until now it has spread as far east as Halifax, N. S.; farther south than Baltimore, Md.; and west as far as the western portion of Ohio. In Canada, during the same period, it has been gradually spreading westward. Last year it was common about Hamilton, and early this summer had extended as far as Paris, and later in the season the first recorded captures were made in London.

The cabbage butterfly is white, with a black dash at the tip of the fore wings, a black spot on the front margin of the hind wings, and in the male (see fig. 9) *one* black spot in

Fig. 9.

Fig. 10.

the middle of the fore wings, but in the female (see fig. 10) there are two. The under side of the fore wings in both sexes is marked by two spots, corresponding to those on the upper side in the female; in other respects the wings are very much alike on both sides, except that beneath there is a tint of yellow at the base and tip. Occasionally male specimens are found of a bright yellow colour, almost like our common sulphur yellow butterfly (*Colias philodice*).

The eggs of this insect are laid on the under side of cabbage leaves, singly or in clusters of two or three, where they are attached by some adhesive substance. They are so very small that they easily escape observation; in shape they resemble a sugar loaf, and under a sufficient magnifying power their surface appears beautifully ribbed and sculptured. When newly deposited the eggs are white, but they soon acquire a yellow tinge, and in about a week they hatch, the enclosed worm escaping by gnawing a hole through the egg shell, after which it devours the remainder of the egg shell, and then sets to work with an insatiable appetite on the cabbage leaves.

Fig. 11.

In about a fortnight after hatching, the caterpillar (*a*, fig. 11) has acquired its full growth. It is then about an inch and a quarter long, of a pale green colour, finely dotted with black, with a yellowish stripe down the back, and a number of small yellowish spots forming a broken stripe along each side. When fully fed and about to transform, it leaves its food plant, and taking shelter under the coping of some wall or fence, or other convenient hiding place, there changes to a chrysalis. The chrysalis (*b*, fig. 11), which is somewhat variable in colour, is usually pale green, sprinkled with very small black dots. The period passed in the chrysalis state varies at different portions of the season. In the summer the chrysalis usually becomes a butterfly within a fortnight; later in the season it remains unchanged until the following spring. There are at least two, perhaps three broods during the year, and the ratio of increase of the insect is enormous.

The caterpillar is dreaded by cooks in every country where it prevails; it is not content with riddling the outside leaves, but prefers to secrete itself in the heart, so that every cabbage has to be torn apart and carefully examined before being cooked; and even after it has been dished up, one needs a watchful eye to avoid an undesirable admixture of animal with vegetable food.

Remedies.

One method suggested is to search for the eggs at the proper season and destroy them; another, to employ children with nets to catch the butterflies, and as these latter are rather slow and heavy flyers, this is not a difficult task; while a third method recommended is to lay boards between the rows of cabbages, supporting them two or three inches above the ground, with the view of luring the worms to select such places in which to pass the chrysalis stage of their existence, and so secure their destruction. Objections can be readily found to all these methods, but they are the best which man's experience has yet enabled him to devise. The use of poisons such as Paris Green and Hellebore is not admissible in this case on account of the difficulty of freeing the plant from such substances before cooking.

Nature has, however, provided a remedy; a small parasitic fly (*Pteromalus puparum*) attacks the chrysalis of this species in Europe, and, strange to say, has in some unknown manner also found its way to this country. This is a little four-winged fly about one-eighth of an inch long, with a yellowish body. The female flies about in search of the chrysalids, which she punctures with her ovipositor, inserting a number of eggs in each; in a short time these hatch into tiny grubs, which consume the substance of the chrysalis; as many as forty or fifty of these have been found in a single case. This little friend is now quite common in the State of New York, as well as in the eastern parts of Canada. It is probable that gardeners will suffer much from the depredations of the caterpillar for several years, until the parasite reaches us, and has multiplied to a sufficient extent to keep the depredator within moderate bounds. In the meantime it may be expected to extend its march westward and northward through our own country, and over the fertile plains of the neighbouring States away out to the far west.

The Pear Tree Slug (*Selandria cerasi*).

In our Report last year we referred to this insect at some length, and detailed to some extent its ravages in our own neighbourhood. The havoc this disgusting little slug made among the pear trees was terrible, consuming the leaves so thoroughly that the trees looked as if they had been scorched by fire—in many instances every leaf dropped from the trees, leaving them for a time as bare as in midwinter; fully a thousand trees in the young pear orchard of the writer suffered severely. Following on the heels of this destructive pest we experienced a winter of unusual severity, when, as might be expected, a large number of these trees, thus weakened, perished from the cold. The extreme winter, however, was not an unmitigated evil. The low temperature which killed the enfeebled trees operated disastrously also on the chrysalids of these slugs, and the result has been that where there were hundreds of thousands last year, during this summer scarcely any could be found—so few have been their numbers that no effort has been necessary to subdue them. Fig. 12 represents the parent of this sometimes troublesome pest, a small, black, four-winged fly, and fig. 13 the larva, or slug, in various stages of its growth. For the benefit of those who may not have the Report of last year to refer to, we would say that to shower the infested leaves from the rose of a watering-pot with powdered hellebore and water, in the proportion of one pound to a barrel of water, is so effectual that it leaves nothing further to be desired.

Fig 12.

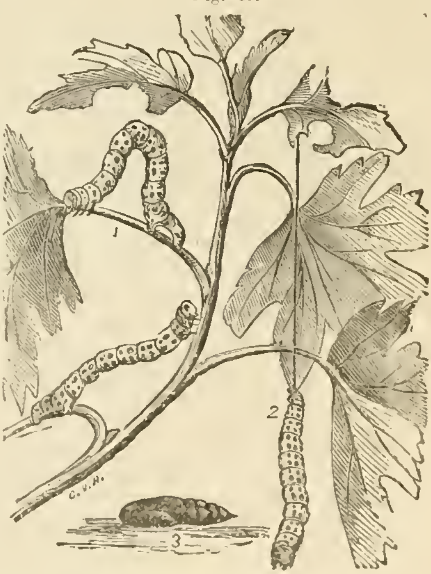
Fig. 13

THE GOOSEBERRY WORM (*Nematus ventricosus*).

This insect also was mentioned in our last Report as having been extremely abundant and very destructive; this summer, on the contrary, it has been unusually scarce. In past seasons constant watchfulness was required to prevent the currant and gooseberry bushes from being eaten bare. In 1875 little or no effort has been needed to keep it within bounds. This insect also passes the winter in the ground in the chrysalis state, and has probably suffered from the same causes which proved so fatal to the pear tree slug. To avoid misapprehension, we introduce again the figure of the larva (see fig. 14).

Fig. 14.

Fig. 15.



Very different is our experience with the other currant worm, known as the measuring worm, (*Abraxis ribearia*), shown at fig. 15. This creature passes the winter in the egg state, and hence did not seem to suffer at all, the eggs of insects being capable usually of enduring the most severe cold without injuring their vitality. This larva has been very abundant and destructive, probably more so in Western Ontario than ever before; they are not so easily destroyed by hellebore as the other species is. If used in the liquid state it should be made about double strength; probably the better plan in this case is to first sprinkle the bushes with water, and then dust the powdered hellebore lightly on, the operator taking proper care to avoid the inhalation of the dust.

THE POTATO BEETLE (*Doryphora decemlineata*).

This insect (see fig. 16) continues its progress eastward and southward. During

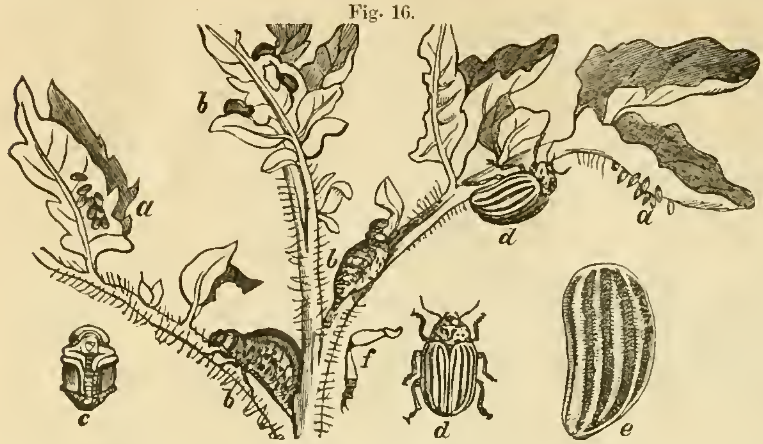


Fig. 16.

the past season it reached as far as Ottawa, and in some of the New England States has approached the sea shore. It is quite possible that before long it may cross the Atlantic secreted among the merchandise carried thither by vessels. During the summer they will survive many weeks without a particle of food, and could easily endure the abstinence which a voyage across the Atlantic would entail. Already many of the European Governments have taken measures of precaution against their introduction,and we sincerely hope that these measures may be successful. Throughout Ontario this insect has not proved so great a scourge as was anticipated, and notwithstanding the immense numbers in which they have appeared, they have scarcely influenced the price of that valuable esculent, the potato, not even in the worst affected districts. We can only attribute this result to the persistent application by our farmers of that valuable remedy, Paris green. Notwithstanding the outcries which some have made against its use, general experience has decided immensely in its favour, and it is almost universally used. During the past summer a series of interesting experiments have been carried on by the chemist of the Department of Agriculture in Washington, with the view of ascertaining how far the soil could be impregnated with Paris green without operating disastrously on vegetable growth. The results of these experiments have shown that any reasonable amount of Paris green required for the destruction of the potato beetle may be used without influencing the soil to the detriment of plant life to any perceptible extent.

It is nevertheless true that in many cases larger quantities of this poisonous substance have been used than there was need for, and some cases of irritation, arising from carelessly inhaling the dust of the powder while applying it, have been reported to us. The use of the Paris green with water is becoming much more general, and is highly approved of by those who have used it in that manner. If the Paris green be of good quality, from one to two teaspoonfuls will be sufficient for a pailful of water. This mixture is occasionally agitated so as to keep the powder suspended in the liquid, and applied with a whisk or small broom, which is first dipped in the liquid and then shaken over the vines. At first sight this seems a laborious process, but most of those who have tried concur in the opinion that it involves no more labour than is required for an application of the powder; that it takes much less Paris green to the acre, and has the additional advantage that it can be applied at any time during the day and in all weathers.

THE APPLE TREE BLIGHT.

This mysterious disease, which was first referred to in our last Report, if not on the increase throughout our Province, is in some districts manifesting an intensity which at first was not expected. This has been especially the case with the trees in the orchards and nursery of Mr. James Dougall, of Windsor. These were visited by the writer on the 10th of August last, in company with some friends, including Thos. Meehan, Editor of the *Gardener's Monthly*, Philadelphia, and Professors Beal and Cook, of the Agricultural College of Lansing, Michigan.

We found that, in addition to the ordinary form of this tree-blight affecting the twigs of the current year's growth only, that there was a blight causing the entire destruction of some of the large limbs of several of the trees. Many of the twigs on these limbs had been blighted the previous year or years, and it is possible that this more serious blight of the limbs is but an extension and further development of the twig blight. On examining the base of the blighted twigs and fruit spurs it was found that where these were killed to the point of junction with the wood that the discolouration arising from the disease extended into the wood of the branch, which seems to point to the probability of the correctness of the suggestion just made. On the other hand, seeing that its character is somewhat distinctive, it may be inferred that it is an entirely different form, resulting from the presence and development of a different species of fungus ; so obscure are the distinguishing features which separate these lower forms of vegetable life, that it would require much close study to determine this point.

The twig blight had affected many of the older trees in Mr. Dougall's orchards so much as to give them a decidedly withered and browned aspect, pervading the entire circumference, and distributed with much apparent regularity over their many branches. It had also injured to a very great extent the young apple trees in his nursery rows : in these the injury appeared to begin in the tips of the upper branches, and from thence spread downwards, extending in many instances half way down the trunk of the tree. Evidences of the extension of the blight were to be seen sometimes in the discolouration of the outer bark, in patches below apparently uninjured portions. In some of these small trees the twigs were blighted down the trunk to near its base, while the trunk remained apparently sound. The odour of the affected twigs, when broken, was very similar to that given off from pear blight. Many of the young trees in the nursery rows had been smitten by the disease early in the summer, and Mr. Dougall had pruned many of these, cutting away the whole of the diseased portion down to the healthy growth, but in most instances the blight attacked the remaining portions, and extending downwards involved more or less of the trunk to its base, indicating probably that the fungoid germs had extended in the sap through the adjoining tissues, without producing as yet any external appearance by which their presence might be recognised.

ON SOME OF OUR COMMON INSECTS.

By W. Saunders, London, Ontario.

In accordance with the plan pursued in our Reports for several years past, we present our readers with a chapter on some of our common insects; and although in this instance we include some which are more or less injurious, still we think they claim attention more from the frequency of their occurrence than from the amount of injury they do. They also in some instances excite curiosity, and elicit admiration on account of their great beauty, or in consequence of their peculiarities.

The Beautiful Deiopeia (*Deiopeia bella*).

This lovely moth, represented in fig. 17 (after Riley), may well claim a place among the most elegant and beautiful of the Lepidoptera. Although rare in some parts of our Province, they are quite common in other localities. We have found them common in the neighbourhood of Port Stanley, on the shores of Lake Erie, and they are usually common and sometimes abundant about Grimsby, Ont. We have also seen them in insect collections from various parts of Canada.

Fig. 17.

This moth measures when its wings are expanded about one and a half inches. Its fore wings vary in colour from lemon yellow to orange, and are crossed by six white bands, each containing a row of black dots. The hind wings vary in colour from pink to scarlet red, with an irregular border of black behind. The fringes of the wings are white.

The under surface of both pairs of wings is of a deep red colour, with the front edge of the fore wings yellowish; the white bands on the upper surface of the fore wings are not reproduced, but the black dots are more prominent, and being more or less confluent, appear as broken bands. The hind wings are marked nearly as above.

The head is white, spotted with black; the shoulder covers white, with some yellow at the base, and two black dots on each; the thorax and abdomen whitish, the former with six black dots, the latter banded with black beneath.

Drasteria Erichtea (Cram.)

In fig. 18 we have this insect in the perfect state well represented. Although it is one of our commmonest moths, a day-flier, abundant almost everywhere, yet we have never heard of its having had a common name bestowed upon it. We are not going to christen it, for we are no admirer of common names where they can be avoided, and we think they can in this instance. *Drasteria erichtea* is not harsh and unpronounceable, as is the case with many, especially of our more recent names, as well as some that have been resurrected, and those who do not care to burden their memories with both names, may drop the latter, and will still be understood if they speak of the moth as "the common *Drasteria*."

Fig. 18.

The female moth, when its wings are spread, will measure about one and a half inches; the male about a quarter of an inch less. The fore wings are grayish brown, with bands and dots of dark brown; one band crosses the wing about an eighth of an inch from the base, and a second—which sometimes does not extend entirely across—is placed midway between the first and the outer margin. There is a dull patch of brown near the front edge of the wing, between the first and second bands, and two or three prominent black dots similarly situated between the second band and the apex; the outer edge is also widely margined with brown.

The inner portion of the hind wings is similar in colour to the front pair; the outer half is crossed by two darker bands irregular in outline, the space between them being occupied by a paler hue, as also is the space between the outside band and the hind margin, which latter is narrowly bordered with the darker shade. The markings on both wings vary much in intensity, being sometimes almost black, in other instances very faint.

The under surfaces of both wings are much paler, with the markings of the upper surface partially but indistinctly produced.

Drasteria erichtea appears among our earliest insects in spring, having passed the winter in the chrysalis state; it is also found up to quite a late period in the antumn. It frequents fields and meadows, and open grassy spots along the sides of our railroad tracks. Its flight is sudden, and after a short but rapid course, it as suddenly alights.

The caterpillar feeds on clover, and when full grown measures one and a quarter inches in length or more. It has a medium sized head, rather flat in front, with darker longitudinal lines. The body above is reddish brown, with many longitudinal lines and stripes of a darker shade. There is a double whitish line down the back, with a stripe of the darker shade of brown on each side, and lower down, close to the spiracles, is another stripe of the same dark hue, while between these two are faint longitudinal lines. The spaces between the segments, from fifth to eighth inclusive, are nearly black above, a feature only seen, however, when the body is coiled up; the larva readily assumes this attitude when disturbed.

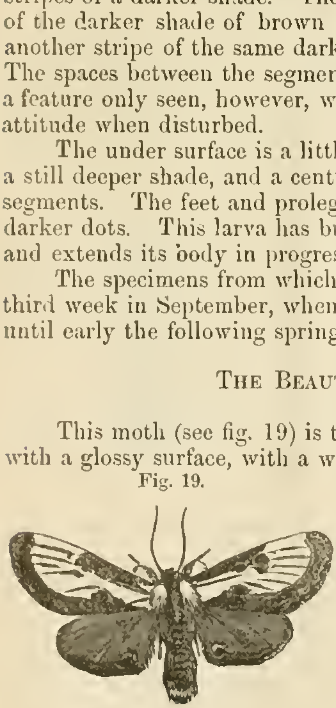
The under surface is a little darker than the upper, with many longitudinal lines of a still deeper shade, and a central stripe of blackish green from the sixth to the ninth segments. The feet and prolegs are greenish and semi-transparent, with faint lines and darker dots. This larva has but three pairs of prolegs, and hence it alternately arches and extends its body in progression.

The specimens from which the above description was taken were full grown by the third week in September, when they became chrysalids, and remained in that condition until early the following spring.

The Beautiful Wood Nymph (*Eudryas grata*).

This moth (see fig. 19) is truly a beautiful creature. Its fore wings are creamy white, with a glossy surface, with a wide brownish purple stripe along the anterior edge, reaching from the base to a little beyond the middle of the wing. On the outer margin is a broad band of the same hue, widening posteriorly, with a wavy white line running through it, composed of minute pearly dots or scales. It is bordered internally with dull deep green. The brownish purple band is continued along the hinder edge, but it is much narrower here, and terminates a little before it reaches the base. There are also two brown spots, one round, the other reniform, near the middle of the wing, often so suffused with pearly white scales as to be indistinct above, but clear and striking on the under side.

Fig. 19.



Colours, creamy white and brownish purple.

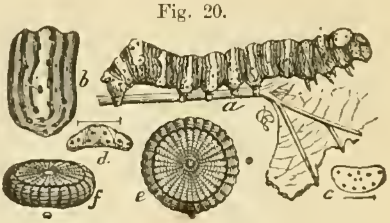
The hind wings are reddish yellow, with a broad brownish purple band along the outer margin, extending nearly to the outer angle, and powdered here and there with a few whitish pearly scales; there is also a faint dot on the middle of the wing, which is reproduced more prominently on the under side. The under surface of both wings is reddish yellow. The head is black, and there is a wide black stripe down the back, merging into a series of spots of the same, which extend nearly the whole remaining length of body. The sides of the body are reddish yellow, with a row of blackish dots close to the under surface. The fore legs are beautifully tufted with white, the shoulder covers also are white, and so is the under surface of the body.

When this moth is at rest—that is, during the day time—its wings are closed like a roof over its back, and its tufted fore legs are stretched out.

The insect passes the winter in the chrysalis state, emerging as a moth from the middle of June to the middle of July. The earliest recorded date we have of the appearance of the moth is June 25th. It is usually common during the last week in June and the first in July, when it may often be found in the day time fast asleep on the leaves of the grape vine.

Soon after the moths appear they begin to deposit their eggs. These are among the prettiest and most beautiful of insect eggs; at *e*, fig. 20 (after Riley), we have a view of the upper surface, and at *f* a side view of this charming object. It is round and very flat; its colour is yellowish or greenish yellow, with an enclosed ring of black placed a little beyond the middle, and sometimes nearer to the outer margin. In the centre of the egg is a large, nearly round dot, and at a little distance from this a circle of smaller dots, from which arise a series of from 24 to 27 raised striae, diverging equally as they approach the outer edge, and crossed by many gracefully curving lines which interlace also the spaces between.

Fig. 20.



When mature, the young caterpillar escapes from the upper part of the egg, lifting the centre and rupturing the portion placed over the black ring. In some cases we have observed the eggshell to be eaten by the newly hatched larva; in others it remains almost untouched. The young larvæ have a strange habit of twisting their hinder segments and throwing them forward, resting on the anterior segments in a curious manner. At this age they eat small holes all over the vine leaves in different parts; they are often solitary, but sometimes two or three may be found on a single leaf.

When mature, the full grown larva appears as at *a*, fig 20; it is then nearly one and a-half inches long, tapering towards the head, thickening towards the posterior extremity. The head is of an orange colour, with a few round black dots and pale brownish hairs.

The body above is pale bluish, crossed by bands of orange and many lines of black. Each segment, excepting the terminal one, is crossed by an orange band, all of which are nearly uniform in width, excepting that on the 12th segment, which is much wider. These are all more or less dotted with round black dots, from each one of which arises a single short brown hair. There are also crossing each segment six black lines, placed nearly at equal distances along each side, but with a wider space in the middle, where the orange band occurs. The twelfth segment is much raised, and the terminal one suddenly sloped. The under side is very like the upper, and also marked with orange and black; feet and prolegs orange, spotted with black.

The larvæ feed on Virginia Creeper (*Ampelopsis quinquefolia*) as well as on the grape-vine, and Mr. Bowles, of Montreal, has found them feeding on the hop.

When full grown, they descend to seek some secure retreat in which to pass the chrysalis, or inactive stage of their existence. They are fond of boring into old pieces of wood, and in the chambers thus formed they find secure lodgment; they will also bore into corn cobs. When rearing them we have supplied pieces of cork for this purpose, and have had as many as twenty-one chrysalids enclosed within two small bungs about 1½ inches in diameter, and one inch thick. The excavation is but little larger than the chrysalis which is to rest in it; it is not lined with silk, but is made moderately smooth, and is furnished with a cap or cover composed of minute fragments of cork, formed into a sort of membrane by means of a glutinous secretion mixed with threads of silk. When nicely finished, the surface of this cover is slightly glossy, the glossiness extending a little beyond the actual orifice, indicating that the glutinous matter has been of a thin consistence and has spread a little during its application. When the lid is lifted the head of the chrysalis is usually found quite close to it.

Fig. 21.

The chrysalis is about seven-tenths of an inch long, of a nearly uniform dark brown colour, and roughened with small blackish points or granulations.

This insect is subject to the attacks of a parasite, a two-winged fly—a Tachina—probably the species known as the red-tailed Tachina fly, *Exorista leucania* (see fig. 21, after Riley). It is not much unlike the common house fly in appearance, is about a quarter of an inch long, with a white face, large reddish eyes, a dark hairy body with four, more or less, distinct lines down the thorax, and patches of a greyish shade along the sides of the abdomen. The parent fly deposits her eggs on the back of the caterpillar, usually a short distance behind the head, where they are cemented firmly by means of a peculiar secretion with which the insect is furnished. Three or four of these eggs are usually placed upon a single caterpillar, where, after a few days, they hatch, when the tiny worms eat their way through the skin into the interior of the body, where they feed upon the fatty matters, instinctively avoiding the vital organs. When the caterpillar is about full grown it dies, and from its body emerge these three or four full-grown whitish grubs, which soon after their exit change to chrysalids. These are nearly one-fifth of an inch long, oval, smooth and of a dark brown colour, from which in due time the perfect flies escape.

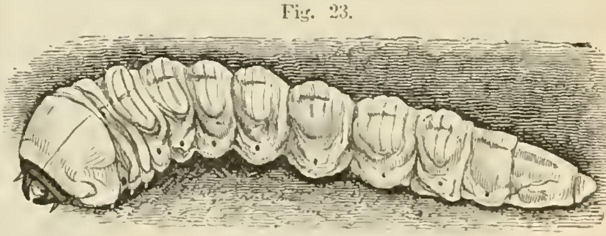
The Cylindrical Orthosoma (*Orthosoma cylindricum*, Fabr.)

This formidable-looking, long-horned beetle, fig. 22, is very common in most portions of Ontario during the month of July. It flies at night with a rapid and noisy flight, entering the open windows of lighted rooms during the evenings, often to the great alarm of nervous inmates. This beetle measures an inch and a quarter, or even more in length, and is about one-third of an inch in width. Its body is long and narrow, and of a light brown colour, which assumes a darker shade on the head and antennæ. The thorax is furnished with three sharp teeth on each side, and each wing case has three slightly raised ribs or lines.

Fig. 22.

The larva of this insect inhabits decaying pine wood, especially pine stumps, and is supposed to be several years in completing its growth ; it closely resembles the larva of its near relative, *Prionus laticollis*, shown in fig. 23 (after Riley). This latter, however, differs somewhat in its habits and appetite, seeming to prefer boring into and feeding on living roots, such as those of the Lombardy Poplar, Balm of Gilead, Apple, Pear, and especially roots of the Grape-vine ; in the latter case frequently causing the sudden death of the vines attacked.

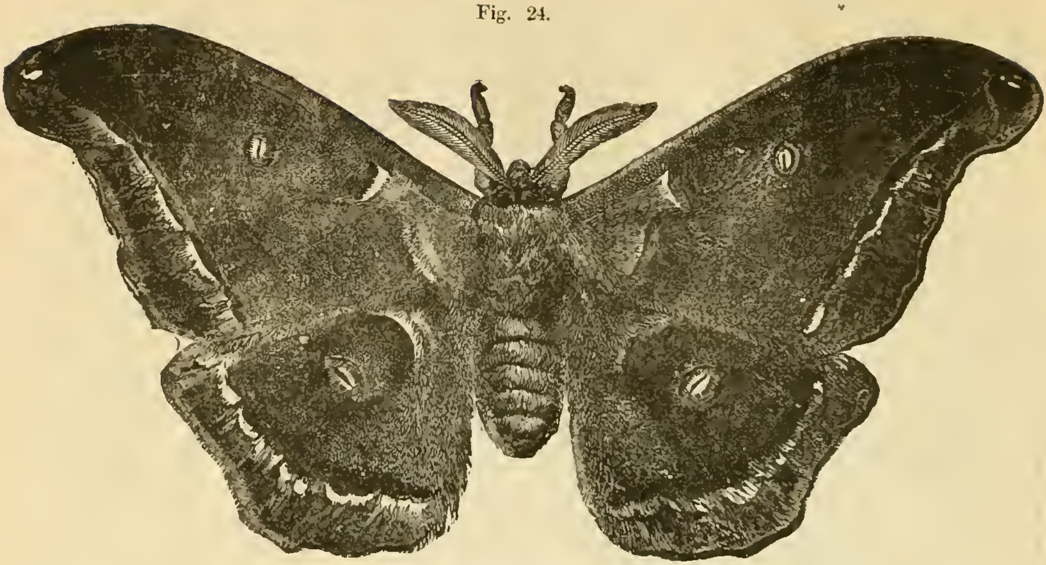
Fig. 23.



The American Silkworm (*Telea polyphemus*).

In our Report last year we gave our readers a sketch of the life history of our regal *cecropia* moth ; the magnificent moth to which we now propose to refer is a fitting sequel

Fig. 24.



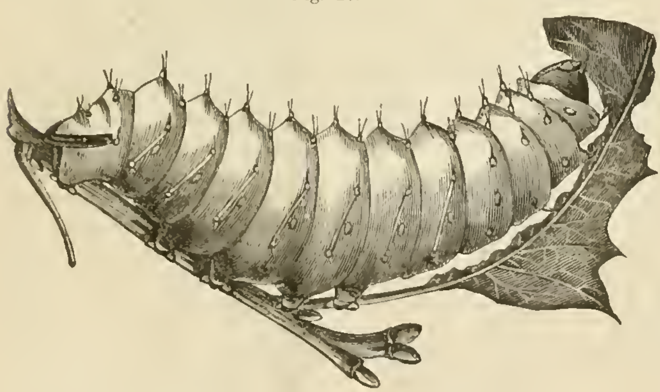
to that. It is, we think, one of the handsomest creatures in existence, with an expanse of wing of from five to six inches. In fig. 24 we have a representation of the male moth; fig. 25 shows that of the female.

Fig. 25.

The moth is usually of a rich buff or ochre yellow colour; sometimes inclining to pale grey or cream colour; at others assuming a deeper, almost brown, colour. Towards the base of the wings they are crossed by an irregular pale white band, margined with red; towards the outer margin is a stripe of pale purplish white, bordered within by one of rich deep brown. Near the middle of each wing is a transparent eye like spot, with a slender line across the middle; those on the front wings are largest, nearly round, margined with yellow, which is edged outside with black. On the hinder wings the spots are more eye-like in shape, are margined with yellow, with a line of black margined with blue above, and the whole set in a large oval patch of deep rich brownish black, the widest portion of the patch being above the eye spot, where also it is sprinkled with bluish atoms. The front edge of the fore wings is grey. The antennæ in both sexes are pectinate or toothed, those of the male (which are very beautiful) being much more deeply toothed than in the female—a character by which the sexes may be readily distinguished. This lovely creature flies only at night, and when on the wing is of such a size that it is often mistaken in the dusk for a bat. When at rest, the wings are held elevated above the body, like those of a butterfly; but, if disturbed, they are spread out flat, both pairs being shown. Early in June the moths first make their appearance, and they may be found throughout that month. In a few days they pair, after which the female deposits her eggs, usually on the under side of the leaves of the oak, maple or hazel; they are generally placed singly, but occasionally two or three may be found on the same leaf.

The egg is about one-tenth of an inch in diameter, convex above and below, with the convex portions whitish and the nearly cylindrical sides brown. Mr. L. Trouvelot, of Boston, who has reared great numbers of these insects for the purpose of experimenting on the silk obtained from their cocoons, gives the result of his valuable observations in the first volume of the *American Naturalist.* He says that one hundred of the eggs, on the day they are laid, will weigh eight grains; that one hundred and ten of the empty shells weigh only one grain, and that six thousand of the newly hatched worms will weigh about one ounce. They are not long, however, in increasing their weight; in ten days they weigh ten times their weight at birth; in twenty days, sixty times; thirty days, 620 times; forty days, 1,800 times; and in fifty-six days, 4,140 times their original weight, having consumed in this period about one hundred and twenty oak leaves, weighing three-quarters of a pound.

Fig. 26.

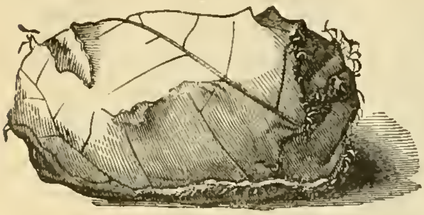


The larva when fully grown appears as represented in fig. 26; it then measures over three inches in length, with a very thick body. Mr. Trouvelot thus describes its appearance: "The head is of a light chestnut brown colour; the body of a handsome transparent light yellowish green, with seven oblique lines of a pale yellowish colour on each side of the body; the segments are each adorned with six tubercles, giving rise to a few hairs, which are tinted sometimes with orange, with a silvery spot on the middle; there are six rows of protuberances, two on the back and two on each side, and the oblique lines run between the two rows of lateral tubercles, uniting the lower one to the upper one by a yellowish line. The under side of the body is longitudinally striped with a faint yellowish band; the spiracles are of a pale orange colour, and the feet are brown. The posterior part is bordered by a purplish brown angular line similar to the letter V."

Having reached maturity the larva begins to search about with a restless air among the branches for a suitable place in which to construct its cocoon. The selection being made, "it now," says Mr. Trouvelot, "feels with its head in all directions to discover any leaves to which to attach the fibres that are to give form to the cocoon. If it finds the place suitable, it begins to wind a layer of silk around a twig, then a fibre is attached to a leaf near by, and by many times doubling this fibre and making it shorter every time, the leaf is made to approach the twig at the distance necessary to build the cocoon; two or three leaves are disposed like this one, and then fibres are spread between them in all directions, and soon the ovoid form of the cocoon distinctly appears. This seems to be the most difficult feat for the worm to accomplish, as after this the work is simply mechanical, the cocoon being made of regular layers of silk united by a gummy substance. The silk is distributed in zigzag lines of about one-eighth of an inch long. When the cocoon is made, the worm will have moved his head to and fro, in order to distribute the silk, about two hundred and fifty-four thousand times."

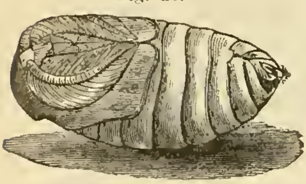
"After about half a day's work, the cocoon is so far completed that the worm can hardly be distinguished through the fine texture of the wall; then a gummy resinous substance, sometimes of a light brown colour, is spread over all the inside of the cocoon. The larva continues to work for four or five days, hardly taking a few minutes of rest, and finally another coating is spun in the interior, when the cocoon is all finished and completely air-tight." The finished cocoon is shown in fig. 27.

Fig. 27.



During this process of spinning, the larva, as might be expected, diminishes in size, which is due mainly to the enormous quantity of silk it has produced. Within two or three days after the completion of the cocoon, the worm sheds its larva skin and enters upon the chrysalis stage of its existence. The chrysalis (see fig. 28) is of a dark chestnut brown colour, its hind segment being armed with a small brush-like cluster of hooks. Through the anterior segments the antennæ, and —on a diminutive scale—the wings of the future moth may be clearly seen. In this condition the insect passes the winter, emerging as a moth in the following June.

Fig. 28.



This insect, especially in the larval state, is subject to the attack of many foes. It has been estimated that ninety per cent. and upwards of the larva fall a prey to insectivorous birds; the thrushes, catbirds and orioles are said to be especially active in this department. They also have their insect enemies. Besides the ordinary run of spiders, bugs, wasps, &c., they have a special and most dangerous foe in a species of Ichneumon fly, known as *Ophion macrurum* (fig. 29). This active creature may often be seen in summer flying about, searching among the leaves of shrubs and trees for her lawful prey; having found the object of her search, she watches her opportunity to place quickly upon the skin of her victim a small oval white egg. This process is repeated until some eight or ten eggs are placed, each one securely fastened by a small quantity of a glutinous substance attached to it for this purpose by the Ichneumon. In a few days these eggs hatch, when the tiny worms pierce through the skin of the caterpillar, and commence to feed on the fatty portions within. The caterpillar continues to grow, and usually lives long enough to make its cocoon, when it dies; and in the following summer, in place of the moth there issues its enemy, the Ichneumon parasite.

Fig. 29.

ON SOME OF OUR COMMON INSECTS.

By R. V. Rogers, Kingston, Ont.

The Luna Moth (*Actias luna*, Linn.)

If any of the insect host is a proof of high art in nature, and of the beauty of the Creator's thoughts, it is most assuredly the fair creature whose name is mentioned above. Allied to families whose members are among the greatest of the insect world, and having cousins and connections surpassing in size and beauty all others of their kingdom in this Dominion, still this moth is as pre-eminent above its fellows as is its namesake—the fair empress of the sky—above the lesser lights that rule the night.

So conspicuous is the Luna in her royal robes that she has a right to feel slighted at being thus long almost unnoticed in the pages of the Entomologist, and now it is hard upon her to be described among "Some of our Common Insects;" but blue blood always tells, and queenly grace and beauty will ever distinguish the Luna from among the *profanum vulgus* of the Articulata.

And now for a biographical sketch of this beauty from the cradle to the grave, and beyond that, after it assumes the resurrection attire, to that day when, its work accomplished, it lays itself down that its body may mingle again with its parent dust.

The eggs, which are more than one hundred in number, are of a dark brown or chocolate colour, smooth and .005 of an inch in length; the sides are flattened and of a lighter shade. In a fortnight the little larvæ begin to appear, making their escape into the outer world by eating an oval opening in the end of the shell. Now one can see that the inner surface of the egg is perfectly white. The little wriggling caterpillars, when they first emerge, are about .02 of an inch in length, and exhibit a black head, greenish on top and yellowish in front; a body black, adorned with two yellow spots on each segment, and decorated with numerous yellow hairs; the under part of the body and feet are of a light yellow. Some crawl about with the empty shell on their tails, others carry it as an umbrella over their heads, but the majority seem to discard it at once, as their human superiors do a friend from whom nothing more is to be expected. Some that I attempted to bring up by the hand, without the assistance of that most careful of mothers, Dame Nature, had in a week grown over a third of an inch in length, and showed the warts crowned with little hairs on each segment. In ten days they began to change their skin, having eaten so much that their first clothes had become too tight for them. Now they showed a head and body of light green, with yellow knobs on each segment: the hairy appendages were not so numerous or distinct as before, and a few of those on the front segments were dark. In a fortnight from its birth the largest one was nearly half an inch long, and when they had been in the land of the living for a month they were nearly an inch in length. When fully grown the head of the caterpillar is nearly elliptical in shape, and of a pearl colour; the rest is of a delicate pale and very clear bluish-green colour. A very pale yellow stripe extends along each side of the body, from the first to the tenth segment, just below the line of the spiracles; and the back is crossed, between the rings, by narrow transverse lines of the same colour. After the manner of its kith and kin, each segment is adorned with small pearly warts—tinged with purple—five or six in number, each furnished with a few little hairs. At the end of the tail are three brown spots, edged above with yellow.

When at rest, this magnificent caterpillar (which, by the way, is very similar to that of its congener, *Telea polyphemus*, save that the latter is destitute of the lateral yellow stripe, and the bands between the segments, the tail being bordered by a brown V-shaped mark) is nearly as thick as a man's thumb; its rings being bunched and body shortened, the length is only about two inches, but when it sets out on its travels, it stretches itself to about three inches. In the CANADIAN ENTOMOLOGIST (vol. vi., p. 86) Mr. Gentry describes an interesting va..ety in which the general colour is a dull reddish brown ; the lateral and transverse stripes of yellow have vanished, the abdominal spots shine conspicuously, but without the yellow edging ; the pearl-coloured warts with their purple edge have, however, assumed a richer hue, and blaze like a coronet of rubies.

When the larva has passed its allotted days in eating the leaves of the hickory, beech, oak or walnut, and is thinking seriously of preparing its silken shroud and the casket in which it is to lie until its resurrection morn, it casts about and draws together two or three leaves of a tree, and within this hollow spins an oval and very close and strong cocoon of whitish silk. It is about $1\frac{3}{4}$ inches in length, of a chestnut brown on the outside ; very thin, and frequently rough on the surface ; covered with warts and excrescences, but seldom showing the print of leaves. Harris says that the cocoons are formed on the trees, and that they fall to earth with the leaves shaken off by autumnal gales ; but other observers assert that the larva crawls to the ground just before its change, and there prepares for its future transformations.

In this state, too, the Luna greatly resembles the Polyphemus, and many a collector having—after careful searching—got together a fair supply of what he deems Luna chrysalids, is greatly chagrined by finding dusky, one-eyed giant Polyphemi issue from the silken tombs, instead of a bright throng of empresses of the night in their delicate bridal attire. The Polyphemus cocoons are, however, white or dirty white ; rather smaller than the Lunas, with rounded ends ; sometimes angular, because of leaves moulded unevenly into the surface, and generally coated with a white powder.

About the month of June the Lunas awake from their long and death-like sleep, burst asunder their cerements—having first loosened the compact threads by ejecting a liquid—and issue forth in all their glory, no more to be mistaken for the sober one-eyed Cyclopeans, but resplendent in gay attire. The wings, which expand from $4\frac{3}{4}$ to $5\frac{1}{2}$ inches, are of a delicate light green colour, and the hinder ones are each prolonged into a tail of an inch and a half or more in length—longer, indeed, than those of the day-flying Papilios. Along the front edge of the fore wings is a broad purple-brown stripe, extending also across the thorax, and sending backwards a little branch to a glittering, eye-like spot near the middle of the wing. These eyes (of which there is one on each of the wings) are transparent in the centre, and encircled by rings of white, yellow, blue and black. The hinder borders are more or less edged with purple brown. All the nervures are very distinct and pale brown. Near the body the wings are densely covered with hairs. The under sides are similar to the upper, except that an indistinct undulating line runs along the margin of both wings.

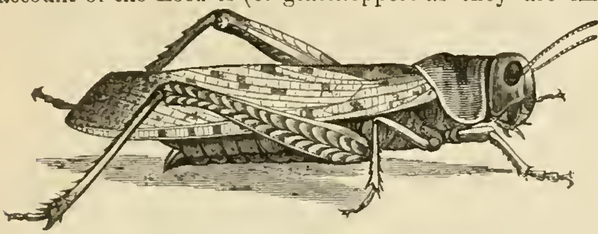
As for the body that bears these lovely appendages, the thorax is white, sometimes yellowish or greenish, crossed by the purple-brown stripe that traverses the whole length of the upper edge of the front wings ; the abdomen is of the same colour as the thorax, and covered with white hairs like wool. The head is white and small, and adorned with wide, flat and strongly pectinated antennæ of a brownish tinge. The legs are purple-brown.

Such is Luna in her various transformations to outward appearance ; notwithstanding her size and loveliness, her habits and peculiar instincts are not very noteworthy. The gift of superior beauty, as among the highest of animals so in the insect world, is not frequently accompanied by remarkable intelligence or superior sense ; and the most gaudy butterfly or moth is a fool in comparison with the dingy-coloured bee. The caterpillars of butterflies and moths have some various instincts—chiefly in the direction of silk spinning and sepulchre building—but the perfect insects only live " to increase and multiply their race, and embellish nature. Their existence in the perfect state is usually very brief ; it is one of the prettiest of honeymoons, and often love subdues and destroys every other passion. The gourmandizing caterpillar is never troubled by the ardent flame which consumes even the thought of sipping the nectar of the flowers that rival in beauty the wings of the perfect representation of elegance and love. The early insect lives and eats, and the perfect form lives and dies."

THE WESTERN LOCUSTS.

BY THE REV. C. J. S. BETHUNE.

In our last Annual Report (1874) we devoted a considerable portion of our space to an account of the Locusts (or grasshoppers as they are improperly termed), which were so



destructive that year throughout large tracts of country in Manitoba and the neighbouring regions of British America, and in many of the States between the Rocky Mountains and the Mississippi River. We now propose to supplement that account by information that we have gleaned from various sources, and that, we trust, will prove interesting to the reader.

During the present year (1875) it is cheering to find that the extent of the plague has been very much diminished, and that many portions of the West are rapidly recovering from the devastation and suffering of the previous year. In the Province of Manitoba, where very serious havoc has been committed by the insect, there are this year many localities where the injury is but trifling. To quote a correspondent of the Toronto *Globe* (October 30, 1875)—" No better wheat and potatoes can anywhere be found than were lately harvested at Portage La Prairie and along the Red River between Fort Garry and Pembina, and in the neighbourhood of St. John. All this is spring-sown, in rich, well-drained land. Efforts in the infested regions, made by settlers and their families during the few hours in which the locust rested, such as building fires, surrounding the field or garden with a ditch into which the insects fall and drown, beating them with bushes, &c., have been successful in saving large parts of the crops." On the other hand, he states: " Many of the farmers this year let their fields go waste rather than plant for the locusts to eat, as they had done for two years. In the gardens of Government House and of the Penitentiary, in the old field at Kildonan, and along the banks of both rivers, we saw the effects of the ravages. The garden of Deer Lodge was destroyed in a few hours." With regard to the future he adds: " It is generally hoped that but little of this plague will be felt for some years in Manitoba. The grounds for such confidence are the historical facts as to its periodicity, the great numbers of the parasites found on the specimens examined, and the fact that the locusts flew off without depositing their eggs. In lands where nature has dealt with less lavish hand the farmer might well hesitate to embark his means and labour in tillage; but the great returns which the marvellously rich, deep soil of this Province will yearly produce, will doubtless allow an ample margin for periodical losses from this plague, and these losses too may be anticipated, and to a great extent met and lessened, by united skilful effort when the lands become settled, as no doubt they soon will be, with industrious farmers using all modern means of agriculture."

Another writer in the same newspaper (Mr. J. M. Machar—*Daily Globe*, Dec. 18, 1875) gives the following information respecting Manitoba:—" Between the Assiniboine and the southern shore of Lake Manitoba there lies a district of about ten miles square, chiefly settled and farmed by emigrants from Ontario. These farmers have harvested, in spite of the grasshoppers, a two-thirds crop, which is better than an average crop in Ontario. Instead of sowing nothing, as did many of their neighbours in the parishes of Baie St. Paul and Francois Xavier, or watching the grasshoppers devour what they had sown, as did most of the others, these brave men sowed in hope, and when the enemy appeared, turned out and fought him. I saw a forty-acre field of splendid wheat at Portage Creek, which had been saved by spreading a swathe of straw across the middle of the field; then the whole family armed themselves with boughs, and forming line drove the grasshoppers before them into the straw. When evening came a match was applied, and in five minutes nothing was left of the invaders but their horny coverings, which, at the time of my visit in August, still littered the ground in millions."

THE LOCUSTS IN THE WESTERN STATES.

Throughout the Western States that lie beyond the Mississippi River, where last year fully one hundred thousand people were estimated to have been seriously affected by the plague of locusts—many being reduced to poverty and starvation—this year the actual suffering has been comparatively slight. From the official reports of the Department of Agriculture at Washington, we gather that the dreaded locust "seems to be perishing from the assaults of parasites; its demonstrations of destructive power were far less formidable than last year." In the early part of the season very serious apprehensions were felt as to the safety of the crops in many localities, but as the summer advanced it was found that though much injury was inflicted in particular places, there was no such wide-spread havoc as in the preceding year.

In the "Monthly Report" for May and June, for instance, it is stated that "The destructive locust, *Caloptenus spretus*, has recommenced its depredations west of the line of the Missouri, and in some counties to the east of that river. It was reported that they were hatching in immense numbers in five of the counties of Minnesota. In some cases they were burned in great numbers in piles of straw. In Missouri they were very destructive in the north-western part of Vernon County; in Platte they swept all the grain and grass crops; they were also a terrible scourge in five other counties. (All of these suffered severely last year—they lie along the western boundary of the State.) In Kansas they had eaten all the stacked tame-grass hay and all the old meadows, twenty-five per cent. of the wheat, and most of the growing corn-plants; in Marshall County they destroyed wheat, oats and gardens; Leavenworth records the most terrible visitation yet known—the popular dismay is indescribable. Similar reports come from seventeen other counties. In some villages the streets are covered with these insects. Fruit-trees have in many cases failed to bear, from the fact that they were last year deprived of all their foliage and young-wood growth by these pests. From some counties come bitter complaints of the falsehoods of newspaper writers and others, palliating or denying the real extent of the disasters. These false representations are made in the interest of speculative property-holders, who fear a depreciation of their investments. In a few counties the injuries have as yet been small, but all such places are yet liable to destructive visitation. The cotton-plant was especially relished by these insects. In Nebraska they had destroyed twenty per cent. of the small grain, and were still at work. In Colorado they were numerous and destructive in three counties."

In the *Prairie Farmer* of the 29th of May it is stated that "the reports from the grasshopper regions of Missouri, Kansas and Nebraska are somewhat conflicting, yet on the whole a little more cheerful from many localities than they were last week. From Sedalia, Missouri, comes an account of three deaths from starvation. At a meeting held at Jefferson City, it was stated that suffering in many parts of the State was imminent, and it was resolved that the Governor should appoint commissioners in every county of the State to solicit relief, and that collections for the sufferers should be taken up in all the churches on the Fast Day, June 3rd." This 'Fast Day' was appointed by proclamation of the Governor of the State of Missouri, as a day of fasting and prayer to Almighty God for deliverance from the plague of locusts, and was, on the whole, very religiously observed throughout the State.

The same paper quoted above relates further that the ravages still continue in the neighbourhood of St. Joseph. "The feeling regarding them varies with localities; some are despondent, while others think the damage will be light. The people of Nebraska generally are reported to be very hopeful; they believe that the entire corn crop at least will be saved. They have developed in patches, but are doing less harm than was anticipated."

In the next issue of the *Prairie Farmer* (June 5th) a further account is given of the locust ravages, as follows :—

"Though in many localities the locusts have begun to try their wings, they do not yet seem ready for a prolonged or general flight. They seem to fly short distances in all directions, though we hear little of encroachments on new ground to the eastward. A few days more will settle the question as to direction and probable damage. All we know now is that in Missouri there is already considerable suffering among the people. A meeting was held at Independence on the 31st. From all portions of the county there came sad accounts of suffering. A relief committee was appointed. From Lexington we hear that the locusts are still at work, with no immediate prospect of leaving. A committee for relief purposes has been appointed. At Fort Scott, Kansas, the pests are reported as on the wing for the north-west. At Olathe they are moving northward. We have few particulars from Nebraska, but from what we do hear, conclude that there is little cause for alarm. The same may be said of Minnesota. In Nebraska, however, there is developing disease among the people, resulting from the privations of the past few months. Scurvy prevails to a considerable extent."

The July "Monthly Report of the Department of Agriculture" at Washington gives a record of the plague of locusts, from which we gather the following :—

"They appeared in several counties of Minnesota. Blue earth offered a bounty for their destruction. About 20,000 bushels were collected and destroyed at a cost of $32,000, without perceptibly diminishing their numbers." They were very destructive in three other counties, but were comparatively innocuous in the rest from which reports had come. In Iowa, Montgomery County had a very destructive visitation in the western part, the greatest injury being to the corn crop. They are also noted in eight other counties. In Missouri they did serious damage in several of the counties mentioned in the preceding month's report. "They swept away all the crops in Clay County ; in Carroll they chewed tobacco." In Texas they were injurious to the cotton-plant. In Kansas they inflicted a very serious amount of damage ; in three counties, three-fourths of the crops were destroyed ; they were "very bad" in fourteen more counties ; while lighter visitations were reported from six others. In Nebraska they are reported as more or less injurious in thirteen counties.

After this the various records show a brighter state of things, the numerous ravages already referred to proving, in many instances, much less serious than was at first apprehended. A correspondent of the *Prairie Farmer*, writing from Johnson County, Nebraska, on the 29th of July, states that "the grasshoppers hatched and commenced eating the wheat on April 28th, and stayed with us until June 13th. They commenced flying when the wind was north-west, and continued to fly up to the 27th of June—some days partly in clouds that could be seen when three miles off, but they did not light much in our county. As to wheat, there may be one-third of a crop of inferior quality, but potatoes and grass never looked better. If nothing happens to the corn, it will be the largest crop raised in the county." Another correspondent from the same State, writing a fortnight later, says : "We have splendid prospects for crops of all kinds planted since the grasshoppers left. Most of our small grain has been harvested, threshed and marketed by the grasshoppers, and so far we have not received any returns ; but we have the best prairie grass I ever saw. If the frost holds off as late as usual, we shall have a large quantity of corn and buckwheat." The "Monthly Report" from Washington, for August and September, mentions locust ravages in a few counties of the States of Minnesota, Iowa, Missouri, Kansas and Nebraska, but notices a great decrease in the reported devastations. "The pest," it states, "is evidently declining very fast, and the earnest hopes of a cessation of their ravages expressed by our correspondents appear to have a solid foundation in facts." The very perceptible reduction in the extent of the plague is attributed to the immense development of parasites upon the bodies of the locusts. The reports for the three remaining months of the year all show that "the plague was stayed" before it caused the utter ruin that was so widespread during the previous year. To give a few instances out of many :—A writer from Minnesota says, "I cannot report in comparison with last year, as we then produced nothing of any account, owing to destruction by grasshoppers. This year all kinds of crops raised here are generally good. The end of the season finds the farmers in better condition than for three or four years." Another from Clay County, Missouri, writes: "Since the destruction by the grasshoppers, crops of all kinds have grown beyond precedent as to quantity and quality. Food for stock is abundant, and pastures abound with rye instead of blue-grass." A third, from Kansas, the State that has suffered most of all from the locusts, states that "the failure of wheat, oats, timothy, clover, flax, &c., by ravages of the grasshopper, caused the planting of an extraordinary breadth of corn, potatoes, beans, buckwheat and vines of all kinds. Then the finest season for the growth of these crops has brought our farmers bountiful harvests of them." Others from different parts of the same State write: "Last year we had almost nothing; this year we have great abundance." "All our crops were destroyed last year, while this year they are all good." "Last season we had nothing worth noting; this season our crops are large beyond any precedent." From Nebraska, it is reported that "neither corn nor potatoes were raised last year; the whole crops were destroyed by grasshoppers; this season we have the best crops ever raised."

From the foregoing Reports it is evident that the locust visitation of this year, though very alarming in the earlier portion of the season, has proved to be of only moderate importance. No doubt there have been here and there, in the infested region, individual cases of extreme suffering, but the general population have escaped without any serious hardship. Where the invading horde of locusts makes but one attack, there is no doubt that it can be repelled and got rid of by vigorous efforts, especially if the population is sufficiently dense to admit of concerted action over a considerable area; but, on the whole, it is apparent that natural causes alone have operated in the reduction of the great army, and that no human measures have had any appreciable effect in averting a repetition of the frightful sufferings of the ever memorable "Locust Year," 1874.

Means of Reducing the Ravages of the Locusts.

In our Report of last year we gave an account of various methods that may be employed in the reduction of the ravages of the locusts; since its publication much has been said and written in different quarters upon the same subject, as, from the vast amount of devastation caused by the insect, it had become a matter of supreme importance to the people of the whole continent, whether personally affected or not. Naturally, therefore, the subject came up for discussion at the meeting of the American Association for the Advancement of Science, held at Detroit in August last. Papers were there read by Dr. LeConte, of Philadelphia, retiring President of the Association, the most eminent of American Entomologists, and Professor Riley, the State Entomologist of Missouri, who has made the locusts a subject of personal study since their appearance in his State. As Dr. LeConte's paper has already been quoted by Mr. Saunders in the earlier portion of this Report, we need only desire the reader to refer to it there.

From Professor Riley's paper, which was of considerable length, we make the following quotations, which the reader will observe set forth for the most part similar modes of prevention to those briefly suggested by us in our last Report (pages 40 and 41):—

"The means to be employed against the ravages of the locust in the more fertile country subject to its periodical visitations, but in which it is not indigenous, may be classed under five heads:—1. Natural agencies. 2. Artificial means of destroying the eggs. 3. Means of destroying the unfledged young. 4. Remedies against the mature or winged insects. 5. Prevention.

"1. *Natural Agencies.*—These are, 1st., climatic conditions which induce disease and prevent the insect's continued multiplication in much of the country it invades. 2nd. Natural enemies, consisting of birds, reptiles and mammals which devour, or in other ways destroy it, and of predaceous and parasitic species of its own class. The agencies in the first and last categories are beyond man's control, and will do their appointed work uninfluenced by his action; but the others are more within his control. Almost all birds inhabiting the western plains feed upon the locust and its eggs, and the prairie chicken and quail are untiring in this good work. The States subject to locust ravages should pass more stringent laws for the better protection of these game birds, with which the markets of the East are annually glutted. Many of the harmless reptiles—toads, snakes and lizards—should be spared from the ruthless war which most persons, ignorant of their habits, wage against them.

"2. *Artificial means of destroying the Eggs.*—The fact that man can accomplish most in his warfare against locusts by destroying the eggs, has long been recognised by European and Asiatic Governments liable to suffer from the insects. The eggs are laid in masses, just beneath the surface of the ground, seldom to a greater depth than an inch; and high, dry ground is preferred for the purpose. Very often the ground is so completely filled with these egg-masses, that not a spoonful of the soil can be turned up without exposing them, and a harrowing, or shallow ploughing, will cause the surface to look quite whitish as the masses break up and bleach from exposure to the atmosphere. Great numbers will be destroyed by such harrowing or ploughing, as they are not only thereby more exposed to the attacks of natural enemies, but they lose vitality through the bleaching and desiccating influence of the dew, and rain and sun. If deeply turned under by the plough, many of them will rot, and the young that chance to hatch will come forth too late the next year to do much harm—providing the same ground be not re-turned so as to bring the eggs to the surface in the spring. Excess of moisture for a few days is fatal to the eggs, and they may very easily be destroyed where irrigation is practicable. Where stock can be confined and fed on soil filled with such eggs, many of these will be destroyed by the trampling. All these means are obviously insufficient, however, for the reason that the eggs are too often placed where none of them can be employed. In such cases they should be collected and destroyed by the inhabitants, and the State should offer some inducement in the way of bounty for such collection and destruction. Every bushel of eggs destroyed is equivalent to a hundred acres of corn saved, and when we consider the amount of destitution caused in some of the Western States by the locust invasion of 1874, and that in many sections the ground was known to be filled with eggs—that, in other words, the earth was sown with the seeds of future destruction—it is surprising that the Legislatures of those States did not make some effort to avert future injury by offering a liberal price per bushel for the eggs. A few thousand dollars taken out of the State treasury for this purpose would be well spent, and be distributed among the very people most in need of assistance.

"3. *Destruction of the Unfledged Young.*—As I have stated in the articles already alluded to, heavy rolling, where the surface of the soil is sufficiently firm, destroys the larger portion of them, but is most advantageously employed when the insects are most sluggish. They drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. But the experience of the present year convinces me that by far the most effectual way for man to protect his crops and do battle to these young locust armies—especially where, as in West Missouri, this spring, there was no hay or straw to burn—is by ditching. A ditch two feet wide and two feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the hoppers will accumulate, and may be buried. We hear much talk about the powerlessness of man before this mighty locust plague; but I am quite confident that here we have a remedy that is at once thorough and effectual, whereby the people of some of the States, at least, may avert in future such evil as that which befel them this spring. There have been a number of partial attempts at ditching by simply turning a couple of furrows with the plough. Even these will often divert the encroaching insects from their course; but they can never be relied on, and you may rest assured that whenever you hear a man declare that ditching is no protection, he refers to such slovenly half-made ditches. No instance has come to my knowledge where a ditch, such as I first described, has failed to effectually keep off the insects. Made around a field about hatching time, no hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the inclosure, they are easily driven into the ditches dug in different parts of the field.

"There are various other ways of catching and destroying the young locusts, as driving them into converging barriers by means of ropes dragged on the ground, with a person at each end, and then crushing them with shovels or burning them by means of torches made of rags and dipped in coal oil and attached to sticks; catching them with nets, &c.; but nothing equals ditching. As for protecting plants by the application of powders and liquids, I have come to the conclusion that it is out of the question.

"If the eggs are duly destroyed, there will be no trouble from the young locusts; but where these once abound, pecuniary inducement to collect and kill them should be offered by the State. It is one of the best means of giving aid and employment to the sufferers, who cannot pursue their ordinary avocations till the plague measurably leaves or is banished.

"In this connection I would also urge the employment of military force, a large amount of which, in times of peace, could be ordered into the field at short notice.

"To many, the idea of employing soldiers to assist the agriculturist in battling with this pest may seem amusing and farcical enough, but though the men might not find glory in the fight, the war—unlike most other wars—could only be fraught with good consequences to mankind. In Algeria, the custom prevails of sending the soldiers against these insects. While recently in the south of France, I found, to my great satisfaction, that at Arles, Bouche du Rhone, where the unfledged locusts (*Caloptenus Italicus*, a species closely allied to the Rocky Mountain locust) were doing great harm, the soldiers had been sent in force to battle with them, and were then and there waging a vigorous war against the tiny foes. A few regiments, armed with no more deadly weapon than the common spade, sent out to the suffering parts of Missouri, Kansas and Nebraska last spring, might, in a few weeks, have entirely routed this pygmean army, and materially assisted the farmer in his ditching operations.

"A few other suggestions, and I will dismiss this part of the subject. Hogs and poultry of every description delight to feed on the young hoppers, and will flourish where these abound when nothing else does. It will be well, in the event of a future invasion, for the people in the invaded districts to provide themselves with as large a quantity as possible of this kind of stock. Where no general and systematic efforts were made to destroy either the eggs or the young locusts, and it is found that, as spring opens, these young hatch out in threatening numbers, the intelligent farmer will delay the planting of everything that he cannot protect by ditching, until the very last moment, or till toward the end of June—using his team and time solely in the preparation of his land. In this way he will not only save his seed and the labour of planting, and, perhaps, replanting, but he will materially assist in weakening the devouring armies. Men planted this spring and worked with a will and energy born of necessity, only to see their crops finally taken, their seed gone, and their teams and themselves worn out. The locusts finally devoured every green thing, until, finding nothing more, they began to fall upon each other and to perish. This critical period in their history would have been brought about much earlier if they had not had the cultivated crops to feed upon; and if by concert of action this system of non-planting could at first have been adopted over large areas, the insects would have been much sooner starved out and obliged to congregate in the pastures, prairies and timber. Moreover, the time required for early planting and cultivating, if devoted to destroying the insects after the bulk of them hatch out toward the end of April, would virtually annihilate them.

"4. *Destruction of Winged Insects.*—Man is comparatively powerless before the vast swarms that wing their way from their native breeding places, and this part of the subject may be passed over in this connection.

"5. *Prevention.*—What I have so far said is, perhaps, of more interest to the farmer than to the members of this association; but in dealing with the fifth mode of counteracting the injuries of the Rocky Mountain locust, I appeal more especially to your wisdom and judgment. Prevention, in dealing with insect ravages, is always better than cure. 'A little fire is quickly trodden out, which, being suffered, rivers cannot quench.' The proper way to deal with this insect is to attack it in its native breeding places.

"In my seventh Report I have shown that the insect is not autochthonous in much of the more fertile country it devastates, and that it never extends east of the 17th meridian. I have also given reasons for believing that the swarms from which we most suffer originate in the Rocky Mountain regions of Dakota, Wyoming, Montana and British America. Our efforts should be directed to its restriction within its natural limits.

"In conclusion, the most important results are likely to flow from a thorough study of the Rocky Mountain locust in its native haunts and breeding places. By learning just when and how to strike the insect, so as to prevent its undue multiplication there—whether by some more extensive system of irrigation, based on improved knowledge of the topography and water supply of the country, or by other means of destroying the eggs—we may hope to prevent the fertile States to the east from future calamity. This knowledge can never be acquired by any single individual. The subject is of national importance, and should receive the consideration of the National Government. It is not merely the question of saving to the nation, in future, such vast sums of money as this insect has filched from the producers of some of the Western States (amounting during the past three years to many millions of dollars); it is a question affecting the welfare of the whole commonwealth on the other side of the Mississippi, and the ultimate settlement of a vast tract of country extending from the base of the Rocky Mountains eastward, to which settlement the ravages of the locust in question offer the most serious obstacle."

We have quoted somewhat fully from Prof. Riley's paper, as almost every word of it is just as applicable to the Dominion of Canada and the Province of Manitoba as to the United States and the State of Missouri.

As a result of the papers of Messrs. LeConte and Riley, the standing Committee of the American Association authorized the circulation, for the signatures of members, of a memorial to the Congress of the United States; we understand that it was signed by many most influential and distinguished members.

The text of the memorial will be found in the introductory portion of this report.

Should the Congress of the United States accede to the prayer of this memorial, as we trust they will, it is earnestly to be hoped that the Legislature of the Dominion will appoint a similar Commission, to co-operate with that of our neighbours in all matters that concern vast areas of the continent, and not merely particular localities. In the case of the locust, it is evident that an exploration of the British American portion of the Rocky Mountains lying between the 49th and 51st parallels of latitude, if not somewhat further to the north as well, is urgently needed with a view to the discovery of the native haunts of the insect, or at any rate to the settlement of the question whether it breeds within the limits of our country or not. Much indeed might be done by the addition of a competent entomologist to the staff of the various surveying parties that are from time to time sent out for the settlement of boundaries, and the surveying of railway routes. Should it be discovered that the locusts do deposit their eggs and come to maturity year after year in any special locality on the eastern slope of the Rocky Mountains, then it would be a wise expenditure of public money to send a properly equipped party to the haunt of the enemy, and strive by every means to accomplish his extermination. The expenses of such a force would be a thousand times repaid by the saving of the crops and fruits of the farmers of Manitoba, and by the removal of what is felt by many to be a serious drawback to the settlement of the Province. Should our neighbours, however, south of the 49th parallel, not unite in the endeavour to keep the enemy in control, any labour on our part would be of little avail. Just as a farmer cannot hope to exterminate the thistles from his fields, if those about him allow the weed to scatter its seeds with every wind that blows; so we cannot hope to free our own territory from recurring plagues of locusts, if the Government of the United States do not join with us in the work. In any case, however, it will be wise to lose no time in discovering, by careful exploration, whether the insect is indigenous to British America or not. The settlement of this point will be one great step towards the accomplishment of an efficient protection against future invasions.

Since the above was written we learn that a Bill has been introduced into the Senate of the United States by the Hon. Mr. Ingalls, for the Protection of Agriculture, and that it has been received and referred to a Committee. In the introduction of the Bill especial reference was made to the depredations of locusts, chinch-bugs, army-worms, cotton-worms, the Hessian fly, &c. It was stated that the farmers of the United States are estimated to have suffered a loss last year of $200,000,000 by these insects, and that $10,000,000 would hardly cover the loss by locusts alone; it was further declared that in seven counties of Minnesota $80,000 were expended in destroying 60,00 bushels of locusts.

The Bill authorizes the Secretary of the Interior to appoint, upon the nomination of the National Academy of Sciences, a Commission, to consist of three eminent entomologists, to serve five years, at a salary of $5,000 per annum each, and to be allowed travelling expenses, &c. They are to devote themselves to the investigation of insects most injurious to the great staples, especially the Rocky Mountain locust, the army-worm, chinch-bug, Hessian fly and cotton-worm. The results of their labours are to be reported to Congress at least once a year.

It is evident that the memorial of the American Association. referred to above, has already produced an effect upon the Legislature of the United States. We have little doubt that the Bill, with perhaps some slight modifications, will be passed by Congress; and we have equally little doubt that, if the work is entrusted to the right men, we shall soon observe some very important results, that will speedily repay the nation many times over for any expenditure that may be incurred. We trust now that the matter will be brought before the consideration of the Legislature of the Dominion, in order that there may be the fullest co-operation with the work on the other side of the line.

Locusts as an Article of Food.

The use of locusts as an article of food was referred to in our last Report, where, after mentioning various instances in which different species of the insect have been made use of in this way in many parts of the world, we stated that "it remains to be proved that a nutritious article of food may not be obtained from the Rocky Mountain locust (*Caloptenus spretus*); certainly it is an experiment worth trying; if successful we should have a double benefit—the lessening of the numbers of the locusts and the supply of food wherewith to meet the famine that they have produced." We are glad to find that our friend, Professor Riley, who has had excellent opportunities for the purpose, has made the experiment with decided success. From his paper on the subject, read before the American Association, we make the following extracts:—

"Whenever the occasion presented, I partook of locusts prepared in different ways, and one day I ate of no other kind of food, and must have consumed, in one form and another, the substance of several thousand half-grown locusts. Commencing the experiments with some misgivings, and fully expecting to have to overcome disagreeable flavour, I was soon most agreeably surprised to find that the insects were quite palatable, in whatever way prepared. The flavour of the raw locust is most strong and disagreeable; but that of the cooked insects is agreeable, and sufficiently mild to be easily neutralized by anything with which they may be mixed, and to admit of easy disguise, according to taste or fancy. But the great point I would make in their favour is, that they need no elaborate preparation or seasoning. They require no disguise, and herein lies their value in exceptional emergencies; for when people are driven to the point of starvation by these ravenous pests, it follows that all other food is either very scarce or unattainable. A broth, made by boiling the unfledged *Calopteni* for two hours in the proper quantity of water, and seasoned with nothing in the world but pepper and salt, is quite palatable, and can scarcely be distinguished from beef broth, though it has a slight flavour peculiar to it and not easily described. The addition of a little butter improves it, and the flavour can, of course, be modified with mint, sage and other spices, *ad libitum*. Fried or roasted in nothing but their own oil, with the addition of a little salt, they are by no means unpleasant eating, and have quite a nutty flavour. In fact it is a flavour, like most peculiar and not unpleasant flavours, that one can soon learn to get fond of. Prepared in this manner, ground and compressed, they would doubtless keep for a long time. Yet their consumption in large quantities in this form would not, I think, prove as wholesome as when made into soup or broth; for I found the chitinous covering and the corneous parts, especially the spines on the tibiæ, dry and chippy, and somewhat irritating to the throat. This objection would not apply with the same force to the mature individuals, especially of larger species, where the heads, legs and wings are carefully separated before cooking; and, in fact, some of the mature insects prepared in this way, then boiled and afterward stewed with a few vegetables and a little butter, pepper, salt and vinegar, made an excellent fricassee.

"Lest it be presumed that these opinions result from an unnatural palate, or from mere individual taste, let me add that I took pains to get the opinions of many other persons. Indeed, I shall not soon forget the experience of my first culinary effort in this line—so fraught with fear and so forcibly illustrating the power of example in overcoming prejudice. This attempt was made at an hotel. At first it was impossible to get any assistance from the followers of the *ars coquinaria*. They could not have more flatly refused to touch, taste or handle, had it been a question of cooking vipers. Nor love nor money could induce them to do either, and in this respect the folks of the kitchen were all alike, without distinction of colour. There was no other resource than to turn cook myself and operations once commenced, the interest and aid of a brother naturalist and two intelligent ladies were soon enlisted. It was most amusing to note how, as the rather savoury and pleasant odour went up from the cooking dishes, the expression of horror and disgust gradually vanished from the faces of the curious lookers-on, and how, at last, the head cook—a stout and jolly negress—took part in the operations; how, when the different dishes were neatly served upon the table and were freely partaken of with evident relish and many expressions of surprise and satisfaction by the ladies and gentlemen interested, this same cook was actually induced to try them and soon grew eloquent in their favour; how, finally, a prominent banker, as also one of the editors of the town, joined in the meal. The soup soon vanished and banished silly prejudice; then cakes with batter enough to hold the locusts together disappeared and were pronounced good; then baked locusts with or without condiments; and when the meal was completed with dessert of baked locusts and honey *à la* John the Baptist, the opinion was unanimous that that distinguished prophet no longer deserved our sympathy, and that he had not fared badly on his diet in the wilderness. Prof. H. H. Straight, of the Warrensburg (Mo.) Normal School, who made some experiments for me in this line, wrote: 'We boiled them rather slowly for three or four hours, season the fluid with a little butter, salt and pepper and it made an *excellent* soup, *actually*; wou like to have it even in prosperous times. Mrs. Johonnot, who is sick, and Prof. Johonn pronounced it excellent.'

"I sent a bushel of the scalded insects to Mr. Jno. Bonnet, one of the oldest and best known caterers of St. Louis. Master of the mysteries of the cuisine, he made a soup which was really delicious and was so pronounced by dozens of prominent St. Louisans who tried it. Shaw, in his *Travels in Barbary* (Oxford, England, 1738), in which two pages are devoted to a description of the ravages of locusts, mentions that they are sprinkled with salt and fried, when they taste like craw-fish; and Mr. Bonnet declared that this locust soup reminded him of nothing so much as crawfish bisque, which is so highly esteemed by connoisseurs. He also declared that he would gladly have it on his bill of fare every day if he could get the insects. His method of preparation was to boil on a brisk fire, having previously seasoned them with salt, pepper and grated nutmeg, the whole being occasionally stirred. When cooked they are pounded in a mortar with bread fried brown, or a puree of rice. They are then replaced in the saucepan and thickened to a broth by placing on a warm part of the stove, but not allowed to boil. For use, the broth is passed through a strainer and a few croutons are added. I have had a small box of fried ones with me for the past two months, and they have been tasted by numerous persons, including the members of the London Entomological Society and of the *Société Entomologique de France*. Without exception they have been pronounced far better than was expected, and those fried in their own oil with a little salt are yet good and fresh; others fried in butter have become slightly rancid—a fault of the butter."

Mr. Riley concludes his interesting account by saying, "I can safely assert from my own personal experience, that our Rocky Mountain locust is more palatable when cooked than many animals which we habitually use on our tables. I mention the species more particularly, because the flavour will doubtless differ according to the species, or even according to the nature of the vegetation the insects were nourished on. I have made no chemical analysis of this locust food, but that it is highly nourishing may be gathered from the fact that all animals fed upon the insects thrive when they are abundant; and the further fact that our locust-eating Indians, and all other locust-eating people, grow fat upon them.

"Locusts will hardly come into general use for food except where they are annually abundant, and o western farmers who occasionally suffer from them will not easily be brought to a due preciation of them for this purpose. Prejudiced against them; fighting to overcome them, killing them in large quantities, until the stench from their decomposing bodies becomes at times most offensive—they find little that is attractive in the pests. For these reasons, as long as other food is attainable, the locust will be apt to be rejected by most persons. Yet the fact remains that they do make very good food. When freshly caught in large quantities, the mangled mass presents a not very appetizing appearance, and emits a strong, and not over-pleasing odour; but rinsed and scalded, they turn a brownish red, look much more inviting, and give no disagreeable smell.

" The experiments here recorded have given rise to many sensational newspaper paragraphs, and I consider the matter of sufficient importance to record the actual facts, which are here given for the first time.

" Like or dislike of many kinds of food are very much matters of individual taste, or national custom. Every nation has some special and favorite dish, which the people of other nations will scarcely touch, while the very animal that is highly esteemed in one part of a country is not unfrequently rejected as poisonous in another section. We use many things to-day that were considered worthless or even poisonous by our forefathers. Prejudice wields a most powerful influence in all our actions. It is said that the Irish, during the famine of 1857, would rather starve than eat our corn bread; and if what I have written shall in the future induce some of our western people to profit by the hint, and avoid suffering from hunger or actual starvation, I shall not have written in vain."

Like the mysterious individual who first tasted oysters, and introduced them to the favourable consideration of the world, we certainly think that Prof. Riley deserves the thanks of the community for his courage in making the experiment of eating locusts, and the zeal with which he carried it out. No doubt our north-western friends, in the Province of Manitoba, especially those of French descent, who are usually more skilled in the arts of cookery than their Anglo-Saxon or Irish neighbours, will ere long look upon Prof. Riley as a public benefactor—one who has introduced a new and estimable addition to the luxuries of the table.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

PROVINCE OF ONTARIO,

FOR THE YEAR

1876.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY HUNTER, ROSE & CO., 25 WELLINGTON-ST WEST.
1877.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1876.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of the Canadian Entomologist,

REV. C. J. S. BETHUNE, M. A.

Head Master of Trinity College School, Port Hope; Vice-President of the Entomological Society of Ontario;

AND

JOSEPH WILLIAMS,

London, Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR 1876.

To the Honourable the Commissioner of Agriculture:

Sir,—I have the honour to submit, herewith, for your consideration, the Report of the Entomological Society of Ontario, for the year 1876, including a detailed statement of the receipts and expenditures during the year, all of which have been duly audited.

The Canadian Entomologist, the monthly organ of our Society, continues to be regularly issued about the 15th of each month, and has, during the past year, contained a great many papers of much practical value. It has now nearly reached the close of its eighth volume, and throughout its issue it has been almost entirely filled with original matter: hence it has become such a depository of the results of entomological observation, that no student of American entomology can dispense with it. Yearly it is growing in favour in European and American scientific circles, and continues also to carry on a good work in our midst by the diffusion from month to month of much valuable information in reference to insect life about us.

The Annual Meeting of the Society was held this year in the City of Hamilton, during the time of the exhibition of the Agricultural and Arts Association, in accordance with the provisions of the Statute, when the various reports were read and approved, and the officers for 1877 duly elected.

I have also the pleasure of submitting a Report on some of the noxious, beneficial, and other insects of the Province which have been prepared on behalf of the Society by Mr. Wm. Saunders, Rev. C. J. S. Bethune, M.A., and Mr. J. Williams.

The pages of this Report will be found illustrated with many excellent cuts, a number of which are entirely new; we have also a plate of a very excellent character, illustrating some of the insects treated of: a new feature in our Reports, and one which we believe will add greatly to their interest.

I have the honour to remain, Sir,

Your obedient servant,

J. H. McMechan,

Secretary-Treasurer Entomological Society of Ontario.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The sixth annual meeting of the above Society was held in the Court House in the City of Hamilton, on the 20th day of September, when the various reports of the officers were read and adopted, followed by the delivery of the President's annual address, a copy of which was requested for publication.

The election of officers for the ensuing year then took place, with the following results:—

President.—W. Saunders, London.

Vice-President.—Rev. C. J. S. Bethune, M.A., Port Hope.

Secretary-Treasurer.—J. H. McMechan, London.

Council.—Wm. Couper, Montreal; R. V. Rogers, Kingston; E. B. Reed, and J. M. Denton, London; J. Pettit, Grimsby.

Editor of Entomologist.—W. Saunders, London.

Editing Committee.—Rev. C. J. S. Bethune, M.A., Port Hope; E. B. Reed, London; and G. J. Bowles, Montreal.

Library Committee.—Messrs. Saunders, Reed, Denton, and McMechan, London.

Committee on Centennial Exhibition.—W. Saunders, Rev. C. J. S. Bethune, M.A., and J. H. McMechan.

Auditors.—J. Williams and Chas. Chapman, London.

FINANCIAL STATEMENT OF THE SECRETARY-TREASURER.

Receipts.

To Balance from 1875	$232 33
" Cash refunded from Centennial account	50 00
" Government Grant for Centennial exhibit	500 00
" Annual grant, 1876	750 00
" Members' Fees	237 70
" Sales of corks, pins, &c., to members	107 32
	$1877 35

Disbursements.

By *Canadian Entomologist*, printing and paper	$391 71
" Engravings	83 63
" Expenses of Annual Report	84 00
" Library	42 47
" Editor's salary	100 00
" Secretary-Treasurer's salary	50 00
" Travelling expenses officers' attending meetings	86 25
" Expenses, sundry small	38 72
" Rent of hall	80 00
" Cork, Pins, &c	163 46
" Collection California Coleoptera	30 12
" Centennial Exhibition expenses	541 39
" Balance cash on hand	185 60
	$1877 35

We certify that the above is a correct statement of accounts for the year ending, September, 1877, as shown by the Treasurer's Books, with vouchers for disbursements.

CHAS. CHAPMAN, J. WILLIAMS, } *Auditors.*

REPORT OF THE COUNCIL.

It is our pleasing duty, at this the sixth anniversary of our Society, to draw attention to the increasing importance of its work, and the growing interest manifested by many in its welfare. The importance of the study of insects is yearly becoming more felt, so much so that it is being introduced in common with other departments of natural history in some of our best schools.

The preparation of the collection of Canadian insects by our Society for the Centennial Exhibition has been a great success. When we ventured the opinion in our last report that this collection would prove an interesting feature in the Canadian Department, and would be in every way worthy of our Society, we scarcely looked for the magnificent display which has since been brought together; a collection of our insects far surpassing anything ever before seen. This collection will, it is hoped, be preserved as far as possible in its present condition, as a collection of reference for the use of our members. In this way it will be of great service to many who have hitherto found great difficulties in the way of procuring the correct names of insects on which they had recorded observations, or which they had collected for their cabinets.

The meetings of the Entomological Club of the American Association for the Advancement of Science were held at Buffalo, beginning on the 22nd day of August. Our Society was represented by three of its prominent and active members: our President, W. Saunders; Vice-President, Rev. C. J. S. Bethune; and Mr. E. B. Reed, all of whom took part in the discussions which took place at the several meetings. Some important conclusions were reached in reference to entomological nomenclature, and a series of rules presented and partially adopted which we hope will greatly tend to the permanency of the names of our insects. Many interesting features of insect life were brought under the notice of the members, and several important papers read. A full report of these meetings will be found elsewhere.

The eighth volume of our monthly magazine is nearly completed, and fully sustains the reputation it has hitherto acquired as a valuable medium for the publication of original observations on insects. In such a journal as ours the great bulk of the matter must necessarily be scientific, and cannot be void of technicalities; yet we are pleased to record the efforts which have been made to present our readers who are not deeply versed in the science of Entomology with such matter as will interest and instruct them.

Our branches in London, Montreal, and Kingston, are still carrying on the good work in their respective spheres; we hope that the coming year will witness a large accession to the number of their members.

Submitted, on behalf of the Council, by
J. H. McMechan,
Secretary-Treasurer.

ANNUAL MEETING OF THE LONDON BRANCH.

The annual meeting of the London Branch of the Entomological Society of Ontario was held on the 18th day of January, 1876, at the Society's rooms.

The minutes of the last meeting having been read and approved, and the usual routine business transacted, the following gentlemen were elected as officers for the year 1876 :—President, G. Geddes; Vice-President, H. B. Bock; Secretary-Treasurer, J. M. Denton; Curator, Chas. Chapman; Auditors, J. H. McMechan and J. H. Griffiths.

The annual report of the Secretary-Treasurer, which had been duly audited, was then read, conveying the pleasing intelligence that there was a balance to the credit of the Branch, after all the current expenses of the year had been defrayed.

REPORT OF THE COUNCIL OF THE LONDON BRANCH.

The Council of the London Branch of the Entomological Society of Ontario feel gratified at the continued interest manifested in Entomological matters by our members. This interest and zeal was especially apparent during the earlier months in the year, when the collection of the Parent Society was being prepared for exhibition at Philadelphia. Then meetings were frequently held, and labours in connection with this undertaking assiduously followed day after day, and we believe that to the efforts of the members of the London branch may be attributed a large measure of the success which has attended the preparation of this collection; the pledge given last year that our members would do their utmost has certainly been fully redeemed. Following the completion and shipment of this collection, Centennial engagements and the approach of the collecting season interfered for a time with the regularity of our meetings.

Some interesting additions have been made to the collections of our members during the summer by captures at sugar, and otherwise, further establishing the favourable position of London and its surroundings as a collecting ground. We hope that with the increased facilities for naming insects which will be afforded by the return of the Society's collection from Philadelphia, that many will be attracted to our ranks, and thus the interests of Entomology be still further subserved.

On behalf of the Council,
John M. Denton,
Secretary-Treasurer.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The third annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on the 2nd of May, 1876, when the following officers were elected for the ensuing year :—President, G. J. Bowles; Vice-President, F. B. Caulfield; Secretary-

Treasurer, Geo. B. Pearson; Curator, C. W. Pearson; Council—W. Couper, H. H. Lyman, and Robert Jack.

The reports of the Council and Secretary-Treasurer were read and adopted.

All business communications to be addressed to G. B. Pearson, 83 Cathcart Street, Montreal, P.Q.

ANNUAL REPORT OF THE COUNCIL OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Your Council, in presenting their third Annual Report, would congratulate the Society on the solid progress made during the year. Although the membership has not increased, much good work has been accomplished, and great interest taken by the members in the study of our science. The monthly meetings have been well kept up during the year, and many interesting insects, both native and foreign, brought before the members. Your Council would remark, that as the result of your labours, the Lepidoptera of the district have been well worked up, and some progress made with the Coleoptera and Orthoptera. The other orders, however, have been comparatively neglected.

Your Council would recommend the members to collect *all* the orders, so that the work of the Society may be better developed and material gathered for future study.

The following papers have been read during the year :—

" On the extraordinary flight of *Danais Archippus*," by Geo. B. Pearson.

" The excursion of the Montreal Branch on Dominion Day," by Geo. B. Pearson.

" List of *Noctuidæ* taken at sugar, at Chateauguay Basin, on 1st July, 1875," by F. B. Caulfield.

" Description of a new species of *Dryocampa*," by G. J. Bowles.

" Notes on *Biston Ursaria*—Walker," by G. J. Bowles.

" List of *Lepidoptera*, collected at the Godbout River," by W. Couper.

" Notes on sugaring for *Noctuidæ*," by F. B Caulfield.

" Notes on the remarkable variations of *Colias Philodice*," by Geo. B. Pearson.

" Description of the larvæ and chrysalis of *Grapta interrogationis*," by H. H. Lyman.

" Notes on some species of *Orthoptera* occuring on the Island of Montreal," by F. B. Caulfield.

" A proposal to compile the Montreal Catalogue," by G. J Bowles.

" On Scudder's historical sketch of the generic names proposed for Butterflies," by W. Couper.

" On *Platysamia Columbia*," by F. B. Caulfield.

" List of the Diurnal *Lepidoptera* of Portland," by H. H. Lyman.

" List of the *Bombycidæ*, occurring at Montreal," by F. B. Caulfield.

" Our work," by C. W. Pearson.

" List of *Noctuidæ* occurring at Montreal," by F. B. Caulfield.

" On the Snow Fly found in April, at Rivière du Loup en bas," by W. Couper.

Your Council have great pleasure in thanking our worthy President for a valuable check-list which he has compiled, for cataloguing the insects of all the orders occurring on the Island of Montreal. This is a work that was very desirable. On the kind invitation of Robert Jack, Esq., the members proceeded to Chateauguay Basin on the 1st of uly last year, and spent a very pleasant and profitable day in collecting in that neighbourhood, and in enjoying the generous hospitality of Mr. Jack and his family.

The following books have been donated to our library during the year :—

Vol. I. " Memoirs of the American Association for the Advancement of Science," donated by S. H. Scudder, Esq.

" Revision of the hitherto known species of *Chionobas* in North America," donated by S. H. Scudder, Esq.

" Notes on some New England Orthoptera ;" " The Two Principal Groups of Urbicolæ (Hesperidæ) ;" " Notes on the Species of Glaucopsyche from East North America ;" " Entomological Notes," Nos. 1, 3, and 4 ; " An Historical Sketch of the Generic Names

Proposed for Butterflies;" "Recherches sur les Mœurs des Fourmis Indigenes," by P. Huber; "De partibus quibus insecta spiritus ducunt," by Christianus Loewe, all of which were generously donated by S. H. Scudder, Esq., of Cambridge, U. S. "Entomological Contributions," Nos. 1, 2, and 3, also kindly donated by J. A. Lintner, Esq., of Albany, New York, and vols. 1, 2, and 3, "Bulletin of the Buffalo Society of Natural Sciences."

"Notes on the North American Lepidoptera contained in the British Museum;" "List of the North American Platyptirices, Attaci, etc., etc., with Notes;" "List of the North American Noctuidæ," two numbers, all of which were generously given by Aug. R. Grote, Esq., Buffalo, New York.

All of which is respectfully submitted.

WILLIAM COUPER,
Chairman.

GEO. JNO. BOWLES,
President.

G. B. PEARSON,
Secretary-Treasurer.

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

To the Members of the Entomological Society of Ontario:—

GENTLEMEN,—In accordance with time-honoured usage, it devolves upon your retiring President at the close of another year of the existence of our Society to offer you a few remarks bearing upon the objects and interests of our body, or of Entomology in general.

And first, gentlemen, I desire to congratulate you on the continued prosperity of our Society and the increasing interest felt and manifested in the furtherance of the chief objects we as an organization have in view, viz., the diffusion of practical information in reference to the life history and habits of our insects, so that we may be able to distinguish our friends from our foes, and thus be placed in a position to apply intelligently such remedial measures for the check of insect ravages as experience may suggest to be most practical and effective.

During the past year circumstances have arisen which have brought our Society more prominently before our people than ever before, notably the fact of the accumulation of that grand collection of Canadian insects which we have prepared and forwarded to the Centennial Exhibition in Philapelphia. My esteemed predecessor, in his annual address last year in Toronto, referred to this proposed work, and expressed himself as confidently anticipating the active co-operation of our members in all sections of our country. The result has more than realized our fondest hopes; our members entered most heartily into the work, bringing together a collection of Canadian insects far surpassing anything ever before seen. The carrying out of the details of this work was entrusted last year to a special committee, consisting of Messrs. Bethune, Saunders and McMechan, and upon consultation it was resolved to accumulate all the material for this collection at the Society's headquarters in London, and there make such selections from the insects sent as might seem desirable. All our members in London who had collections, freely placed them entirely at the disposal of the committee, while many of those resident in other localities throughout the country expressed their readiness to contribute anything or everything in their power to fill up blanks in the desired series of specimens.

As is usual in such cases, the bulk of the work of arranging, classifying and labelling specimens fell upon a few individuals. It affords me much pleasure to have the opportunity of naming especially *one* who has laboured most assiduously and has contributed more than any other person towards the success of this enterprise; I allude to my esteemed friend, Mr. Johnson Pettit, of Grimsby, who arranged the entire collection of Coleoptera and freely contributed from his own stores—the accumulation of years—a large proportion of the specimens. The extreme neatness and care manifested by him in the mounting and arrangement of the insects has been the admiration of all, and some idea of the accuracy of his determinations may be arrived at when I say that such authorities as Dr. Horn and Dr. LeConte, of Philadelphia, after a critical scrutiny of the whole series of Coleoptera, filling some twenty-seven cases in all, could only detect two or three errors, and these among the smallest and least conspicuous specimens ; such results reflect great credit on the labours of our esteemed coadjutor. In the arrangement of the other departments, your President was ably aided by several gentlemen, notably Messrs. E. B. Reed, J. M. Denton and G. Geddes, of London ; indeed, all our London members were ever ready to render all the assistance in their power.

The expenses necessarily attendant on this work have been considerable. The making and lining of suitable cases in which to display the insects, the printing of labels, &c., and the numberless outlays entailed by the transmission of specimens to and fro from all parts of the country, as well as many other incidentals which it is needless to enumerate here, combined, have involved a large outlay. This has been chiefly met by a special grant of five hundred dollars from the Government of Ontario, the remainder being drawn from the Society's resources.

To make the collection as perfect as possible, as far as accurate naming is concerned, the doubtful specimens in the orders most largely represented were submitted to the examination and correction of specialists. The entire collection of Lepidoptera was carefully gone over by Prof. A. R. Grote, of Buffalo, who generously placed his services at the disposal of the Society for this purpose, and twice visited London in order to complete the work. Dr. Horn also kindly rendered all possible aid in the determination of such Coleoptera as were sumbitted to him, and to Dr. A. S. Packard we are indebted for naming some of the Geometridæ.

The collection arrived safely and in good condition in Philadelphia, where it at once attracted much attention. The whole display consisted of eighty-six glass cases, forty-five of which were filled with Lepidoptera, twenty-seven with Coleoptera, and the remaining fourteen occupied by the other orders, the whole arranged in a double row on a suitable stand *seventy-six* feet in length, in the Canadian Department in Agricultural Hall.

There were no other collections on exhibition in Philadelphia which would compare favourably with that sent by our Society. There was a very good one in the United States Government Building, from the Department of Agriculture in Washington, arranged by Prof. Townend Glover ; this, however, consisted chiefly of Lepidoptera.

There was a small collection shown in the Canadian Department, adjoining that of our Society, consisting of four or five cases, containing Canadian insects, representing the various orders ; they came, I believe, from Montreal, but I did not succeed in finding the name of the party to whom they belonged. Through the neglect or carelessness of our Canadian Commission, neither this collection nor that of our own Society *are mentioned* in the official catalogue, do not appear to have been entered as belonging to any department of the exhibition, and hence were not examined at all by the Centennial judges. Had it been otherwise, we should no doubt have been honoured with awards which, in the case of our Society, if we may judge from the laudatory comments of those best able to form an opinion, were well deserved.

In the Kansas State Building there was a collection from the State Board of Agriculture, arranged by Prof. Snow, consisting of thirty cases : sixteen of Lepidoptera (seven of butterflies and nine of moths), five of Coleoptera, two Neuroptera, two Orthoptera, three Hymenoptera, one Diptera, and one Hemiptera. These were very well set up, classified, and nearly all named, and were very creditable to Prof. Snow and the Board by whom they were sent. There was, nevertheless, one drawback to viewing them with any satisfaction : the dust was allowed to accumulate on the glasses to such an extent as to obscure the objects contained.

There was a collection from Brazil, shown in the Brazilian Department in the Main Building. This, we were told, was the work and property of a private gentleman residing in Rio Janeiro ; it was arranged in thirty-five cases, thirty-one of which were Coleoptera and four Lepidoptera. This collection was very much mixed ; there was no attempt made to name the insects, except to the extent of partially indicating the family names. Neither was there much effort towards a correct classification ; they seemed to be partly arranged with regard to their natural relationship and partly with the view of display. Among the butterflies and moths there were some superb specimens whose brilliance attracted much attention. There were also some very beautiful and interesting things among the Coleoptera. The Curculionidæ were very brilliant and numerous in species, with forms greatly varied ; the Cerambycidæ were also remarkable, handsome, and largely represented, some of them of great size. We noticed one enormous *Prionus* fully six inches long ; the *Cetonias* were also very beautiful. Some of the Buprestidæ were wonderfully brilliant with metallic shadings, and the Chrysomelidæ very numerous, and some of them very charming, the Cassidæ being largely represented. Among the Scarabeidæ there were some enormous specimens, among others, species of *Copris* with remarkable horns, and some brilliant species of *Onthophagus* ; there were also a number of very handsome *Elaters*. One of the rarities in this collection was a fine example of *Hypocephalus armatus*, an extremely rare insect about two inches in length, and of which it is said there are only two or three known specimens in collections. The more brilliant Brazillian insects, especially the Coleoptera, are largely employed by the inhabitants of that country in the ornamentation of jewellery and other fancy articles, often associated in the latter case with the feathers of their brilliant plumaged birds.

In the Department of Queensland there was a large case, filled chiefly with Lepidoptera in a fine state of preservation, embracing many very beautiful and strange-looking things ; almost the only familiar objects among them were specimens of *Danais archippus*. In this instance, also, none of the specimens were named, which detracted greatly from the interest which would otherwise have attached to them. We learned that this collection had been sold for $150 to Mrs. Brigham, of New York, a lady who, we believe, takes a deep interest in Entomology, and who has a very large and handsome collection of Lepidoptera.

The Orange Free State of South Africa exhibited two cases of insects, among which there was a curious admixture of millipedes, scorpions and spiders, arranged in a semi-ornamental manner. One case contained chiefly Coleoptera, with a few Hymenoptera, Hemiptera and Orthoptera. Among the Coleoptera there were some curious and beautiful forms, especially among the Cetonidæ and Cerambycidæ ; also some handsome Scarabeans, Chrysomelans and Curculios. The second case was filled mainly with butterflies, among which there were a few very handsome ones. That cosmopolitan species, "the painted lady," *Cynthia cardui*, was represented by several specimens ; there was also a *Sphinx* closely resembling the death's-head moth of Europe, and a *Utesthesia* very like our *bella*. Besides these there were a number of very curious and handsome moths, with a few Orthoptera and Neuroptera. No attempt was made in the way of naming anything in this collection, nor any effort at classification.

An American gentleman, whose name I did not learn, had a very curious exhibit of insects in Agricultural Hall, of a purely ornamental character, in three cases. One was a circular arrangement, and was built up chiefly with butterflies and moths ; the other two represented public buildings and were constructed of beetles ; the specimens were immensely numerous and well preserved ; the whole arrangement indicating great ingenuity and perseverance on the part of the collector.

India had a very fine exhibit of silks, raw and manufactured, with the insects and cocoons from which they were obtained. The Tusseh silk-worm moth, *Antheræ paphia*, is very handsome, not unlike our *polyphemus* ; the cocoon is egg-shaped, and yields a very strong-looking silk. The *Bombyx Huttonii*, or wild silk-worm moth, is also very pretty ; in form it resembles *B. mori*, but its wings are beautifully marked and tipped with brown.

It was very gratifying to observe the prominence given to the study of Natural History in the Educational Departments of many of the nations thus represented at the Centennial. Nearly all of them had small collections illustrating the course of teaching in this branch of study, and in nearly every instance Entomology occupied a prominent position. In the model schools of Sweden and Belgium this was very noticeable ; also in the Russian exhibit, where there were cases of insects of all orders, including in many instances the blown larvæ very neatly set up. In the same department in the Japan exhibit there were similar cases fairly classified, illustrating the various orders. The Chinese make use of insects, too, but with them they are used as medicines ; among their *materia medica* collections we observed dried caterpillars, the empty pupa cases of a species of *Cicada*, and other similar substances, all extolled as possessing rare medicinal virtues.

The bringing together of such an immense number of agricultural productions as are now on exhibition in Philadelphia, including almost every variety of grain, peas, beans and other useful productions on the face of the globe, affords a favourable opportunity for the introduction of any insect pests which may infest these articles in the country of their growth ; these, if introduced and acclimatized, may attack similar or related products in this country, unless precautions are taken against their dissemination, and thus we may have new foes to fight which may be very difficult to contend with. The American Centennial Commission, who do not seem to have overlooked anything, have, with wise foresight, appointed a special Commission of eminent Entomologists to report on the insects introduced along with the products exhibited. This report will be looked forward to with much interest by agriculturists as well as Entomologists.

The Agricultural Building in which our insects were shown, was well supplied with skylights, which admitted a flood of light on everything below. Exposure to this brilliant light for so many months has had a damaging effect on the colours of some of our Lepidoptera, the moths being much more faded than the butterflies ; this fading is especially noticeable in insects having any red colours on their wings, such as the Catocalas and Arctians ; many of these, however, can be replaced without much difficulty.

Suitable arrangements have been made for the careful packing and re-shipping of the insects at the close of the Exhibition, when they will be forwarded to the Society's rooms in London, Ont. Here it is proposed to keep the collection as far as possible undisturbed, where it will serve a good purpose as a collection of reference for collectors to name their specimens from. Mr. Pettit has kindly consented to allow all that he has contributed to remain in the Society's rooms, and all the London members will follow his example. Mr. Wm. Couper, of Montreal, has generously donated all he has sent to the Society, and I doubt not that most of our other friends in Montreal and elsewhere, who have contributed to the collection, will allow such of their insects as are not represented in our cabinets in London, to remain at least for a time, when no doubt most of them could be replaced. The advantages which will result to our Society from the possession of a collection so well worked up and so correctly named, can scarcely be overestimated, affording as it will, conveniences to collectors for naming specimens such as we have never had before. If for no other reason, we shall, in the possession of these advantages, always have cause to remember with pleasure the hundredth anniversary of American independence.

The continuance of the organ of our Society, the *Canadian Entomologist*, has also contributed greatly to the maintenance of the interest felt in our Society. During the past year important matters have been discussed in its pages, and a mass of new facts, throwing light on the habits and life history of many of our insects, placed before our readers. Much space has also been given to the important department of descriptive Entomology. Indeed, I scarcely think we should be deemed presumptuous in saying that our little journal is an important bond which does much to bind together the brotherhood of Entomologists throughout America.

The recent action of American Entomologists on the subject of Entomological nomenclature claims more than a passing notice. At the meetings of the Entomological Club of the American Association for the Advancement of Science, held last month in Buffalo, N.Y., this important subject was discussed and conclusions reached in reference to it which, I hope, will greatly tend to the stability of our nomenclature, the great end and aim which all parties claim to have in view. Amidst the conflicting opinions held by leading Entomologists on this subject, it was scarcely to be expected that entire unanimity could be secured ; but it was most gratifying to notice the conciliatory spirit manifested by all, and the desire apparently as far as possible to meet each other's views. A series of resolutions touching on important points was presented by the Committee named last year to report on this subject, and on some of these they were unanimous, while on others there was a divided opinion. Those rules which were unanimously adopted will, it is understood, be strictly carried out by all who were present, while those on which there was expressed a divided opinion will, in the meantime, be left to be acted on or not, as the individual choice may dictate. Although this does not leave the subject in as satisfactory a state as entire unanimity would have done, still it was felt that by the action taken very much had been done towards settling some of the disturbing elements which interfere with the fixity of nomenclature. A report of these important meetings will be found in the *Entomologist;* we commend them to the careful perusal of our readers. Our own Society was well represented in this gathering by the presence of the Rev. C. J. S. Bethune, M.A., E. Baynes Reed, and your President.

I shall not attempt, gentlemen, to trespass longer on your time and patience. Thanking you for your kind partiality in electing me to fill so important an office among you,

I have the honour to be, very sincerely yours,

WM. SAUNDERS.

London, September, 1876.

REPORT OF THE COMMITTEE ON CENTENNIAL EXHIBITION.

Your committee take much pleasure in reporting the great success which has attended the enterprise of which they have had charge, a success indeed greater than the most sanguine had anticipated. On entering upon our labours the magnitude of the undertaking was such, that we felt some misgivings. To get together such a collection as would do credit to our Society and to the Province we have the honour to represent, in so short a time as that allotted to us was felt to be no mean task, but having resolved to do our best, work was begun without delay.

On mature deliberation it was thought best to bring together in London, all the insects that could be procured from the collections of all our members in Canada, and there making the Society's rooms our head-quarters, to assort and arrange them as experience might suggest. Our first attention was given to the preparation of suitable cases in which to place our specimens, which should be as near as possible dust-proof and pest-proof It was finally determined to adopt the form of case used in the Zoological Museum, at Cambridge, Mass., with some slight modifications; and having been furnished through the kindness of Professor Hagen, with a sample case as a pattern, we had but little further difficulty in this matter. To secure the specimens against injury during the transportation to so great a distance, we thought it necessary that the bottoms of the cases should be lined with cork of extra thickness, so that when the pins on which the specimens were mounted were thrust into it they should be held firmly in place. We accordingly ordered from a cork factory in Manchester, England, a sufficient supply for this purpose, of double the ordinary thickness, and when the drawers were lined with this cork, and the pins firmly inserted, it was almost impossible with any ordinary amount of jarring or shaking to displace them.

The work to be done on the Coleoptera was very laborious. This was kindly undertaken by Mr. Johnson Pettit, of Grimsby, and to his labours and kind contributions of material, we are indebted for much of the success of our enterprise. The writer undertook the work needed on the Lepidoptera; Mr. E. B. Reed devoted his attention to the Hemiptera and Diptera; Mr. Geddes, to the Hymenoptera; and Mr. J. M. Denton, to Orthoptera. By this division the labour was lightened, and the work progressed rapidly. The following collections in London were placed entirely at our disposal, viz:—Those of Messrs. W. Saunders, E. B. Reed, J. M. Denton, G. Geddes, H. B. Bock, W. E. Saunders, and J. Williams. Large stores of valuable specimens were forwarded by Mr. Pettit. Messrs. William Murray, and J. Moffatt, of Hamilton, sent some very handsome Lepidoptera, and Mr. H. Cowdry, of Toronto, contributed to the Coleoptera. Our members in Montreal were also very prompt and liberal in responding to our appeal. Mr. Wm. Couper donated a large number of specimens, while a great many additional were loaned by Messrs. F. B. Caulfield, C. W. and G. B. Pearson, H. H. Lyman, P. Keutzing, G. J. Bowles, W. Hibbins, J. T. Whiteaves, indeed without their help we should have been entirely without representatives of many species restricted to the eastern portions of our Dominion. Added to all these were the specimens already contained in our Society's cabinets in London.

In due time the collection was completed and ready for shipment. It consisted of eighty-six cases, twenty-seven of which were filled with Coleoptera, forty-five with Lepidoptera, three Hymenoptera, five Neuroptera, two Hemiptera, three Diptera, and one Orthoptera, and when spread out they presented a very fine appearance. To ensure correctness in naming, all doubtful specimens were as far as possible submitted to specialists. Our best thanks are due to Mr. A. R. Grote, of Buffalo, N. Y., who twice visited London for the purpose of examining and naming our Lepidoptera. To Dr. A. S. Packard, of Salem, Mass., we are indebted for naming some of our Geometers, and to Dr. Geo. H. Horn, of Philadelphia, for his abundant labours in naming our Coleoptera.

The cases were packed with cotton in suitable Cabinets and these enclosed in strong outer cases with elastic packing between the two and with these precautions the collection reached its destination in safety. Arrangements were made for the careful unpacking of the specimens on arrival, and their proper classification when displayed. Similar provisions have also been made for their re-packing and return. Our insects are displayed in the Canadian department in Agricultural Hall, on a suitable stand built for the purpose, seventy-six feet in length. The many encomiums bestowed on our collection by those best able to judge of its merits will warrant us in stating that our Society may justly take to itself the credit of having brought together by far the finest collection of Canadian insects ever seen. We trust that this magnificent collection will, on its return, be preserved as far as possible in its present state as a collection of reference for the convenience of our members who may desire to name their specimens and as an enduring memento of the interest taken by our Society in the great Centennial Exhibition.

On behalf of the Committee,

WM. SAUNDERS,
Chairman.

From among the many favourable notices of our collection which appeared in the American papers, we clip the following from *The Daily Graphic*, New York, Sept. 26, 1876 :—

AT THE CENTENNIAL.—*The Exhibit of the Entomological Society of Ontario, Canada.*—Every lover of nature, every admirer of beauty in form or colour who visits the Centennial Exposition can scarcely avoid being charmed with the display of Canadian insects, exhibited by the enterprising Entomological Society of the Province of Ontario. The collection is in the Canadian department in Agricultural Hall. It is arranged in eighty-six glazed cases laid in a double row upon a table over seventy-five feet in length. Forty-five of these cases are filled with butterflies and moths (Lepidoptera); twenty-seven with beetles (Coleoptera); and the remaining fourteen with insects of all other orders—viz. : Bees, wasps, hornets, and other stinging and piercing insects, cicadas and bugs (properly so-called), dragon flies, lace-winged flies, &c., grasshoppers, locusts, crickets, &c., the small two-winged flies, and many others. Many of the specimens are so large and so gorgeously coloured that they have the appearance of natives of some of the tropics rather than of the more northern Canada—a country which many are apt to imagine is a land of ice and snow. This display, combined with that of the Canadian Fruit-Growers' Association near by, ought to do much to instruct the general public in regard to the vast resources and the excellent climate of the great Dominion.

The collection must not, however, be regarded merely as a display of curious or beautiful objects; it possesses a very high scientific value as well. The practised student of entomology will there find thousands of species of insects, all correctly named both as regards genus and species, and all scientifically arranged according to the best system of classification. Although the critic may find fault with the particular system of nomenclature that has been adopted in some special families, he must confess that there is given an excellent illustration of the progress of scientific zoology in Canada, and of the energy and skill of the members of the Canadian Entomological Society in particular. This society was first organized in 1863, and had few members and exceedingly limited resources. For five years it continued to make good progress in a quiet way, the labours of its members being chiefly confined to the collection and determination of species and the publication of lists of Canadian insects. A great deal of good work was thus done, and the way was paved for other work of a more practical though not a more useful and scientific character. In August, 1868, the society issued the first number of the *Canadian Entomologist*, a small monthly publication, containing original papers on the classification, description, habits, and general history of insects. This serial has been received with much favour by the leading entomologists of America, most of whom have from time to time contributed to its pages. It has now reached the middle of its eighth volume, and has increased to three times its original dimensions ; it has also improved very mnch in style and typographical appearance, as well as in the excellence of its illustrations. The editor of the first five volumes was the Rev. C. J. S. Bethune, of Port Hope, who was succeeded by Mr. Wm. Saunders, of London, the present conductor of the journal. It is noteworthy, as an evidence of the persistent enterprise of the Canadians, that this is the only serial publication on insects in North America that has continued to exist for more than a few years ; it has succeeded in outliving several contemporaries started about the same time. In 1870 the society first began to receive a small pecuniary grant from the public funds of the Province of Ontario, in return for which it annually presents to the Legislature an illustrated report on insects, useful to agriculture, horticulture, and aboriculture. Five of these reports have thus far been issued, and have been widely distributed amongst the farmers, gardeners, and others of the Province. The information and instruction thus afforded have done much to educate the people of the country and to save their crops and fruits from the pestilent ravages of destructive insects.

The present officers of the society are as follows : President, William Saunders, London ; Vice-President, Rev. C. J. S. Bethune, Port Hope ; Secretary and Treasurer, J. H. McMechan, London ; Council—Wm. Couper, Montreal ; R. V. Rogers, Kingston ; J. Pettit, Grimsby ; J. M. Denton and E. B. Reed, London. The headquarters of the society with its library and cabinets, are at London. It has also flourishing branches in Montreal and Kingston.

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

In accordance with previous announcement, the members of the Entomological Club met on Tuesday, the 22nd of August, at 2.30 p.m., in the rooms of the Buffalo Society of Natural Sciences, Dr. LeConte in the chair. The following members were present :—Dr. John L. LeConte, Philadelphia, President ; S. H. Scudder, Cambridge, Massachusetts, Vice-President ; C. V. Riley, St. Louis, Mo., Secretary ; J. A. Lintner, Albany, N.Y. ; Dr. H. Hagen, Cambridge, Massachusetts ; Dr. John G. Morris, Baltimore, Md. ; B. P. Mann, Cambridge, Mass. ; W. Saunders, London, Ont. ; Rev. C. J. S. Bethune, Port Hope, Ont. ; E. B. Reed, London, Ont. ; A. R. Grote, M. M. Maycock, Dr. L. F. Harvey, Henry S. Sprague, O. Reinecke, W. W. Stewart, of Buffalo, and others.

PRESIDENT'S ADDRESS.

After calling the meeting to order, the President read the following address :—

In resuming the chair, which by your kind partiality I occupied at the last meeting of the club, permit me, after thanking you for the honour you have done me in thus calling me a second time to this position, to congratulate you on the evidence of increased interest felt in the branch of Zoology to which we give our attention.

This increased interest is shown not only by the larger attendance at the present meeting of Entomologists from distant residences, but by the increase of correspondence between those who collect and study insects. I have received during the year several applications from new correspondents for advice and assistance in the study of Coleopetra ; and my colleague, Dr. Horn, informs me that the same is the case with himself. Unfortunately I have been obliged to reply to some of the applicants with a temporary negative, as my time has been almost wholly taken up with efforts to complete my memoir on Rhynchophora, now in the course of publication by the American Philosophical Society. This memoir would have been finished some weeks ago, but the exceptional inclemency of the summer heat rendered all work with lenses difficult and uncertain. I think that I may promise that the MSS. will be complete in a few weeks. Meanwhile I am glad to say that the arrangement of my cabinet specimens is so far perfected that Dr. Horn or I will be willing to name any sets of Rhyncophora of the United States or Dominion of Canada, which are sent us, provided that the return of the specimens sent is not required. The subject has been such an extremely troublesome one, and there are still so many uniques in our cabinets, that they need filling up in order to give them that value for future reference which I hope they will possess, and it will also be desirable for the proper recognition of the new genera and species, many of which are very abundant, that specimens should be distributed to foreigners, who have studied this difficult group of objects.

The excellent volume of Dr. A. S. Packard, jr., "Monograph of the Geometrid Moths of the United States," forming Vol. X of the United States Geological Survey of the Territories, requires special mention among the contributions to Entomology since our last meeting. We owe the existence of this volume to Dr. F. V. Hayden, Geologist-in-Chief of the Survey, and I hope that a continued appreciation by the National Legislature of the importance of the work done and published by the survey, will ensure us many future volumes of similar merit.

The ordinary routine work of the description of new genera and species, is going on in the various orders of insects with about the usual degree of rapidity. But from every one comes the same complaint: Too many new forms to be described!

The observations on economic applications of Entomology for the protection of agriculture are also advancing in a most commendable mannner, considering that the public and their servants in office still fail to recognise the magnitude of the interests involved.

References to the memoirs contained in the volumes of reports, and to isolated papers in agricultural and other journals, will be found in *Psyche*, a periodical, which, though small, is indispensable to every one occupied in the study of the insects of North America.

I would gladly stop here, but a truthful instinct, a sense of duty to science, and my obligation to you alike forbid silence. I have to speak of a subject of a disagreeable nature.

It is concerning the efforts made by you and other members of the Association at the last meeting at Detroit, to procure the appointment of a Commission for the protection of agriculture against noxious insects; this Commission to be composed of properly informed men of science, and chosen under such circumstances as would prevent the influence of political bias, or personal favouritism. If I do not fatigue your memory too much, you will recollect the memorials that were so extensively signed in relation to this subject, copies of which memorials are again before you. These memorials were extensively circulated at the West, and were signed by many of the most influential bodies for the promotion and protection of agriculture in that region. During the winter these memorials were sent to Congress, in the expectation that some proper legislation would follow. One of the Senators, in fact, introduced a bill which seems to have been very carefully considered, and indeed bears upon its face some evidence of scientific guidance. This bill provided for the appointment of three Commissioners for five years, the Commissioners to be nominated by the Council of the National Academy of Science to the Secretary of the Interior. This bill, having been referred to the Committee on Agriculture, was returned, completely orchidized, in such form as to provide for one Commissioner, to be appointed by the Department of Agriculture, the very enemy and incubus from which the western agriculturists specially desired to be relieved.

The bill in this form passed the Senate, several of the members taking occasion in the discussion which preceded the passage to talk to the demonstration of their own ignorance of the subject. However, this discussion has been already so severely commented upon in several of the newspapers of the Mississippi Valley, that it is quite unnecessary for me to add anything farther, except the hope that the Legislature which choose the successors of those Senators will have men of better education and higher intelligence offered to them as candidates for the position.

I regret to have been obliged to introduce this unpleasant subject, about which I feel a warmth and severity, unsuited to the position in which you have placed me. I must therefore close by begging you, in your respective localities, to continue aiding me in my endeavour to cause the Government authorities to give proper attention to this most important subject.

The minutes of the last meeting held in Detroit were read by the Secretary, C. V. Riley, and approved.

The consideration of reports of committees was postponed, owing to the non-arrival of some of the members.

Mr. Riley made some remarks upon the variation in the venation of the wings of *Anisopteryx pometaria* (or *A. autumnata*), and exhibited mounted preparations of wings of this insect differing greatly from the figures in Dr. Packard's new work.

Mr. Grote considered the variation of neuration in the Geometridæ as of no great value as a specific distinction.

Mr. Riley said that he had scarcely ever raised a large number of forms from the egg without finding that in the imago state there appeared to be more than one so-called species. Whenever he used large quantities of material he found this result. He thought, therefore, that writers when describing species should always state the number of specimens they had before them.

Dr. Hagen then read a valuable paper "On Genera," at the conclusion of which he was warmly applauded.

On motion of Mr. Grote, the Report of the Committee on Nomenclature was then taken up, when Mr. Riley read a majority report of the committee.

Mr. Scudder did not approve of the course taken in reference to the rules on nomenclature which had been presented, and thought that members of the committee had exceeded their instructions, and desired that the resolution passed at the last meeting, appointing the committee and defining its duties, be read. He thought that the opinions of leading naturalists on this subject should have been gathered and compared.

The resolution giving instructions to the committee was read as follows: "That the Club appoint a committee of five to prepare and present to the Club at its next annual meeting a compendium of the views of the leading Entomologists of the country upon points which, in their judgment, require elucidation, and also to present a series of resolutions touching such points, in order that intelligent discussion may be had upon them and some general agreement, if possible, arrived at."

Mr. Riley urged as reasons why a majority report had been presented, the difficulty of getting the members of the committee together, and the urgent necessity that some action should be taken in the matter without further delay.

Mr. Saunders supported these views, and urged that the opinions of many of the leading Entomologists on the subject of nomenclature had been given in the pages of the *Canadian Entomologist* during the past year, while others had expressed their views by letter to members of the committee; and seeing that there had been no opportunity for the committee to meet together as a whole, he thought it desirable that these resolutions, which had been endorsed by a majority, should be presented as a guide to the discussions which might take place on the subject.

Mr. Scudder did not think this a proper time or place for the introduction of such rules; he fully agreed, however, that it was very desirable to establish stability in nomenclature.

Mr. Mann regarded Mr. Scudder's remarks as a motion to set aside these rules, and as such was prepared to support it.

Dr. Hagen, in a few words, gave a sketch of the history of nomenclature, showing how tidal waves of new names had been poured from time to time on the Entomological world with the greatest zeal on the part of those who had introduced them; that in many instances these changes were unnecessary, and produced confusion instead of establishing order. He thought it highly necessary that some understanding should be arrived at among Entomologists which would lead to greater stability in nomenclature.

Mr. E. B. Reed spoke for those who had comparatively little time to devote to Entomology, and thought that they were a class who should be considered, and that while it was, perhaps, no great task for those who devoted their whole time to Entomological studies to master the great number of new generic and specific names from time to time introduced, it was imposing a burden on their less fortunate brethren which was grievous to be borne—which was, in fact, more than they could bear, and tended to discourage many and deter others from entering on the study of Entomology. He urged that it was from among the ranks of these beginners that some of the future leaders of Entomological science would be drawn, and it was well to consider what effect these discouraging circumstances would have on the present and future progress of the study.

After some further discussion, the resolutions were referred back to the Committee to report on to-morrow. Meanwhile, they were ordered to be printed for the members, so that discussion could be had upon them.

Evening Session.

At 7.30 the meeting was again called to order, the President in the chair.

Mr. Riley offered some remarks on a parasite, a mite which attacked the Colorado Potato Beetle. This insect (of which mounted specimens for microscopic examination were submitted) is furnished with a strange and extraordinary development of what he supposed were the maxillæ, by which it was able to attach itself to the Doryphora, and at the same time extract nourishment as well. He thought it was an organ somewhat similar in character to the extensile maxillæ of the larvæ of Dragon Flies.

Mr. Scudder thought that since they appeared to him to be jointed, they must be a palpus of some sort.

Dr. LeConte, after further examination, was of opinion that they were not jointed.

Mr. Scudder then read an interesting paper on "Mimicry in Butterflies explained by Natural Selection," quoting largely from a recent contribution by Fritz Muller on this subject, in which he gives the results of observations made by him on butterflies in Southern Brazil. This paper will appear in *Psyche*, the organ of the Cambridge Entomological Club.

Mr. Riley gave the result of some observations on the eggs of *Corydalis cornutus*, from which it would appear that the mass of eggs hitherto regarded as belonging to this species are probably those of a *Belostoma*. He had found in one day, thirty or forty patches of eggs, which he believed to be those of *Corydalis cornulus*, on the leaves of trees whose branches overhung the water. These flat patches were very strangely arranged, and contained an immense number of eggs, often numbering between three and four thousand in a patch. The eggs are at first translucent, but become darker as they approach maturity, when the young larvæ break through the eggs beneath.

Dr. Morris doubted whether these really were the eggs of the *C. cornutus*, and questioned whether the larva was aquatic at all.

Dr. Hagen thought that there was something strange in reference to these insects. Mr. Riley had kindly sent him a large number of eggs, but when hatched he had failed in every attempt to keep the young larvæ alive. Since they are furnished with both branchia and stigmata, he thought they must be regarded as water insects.

Mr. Lintner had found the larvæ under stones, but when they enter the chrysalis state they make their way into the water, and in this condition they are often captured in large numbers and used as fish bait.

Mr. Riley said that the larvæ in Missouri are frequently found in water, and he had no doubt but that the eggs he had referred to were those of *Corydalis cornutus*.

Mr. Scudder stated that Mr. Sanborn had frequently taken large numbers of the larvæ in the water in the neighbourhood of Cambridge.

Mr. Saunders had never found them in the water, but had frequently captured them buried in moist sand or under stones along the banks of rivers.

Mr. Riley next exhibited to the Club some silken masses containing eggs of *Hydrophilus triangularis*, which were very remarkable and interesting.

Mr. Saunders offered some remarks on a mass of pupæ and escaping insects of *Calopteron reticulatum*, which he found one morning early in summer at the roots of some long grass. The mass was fully as large as a hen's egg, and must have contained some hundreds of individuals. A large number of the freshly escaped insects were captured, with a view to ascertain whether there was much variation in the markings, and whether the form *terminalis*, which is said to be a variety of *reticulatum*, could be found among them. He saw none approaching this latter form—all were well-marked specimens of *reticulatum*.

Dr. LeConte mentioned the curious fact that in some species of *Calopteron* the larval skin was not shed when it pupated, but that the larva skin and pupa skin both remained *in situ* until the perfect insect escaped.

Dr. Morris then made some interesting remarks on the mouth parts of the woodpeckers.

Mr. Riley exhibited specimens of blown larvæ very nicely set up; he thinks, however, that in this condition they are scarcely of value for scientific study, and for this purpose prefers the specimens preserved in alcohol.

Mr. Scudder differed from Mr. Riley, and thinks that the advantages are in favour of the blown specimens, and much prefers to study larvæ in this way.

Dr. Hagen agreed with Mr. Scudder that blown larvæ were advantageous for study.

Dr. Morris asked if any of the gentlemen present who were in the habit of raising larvæ, had made any observations in reference to the length of time the development of the perfect insect may be retarded. He stated that three or four years since he had placed a number of cocoons of *S. cynthia* on a shelf in his house, and that after lying there all that time some of them had this year produced the perfect insect.

Dr. Hagen referred to an instance related by Kirby & Spence where a beetle, *Buprestis splendida*, was ascertained to have existed in the wood of a pine table more than twenty years (7th edition, p. 121).

Mr. Saunders mentioned the fact that the perfect insect of *Œcanthus niveus* frequently came to sugar at night, when they were readily captured. He thought that where they were very numerous this method of trapping them might be employed with advantage.

Mr. Lintner observed that he had take 16 species of *Catocala* at sugar this season, and that a friend of his who has been sugaring industriously has found the *Catocalas* to be most abundant about midnight.

On the 24th another meeting of the Club was held at 2 p. m., the President in the Chair.

The Committee on Nomenclature, consisting of Dr. LeConte, S. H. Scudder, A. R. Grote, C. V. Riley and W. Saunders, reported a set of rules, on some of which they were unanimous, while on others there was a divided opinion. They had given all the attention to the subject possible within the limited time at their disposal, but had not found time to consider the explanations offered in the majority report presented, and suggested that these be referred back to the Committee, with power to print such explanations as may be agreed on with the rules.

The following are the rules submitted :—

1. The binominal system, as originated by Linnæus, is the only one to be recognised. The use of a third word, however, connected with the second by a hyphen, as is common and desirable in the case of gall insects, *e.g. Cynips quercus-palustris*, is not to be considered as an infraction of this rule. (Unanimous.)

2. Where a specific name has been generally adopted during a period of twenty years, such name shall not be changed for one of prior date. (Divided opinion.)

3. The name placed after a genus should be that of the author who established the genus in the sense in which it is actually used, but the name of the author who first proposed the term should be cited in brackets. (Unanimous.)

4. No generic or specific name should be acknowledged which has not been printed in a published work. (Unanimous.)

5. A generic name, when once established, should never be cancelled in any subsequent subdivision of the group, but retained in a restricted sense for one of the constituent portions of the original genus. (Unanimous.)

6. In constructing family names they should end in *idæ*. (Divided opinion.)

7. The tribe should occupy an intermediate place between the sub-family and genus. (Unanimous.)

8. The authority for the species and not for the generic combination should follow the name of an insect. (Divided opinion.)

9. The proposition of a genus by simple designation of a type is to be greatly deprecated. All new names should be accompanied by ample definitions that will permit no doubt as to the species intended or as to the characters of the genus proposed. (Unanimous.)

10. No description should be made from a figure. (Unanimous.)

11. The number of individuals upon which either a specific or generic diagnosis is based should always be stated. (Unanimous.)

After a lengthy discussion, on motion of Mr. E. B. Reed, the following resolution was unanimously passed:

That the report of the committee be adopted, and that any rules on which this committee have expressed a divided opinion have a marginal note attached thereto, reciting such fact.

It was also resolved that all the explanations, &c., offered in the majority report be referred back to the committee with power to print such explanations as may be agreed on, with the rules.

Moved by Rev. C. J. S. Bethune, seconded by S. H. Scudder—That no alteration or addition to the rules now adopted be made, unless such alteration or addition be proposed at one annual meeting of the Club, and be adopted at a subsequent annual meeting. Carried unanimously.

The election of offcers for the ensuing year then took place, resulting as follows:—President, Dr. LeConte; Vice-President, S. H. Scudder; Secretary, C. V. Riley.

Mr. Scudder brought to the notice of the members a pattern insect box, which he believed to be pest-proof. These boxes are exceedingly well made (manufacturers, Hancock & Greeley, Cambridgeport, Mass.), are about 19 x 15 in., and are sold at $2.70 each, without cork.

Mr. Saunders suggested the desirability of the Club appointing a permanent committee to whom disputed points in reference to Entomological matters might be referred. On motion of Mr. Mann, seconded by Mr. Saunders, it was resolved that the Permanent Committee of the Club shall consist of the President, as chairman, and four other members to be named by him.

Mr. Lintner presented to the meeting a very complete and extensive list of insects taken at sugar by him during the present season. These were arranged in a tabular form in a very neat and methodical manner, showing at a glance the insects taken each evening, and whether they were abundant or scarce.

On motion of Mr. Riley, Dr. Larkin was requested to bring before the Club some facts in reference to a mite said to be parasitic on the human subject, when he read a very amusing letter from an afflicted patient in reference to this matter. The Club then adjourned.

ON GENERA.

By Dr. H. Hagen, Cambridge, Mass.

(Read before the Entomological Club of the A. A. A. S., at Buffalo, N. Y.)

There will hardly be a naturalist who has not spent considerable time to study the questions:—What is a genus, and what are generic characters? Indeed, work is nearly impossible without having taken a position with regard to these questions. A full record of the literature, even the most condensed one, would be here out of place, but I have been induced by a recent and most surprising discovery bearing upon this question to make this communication. I have been speaking here only about *natural* genera. The consideration of the genus as an artificial division differs fundamentally, and to avoid mistake we should not call artificial divisions by this name. The characters of artificial genera depend solely upon the taste of the worker and the convenience of separating into groups animals and plants. All species are considered to belong to the same natural genus which agree in structural characters, external and internal, or anatomical ones in the different stages, in transformation, in the manner of living. These definitions of a genus are accepted as well by naturalists who are strong Darwinians as those who oppose the development theory. In a prize essay of the Jena University, D. P. Mayer, a pupil of Prof. Haeckel, in a paper on the "Ontogeny and Phylogeny of Insects," enlarges this definition in so far as he asks for a conformity in the embryological characters. I believe no one will object that this definition is a good and exhaustive one; but if we attempt to use it in a special case we become bewildered by the astonishing amount of characters unknown to us, and the impossibility to make them out for our work. At present we know hardly well enough the external character of the imago. Of other characters our knowledge is merely fragmentary and often a *tabula rasa.* We may say that a century of hard work will not fill these gaps in our knowledge. It is obvious that we cannot wait till this enormous amount of work is done. And it is certain that naturalists will not and can not stop creating new genera.

Genera created with such a limited amount of knowledge will depend upon the experience and taste of the worker. Many of such genera will have to be modified or dropped by a farther advancing knowledge,

The most important question (what are generic characters?) is still unanswered.

The large literature and the difference of opinion emitted by prominent authorities seem to prove that a sufficient affirmative answer is impossible till our knowledge is further advanced. But here, as in other abstract questions, we can proceed in a negative manner by exclusion.

Genera consist of a number of related species. If we knew the character of the species, the specific character, we can by exclusion come nearer the character of the genus. Species differ by structural character, and as the species form the lowest degree of the classification, we can be sure that species must differ at least by minutest points of structure.

I think there is no objection of consequence possible. I know very well that differences in minuter points of structure have been considered as generic characters. But naturalists beginning with the construction and definition of the higher degrees of class, order, family, &c., used up all characters at hand, till, coming to genera, nothing was left but minute differences of structure; the simple consequence of using specific characters for generic ones was that nearly every species was considered to be a genus.

I said before that species must differ at least by minuter points of structure. The discovery which I mentioned before proves that structural characters of species are more important, and can by a different manner of living be changed in such a way as to represent forms which were formerly believed to belong to different genera. *Branchipus* and *Artemia,* belonging to the Phyllopod Crustacea, are represented by several species here and in Europe. The two genera are nearly related one to the other, and differ principally in the following points: *Artemia* has eight post-abdominal segments, the last one very long. *Branchipus* has nine post-abdominal segments, the last two of equal size. *Artemia* has three articulated claspers in the male; *Branchipus* two articulated claspers. *Artemia* is often propagated by Parthenogenesis, *Branchipus* never.

Nobody will deny that those characters of structure go very far beyond minuter points of structure, and are marked well enough to justify the separation sixty years ago by Dr. Leach. Now it is proved that not only the species of *Artemia* known up to-day from Europe, Asia and Africa, but even some species of *Branchipus* belong to one and the same genus and species. In the American fauna five species of *Artemia* and three of *Branchipus* are described; of course they will have to be studied again in a similar manner as the European ones. The two European species of *Artemia* are remarkably different. *Artemia salina* has a strongly bifid tail surrounded by 15 to 20 bristles and narrow gills; *Artemia mulhauseni* has a rounded tail without bristles and very large gills. This latter species lives in pools of a very concentrated salt water of 25° Beaumé; the other species in common salt water of about 8°. In 1871, a dam which surrounded a salt pool containing *Artemia mulhauseni*, broke down by accident, and the sea water washed in at the same time; *Ar-*

temia salina, which abounds in the sea water, appeared in large numbers in the pool. The dam was immediately repaired, and in the space of three years the amount of the salt in the pool arrived gradually at the same concentration as before.

A Russian naturalist, Mr. Schmaukevitch, living near the spot and studying carefully *Artemia*, was astonished to find the species somewhat changed in every following generation, till in three years the *Artemia salina* was changed entirely into *mulhauseni*. The fact was so extraordinary that he decided to confirm it by a more conclusive proof. He raised at home in open glass dishes *Artemia salina*, and by successive additions of salt to the water, he was able to transform the species into *Artemia mulhauseni*. To make the counter proof, he diluted the water gradually and the species returned to the form of *Artemia salina*. But by continued dilution of the water he was more surprised to find that in the third generation the long abdominal segment began to be separated into two segments, and finally to be changed as in a *Branchipus*. He found later in salt pools of only four to five degrees (living together) *Artemia salina* and *Branchipus spinosa*, and in water with a lower degree of salt two other related species, *Branchipus ferox* and *media*.

Mr. Schmaukevitch has made similar experiments with similar results on *Daphnia*, *Cyclops*, and *Canthocamptus*, which he has not yet published. There can be no doubt about the facts under such conclusive proof, and Prof. V. Siebold is now engaged in raising the American species from Salt Lake for similar experiments. These facts oblige us to consider all these different forms as belonging to one and the same species, since it is possible to change at will one form into another by altering the conditions of living. As long as this is possible they cannot be considered as differentiating or Darwinian species. We have now the proof that specific characters exist which do not depend on minuter points of structure. Therefore, we are taught that we must considerably enlarge the characters of species and those of the genus.

What has been thus proven in Crustacea will certainly be observed also with other Articulates. Since insects do not possess a post-abdomen, there cannot occur the same differences as in the case cited, but analogous ones will not be wanting. It is obvious that so-called "salt insects" are the first ones which will need new and careful study. Those known areColeoptera, Diptera, Hemipteraand Orthoptera, and the species are often nearly related to other ones which do not live in salt regions. Further, it is evident that similar changes will be the result of different conditions of life. So-called "local varieties" are certainly nothing else, and a vast field of observation and study is opened by the remarkable discoveries of Mr. Schmaukevitch. I believe that we are now justified when we exclude from generic characters all the following ones :

1. Every character based on the number of parts, when the number ceases to be a small one ; the more so when it varies in related species. If a number is larger than about a dozen, we can never rely upon the constancy of the number in antennal joints and anal appendages. In spines, bristles, spurs, a much smaller number is constant ; transversal veins of the wings belong to the same category.

2. The external coating of the body, consisting in hairs, scales and other appendages, is not a generic character. The hairs, tufts, brushes, spines, spurs, are often only sexual and can not be considered generic characters ; also, hairy eyes, since we find this character changing in the most related species and probably in the same species in Diptera.

3. The presence or want of the ocelli or eyes is not a generic character.

4. The veins of the wings give only to a certain degree generic characters, viz : the principal branches, but certainly not after the bifurcation.

Having arriving so far by exclusion, it is important to state what is left for generic characters.

So far as I am advanced in the study of generic characters, I think the following should be used :

1. The form and relation of the three principal parts of the body.
2. The organs providing nutrition (mouth parts).
3. The organs making possible the working of the mouth parts, *i. e.*, the organs of locomotion.

The anatomical characters may be of prominent help. At present our knowledge as to their details is too limited to admit our using them to a profitable extent. We begin to be better acquainted with the previous stages, and this acquaintance will bring these characters into more prominence. I doubt embryological characters to be of generic value. But very little is certainly known about them, and nothing known is ready for our use. The parts serving for propagation have probably a higher value than generic characters. Characters for genera should be of a co-ordinate value. I think it is obvious that a genus should never be accepted if its characters are not satisfactorily given, and that genera based on the mere specification of a type should never be accepted.

INSECTS INTRODUCED BY THE CENTENNIAL EXHIBITION.

During the progress of the Centennial Exhibition, it was observed that many of the cereals and seeds exhibited were infested with insects, some samples being almost destroyed by these pests. At the suggestion of the Centennial Commission, a committee of scientific gentlemen was appointed to investigate this matter and report as early as practicable on the character of the insects thus introduued. This committee was also charged with the further work of reporting on any new plants or weeds which might be similarly brought into the country. A report on the plants could not be prepared until next year, but as the subject of injurious insects was a highly important one, it was deemed wise to report on that as soon as possible, hence all the information obtainable on the subject up to the time of the close of the Exhibition was submitted in the following report, read by Dr. LeConte, chairman of the committee, at a meeting of the Academy of Natural Sciences in Philadelphia, held early in November :—

REPORT ON INSECTS INTRODUCED BY MEANS OF THE INTERNATIONAL EXHIBITION.

On behalf of the Committee appointed by the Academy of Natural Sciences of Philadelphia, at the meeting held October 10th, 1876, "to investigate and report upon the introduction of new species of insects and plants through the medium of foreign exhibits at the Centennial Exhibition," I have the honour to present the following report, with the desire that it may be forwarded to the proper authorities of the Centennial Commission, at whose instance the Committee was appointed.

The Committee is composed of the following members of the Academy :—

Dr. Joseph Leidy, Dr. George H. Horn, Mr. Thomas Meehan, Dr. J. Gibbons Hunt, and Dr. John L. Le Conte, Chairman.

It was apparent that while the labours of the botanists of the Committee could not properly commence until next spring, when careful observation will recognise any new introductions of plants, the entomological investigations should be made as speedily as possible. Accordingly, Dr. Horn and myself, availing ourselves of the admission cards which had, with great liberality, been sent to the members of the Committee, went frequently to the exhibits in the Main Building and Agricultural Hall, and made collections in all the agricultural products from foreign countries, which were found to be infected.

Most of the species which we obtained have been already distributed over the globe by the ordinary channels of trade, and nothing is to be apprehended from the addition of a few hundred thousand specimens, to the incalculable millions of individuals of the same kind, that we have now domiciled amongst us.

I am happy to add that the species found, which have not been previously observed in the United States, will be innocuous ; they are dependant for their support upon plants which do not grow here, and which would be of no commercial value to us if they were cultivated.

I may therefore announce, with moderate certainty, that no evil result will occur to our agricultural interests from any introduction of foreign insects by means of the Centennial exhibits.

Before concluding this report, by a list of the insects collected in the buildings, it is our duty to notice some remarkable differences between the exhibits from different countries, indicating the care with which the specimens had been prepared, and the means taken to prevent depredations by insects.

All those exhibits which had been moist when packed, or had become moist or mouldy on the voyage or during the Exhibition, abounded in *Bruchus*, *Calandra*, and *Tineidæ*; while those which were protected against moisture were unattacked. It stands to reason, in fact, that insects dependent on a circulating fluid for their vitality, and having, during their early stages as larvæ, a very soft and moist body, cannot obtain in properly dried grains the requisite amount of moisture for their sustenance, and the egg, if previously deposited, will remain, like an ungerminating seed, for a favourable moment to develop, or if hatched, the larva will die at an early stage.

It was, therefore, with great pleasure that we recognised the appreciation of this almost self-evident proposition by the Department of Agriculture of Portugal. The exhibits in bottles were entirely free from all mould and infection, and in each bottle was a small quantity of caustic lime,* wrapped in paper, which, by its hygrometric power, had kept the specimens perfectly dry.

We do not intend to have it inferred, from what is above stated, that all the other exhibits were in a condition inferior to that of Portugal; on the contrary, many of them, as well as many from our own States, were in most admirable order; but, so far as we could learn, this good condition had been produced by great personal care, and the removal from time to time of the infected parts; not by the use of a preventive agent.

While investigating the occurrence of a small species of *Tineidæ* in the Italian exhibit of Leghorn straw, I learned that some importations of straw goods, by Messrs. Albinola & Bailey, of New York, had been attacked by insects. I immediately wrote to those gentlemen, who, with great courtesy, sent me two collections of the insects, infesting a recent importation which had become mouldy from being packed in a moist condition. The names of the species contained in this set are appended; they are all either carnivorous or fungivorous, and can therefore do no harm; some of them have not been before observed in the United States, or their habits have not been noted. What is more important, however, is that none of the straw goods were attacked by moths either on this or previous occasions. It is therefore to be inferred that the moth in the Italian exhibit was the grain-moth of the seed of the grass which produced the straw used in the manufacture of the Italian goods. What confirms this inference is that the moths occurred in but one case, in which were exhibited several bunches of the straw with the heads of grain still remaining.

Prof. C. V. Riley, in the Proceedings of the Academy of Science of St. Louis, Oct. 2, 1876, has given a list of the species which he collected at the Centennial Exhibition, with very useful and suggestive remarks. We have obtained specimens of all the species mentioned by him except one, Crambide Lepidopteron, from the Egyptian exhibit, for which we sought without success. At an earlier period in the season, and with smaller attendance of visitors, the number of species in our list would perhaps have been larger, but no additional advantage would have been obtained therefrom. The species, with the few exceptions noted, are either innocuous or previously introduced.

J. L. LeConte, *Chairman*,
Geo. H. Horn,
Joseph Leidy.

---

* The nature of the powder was suspected by the Committee, but the determination was made through the analysis of Mr. Edward Goldsmith.

List of Species Collected in the Centennial Buildings in Foreign Exhibits.

COLEOPTERA.

Silvanus surinamensis.

Argentine Confederation and Brazil, in various materials.

Læmophlœus ferrugineus.

In beans, Brazil. These two species lived upon the debris of *Bruchus*, and were accompanied by a species of *Psocus*.

Bruchus picturatus, *Fahræus.*

Argentine Confederation; in seeds of two leguminous plants, one of which produces a screw bean, resembling *Strombocarpus* of Arizona.

Bruchus, *sp.*

Allied to *B. prosopis*, of Arizona and New Mexico. Argentine Confederation; also in the screw bean. These two *Bruchi* are depredated upon by three small species of Ichneumonidæ.

Bruchus, *sp.*

Of larger size and more uniform colour. Argentine Confederation, in the seeds of another leguminous plant, allied to *Prosopis.*

Bruchus, *sp.*

Of larger size and more mottled colour; in the seeds of three other leguminous plants of the Argentine Confederation.

Bruchus scutellaris.

Venezuela, in beans.

Bruchus obsoletus.

In beans from various countries of both continents.

Bruchus pisi.

In peas; Spain and Portugal.

Bruchus, *sp.*

A small broad species, with traverse prothorax; male rather uniformly clothed with grey-brown pubescence; antennæ as long as the body; female black, with a grayish-brown broad dorsal stripe on the prothorax, and a small transverse white band on each elytron, extending from the side margin nearly to the suture, a little in front of the middle; thighs not toothed. Length ·09 inch.

Brazil, in a bluish-gray variety of bean. I cannot identify this species among those described in Schönherr's work; it is of the same form, and belongs to the same division as *B. pisi*, but is much smaller, and quite different in other characters. It is the only one of the species here mentioned which is capable of being introduced; and I have, therefore, given such a description as will enable it to be recognised. The antennæ are only feebly serrate. This species is mentioned by Mr. Riley as *B. granarius*, but it does not agree with the figure of Olivier.

Rhizopertha pusilla.

Victoria, Australia; in wheat. This insect has been previously introduced into the United States in Persian wheat, distributed by the Patent office. (*Vide* Lec. Class, Col. N. Am. p. 208.)

Calandra oryzæ.

This destructive insect abounded in exhibits of corn (maize), wheat, and rice from every part of the globe. I also observed it in arrow-root from Brazil.

ARÆOCERUS COFFEÆ.

Eating the thin shell of cacao-nuts from Brazil, but apparently not attacking the interior of the nut. Previously introduced both in the Atlantic and Pacific States.

LEPIDOPTERA.

The ordinary and well-known *Tineidæ*, which affect wheat and corn (maize) (*Butalis cerealella*, *Ephestia Zeæ*), abounded in exhibits from various countries. There was a smaller form which is mentioned above, as coming from the grass seeds of the Leghorn straw. Specimens have been identified by Professor C. V. Riley as the common grain moth, *B. cerealella.*

HYMENOPTERA.

Besides the three *Ichneumonida* parasitic on the *Bruchi* in the Argentine Confederation exhibit, I observed a small species of *Pteromalus* parasitic on the *Tinea*, *Bruchus obsoletus*, or *Calandra oryzæ* which infested a small bag of Brazilian wheat.

List of the Species Found in Mouldy Specimens of Straw Goods from Italy.

These species were collected by Messrs. Albinola & Bailey, in New York. They are either carnivorous or fungivorous ; those of the latter kind live upon the mould, which, as determined by Dr. J. G. Hunt, is a species of *Aspergillus*, previously known in this country.

LATHRIDIUS FILIFORMIS.

LATHRIDIUS STRIATUS.

CORTICARIA, *sp.*

(Not identified.)

HOLOPARAMECUS SINGULARIS.

Has not been previously observed in the United States.

SILVANUS SURINAMENSIS.

SILVANUS ADVENA.

LÆMOPHLŒUS FERRUGINEUS.

MURMIDIUS OVALIS.

Habits not previously observed in the United States, though its occurrence was known.

TRIBOLIUM FERRUGINEUM.

ON BLISTERING BEETLES.

BY W. SAUNDERS, LONDON, ONTARIO.

Probably there are few of our readers who are not practically acquainted with the powerful blistering qualities of the imported Cantharides, or as the insect is more commonly, although incorrectly designated, the Spanish Fly. It belongs to the order of Coleoptera (Beetles), and hence should be known as the Spanish Beetle. The use of this insect, in the practice of medicine, dates from a very early period, and it is one of the few remedies, the usefulness of which, within certain limits, neither time nor fashion has been able to set aside. That species of Cantharides known as the Spanish Beetle is not the only one in use. In China and India, allied insects, very different in colour, but similar in properties, have long been used for like purposes ; and these Asiatic insects are now found in our drug markets, and having proved equally efficient with the well-known European variety, are gradually growing in favour.

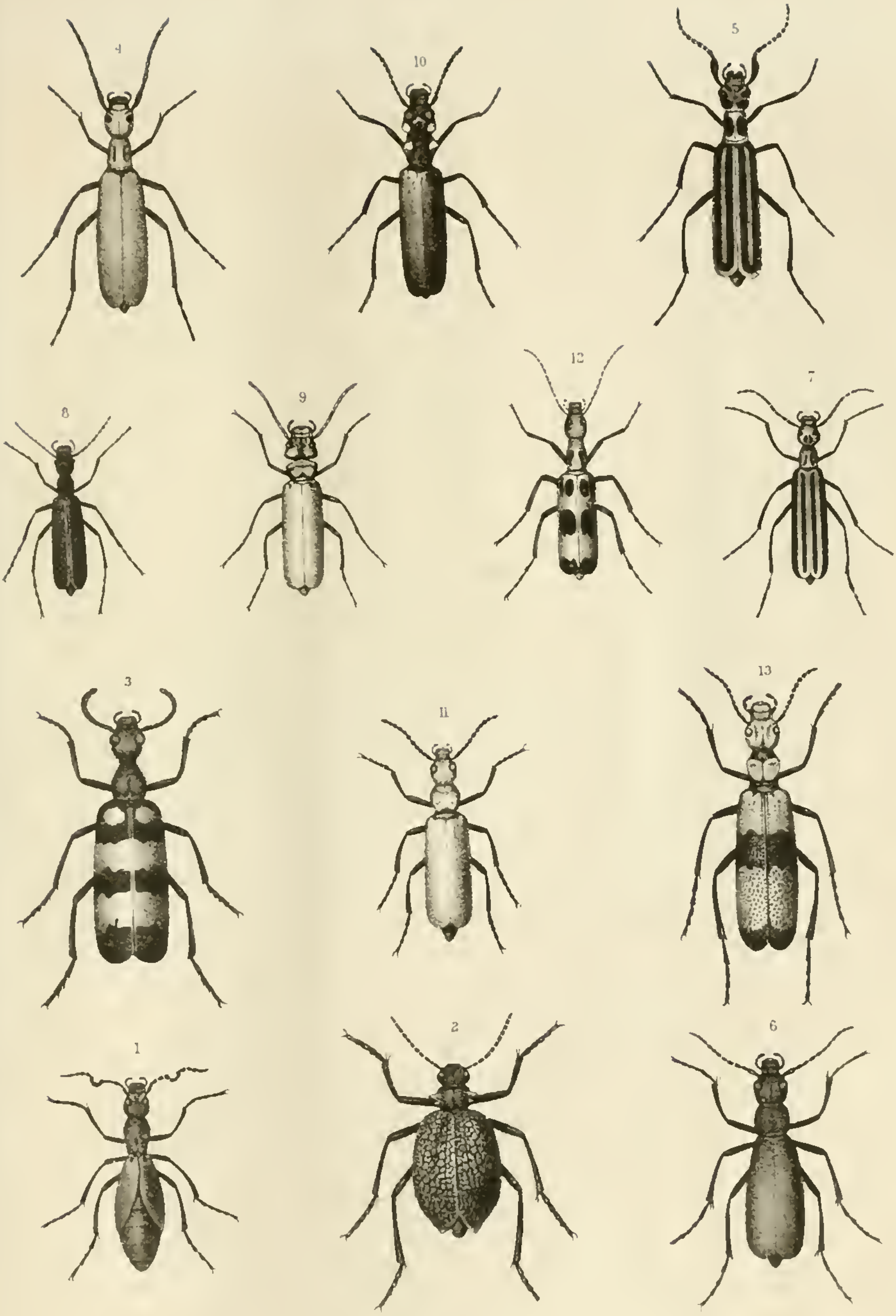
It is not so well or so generally known that we have in America, and even in Canada, several species of Cantharides, as well as some other closely allied blistering insects, which might at any time be used as substitutes for the Spanish Beetle (*Cantharis vesicatoria*).

One of our commonest species is that known as "the Striped Blister Beetle" (*Epicauta vittata*), see fig 7 in plate, which is very destructive in some seasons to the potato vines, and also attacks the leaves of beets, devouring them most voraciously. At times, these insects are found in such numbers, that they are very injurious to the crops they infest. In some of the Western States, this species has occasionally committed havoc on the potato vines as great and as terrible as that of the now well-known Colorado Potato Beetle. The circumstances attending their propagation and growth, as we shall hereafter show, are, however, of such an exceptional character, that a year of abundance is almost sure to be followed in the same locality by one of unusual scarcity.

The Ash Grey Blister Beetle (*Epicauta cinerea*), is another species very common in many parts of Canada. We have been informed that in the Great Manitoulin Island, this species, as well as the preceding one, is usually found in considerable abundance. The body is of an ash grey colour, occasioned by its being thickly clothed with short ash-coloured hairs or down, which, when handled, comes off like the bloom of a plum, and leaves the insect black. This variety attacks not only the potato leaves, but also English or Windsor Beans, and according to Mr. Riley, the foliage of the apple tree sometimes suffers from its depredations.

The Black Blister Beetle (*Epicauta atrata*) is also common with us; it is usually found during the month of August, on the leaves and blossoms of the common Golden Rod (*Solidago*). When approached or disturbed, they quickly quit their hold on the plant and drop to the ground.

These northern species are smaller in size than the European insect, a feature which would add to the cost of collecting them. Another bar to their successful introduction has been found in their colour. By a strange misconception, the presence of the brilliant green particles in the wing-cases, in the powdered Cantharides, has been associated with their activity, and any sample of powder or of prepared blistering-plaster where these brilliant particles are wanting, would, by many, be at once condemned. The Chinese Beetle (*Mylabris cichorii*), recently introduced, has done much to remove the latter objection ; yet, notwithstanding, it has been shown that the Chinese insect is fully as powerful in its action as that from Europe, the relative market value of the insects belonging to these two species indicates that popular prejudice still favours the use of the Spanish Beetle.



1. Meloe angusticollis Say.
2. Cysteodemus armatus Lec.
3. Mylabris cichorii Linn.
4. Macrobasis albida Say.
5. Macrobasis atrivittata Lec.
6. " " segmentata Say.
7. Epicauta vittata Fab.
8. " " cinerea Forst.
13. Tegrodera erosa Lec.
9. Cantharis vesicatoria Linn.
10. " " vulnerata Lec.
11. " " nuttalli Say.
12. Pyrota mylabrina Chev.

In the western and southern portions of our continent we have species which are large as well as abundant, and which, there is every reason to believe, possess all the activity needed, most of them probably would be found in every respect as valuable as the imported beetles. Some of the species about to be referred to have not yet been recorded as occuring within the limits of the Dominion of Canada, but when the insect fauna of the rich plains of the west shall have been carefully collected, doubtless some of these or others equally large and useful, will be found on our own side of the line ; in the meantime, we give the localities where they are at present known to occur.

Through the kindness of Dr. George H. Horn, of Philadelphia, whose extensive contributions to our knowledge of American Coleoptera have made his name familiar both in Europe and America, we have been supplied with much information in reference to the species here treated of ; an acknowledgment is also due to Prof. C. V. Riley, State Entomologist of Missouri, for some valuable notes on the habits of these insects. We have had a lithographic plate prepared by Messrs. Sinclair & Sons, of Philadelphia, under the kind supervision of Dr. Horn, in which each of the species referred to is figured of the natural size, excepting 7 and 8, which are somewhat enlarged. This plate is remarkably well executed, and is probably one of the best plates of Coleoptera ever published ; besides the American species, it contains figures of *M. cichorii* and *C. vesicatoria*.

We shall first enumerate the species, giving brief descriptions, as plain and void of technicalities as possible.

1. *Meloe angusticollis*—Say.—This insect (see fig. 1 on plate) is of a dark bluish violaceous colour, with the head, thorax and wing-cases thickly punctured with minute dots or impressions. The thorax is slender, narrower than the head ; feet slightly hairy, with the spines of the legs reddish. Found in the Eastern States and in many parts of Canada.

2. *Cysteodemus armatus*—Lec.—Entire body bluish black ; thorax with a strong lateral spine on each side ; wing-cases very convex, and much larger than the abdomen, which they cover, and with very coarse elevated reticulations on their surface. This insect varies greatly in size ; the figure represents a medium sized specimen.

Extremely abundant in Arizona and the desert regions of California wherever the greasewood, *Larrea Mexicana*, grows. This insect is not as good a vesicant as some others ; the proportion of hard tissue in its structure is large as compared with the softer and more active portion, too large, perhaps, to admit of its being of much value.

3. *Mylabris cichorii*—Linn.—All parts of this insect are black, excepting the wing-covers, which are of an obscure yellow, with three transverse, black, irregular, undulating bands, the one at the apex broadest. The first band is sometimes interrupted, and occasionally reduced to three or four spots.

Found in abundance in the southern portions of China, and also throughout India, on the flowers of the wild chicory and other composite plants. It is also said to occur in southern Europe, extending from Italy through Greece and Egypt to China.

4. *Macrobasis albida*—Say.—All parts of body black, densely covered with minute greenish or yellowish-white hairs. The thorax is slightly longer than wide, the wing-covers broader than the thorax, becoming wider behind, and are densely punctured.

Abundant in Texas, New Mexico and on the plains.

5. *Macrobasis atrivittata*—Lec.—Also black ; form more elongated than *albida* : head thickly clothed with fine black hairs, with a small white space in front of the eyes ; thorax with grayish hairs, with a large black space in the middle ; the wing-covers have black hairs, and their apex and sides are margined with gray ; there is also a moderately broad grayish stripe extending from the humerus to near the apex.

Found in Texas, and is probably quite abundant, but we have not been able to obtain definite information on this point.

6. *Macrobasis segmentata*—Say.—This insect is black also, with the segments of the body beneath margined with whitish. The thorax is nearly as broad as long, and its posterior edges are grayish. Wing-covers finely punctured and sparsely covered with short black hairs.

Occurs with *M. albida*, and is also abundant.

7. *Epicauta vittata*—Fab.—The head of this species is of a light reddish colour, with darker spots ; antennæ black ; thorax black, with three yellow lines ; wing-covers black,

margined with yellow, and with a yellow stripe down the middle. Abdomen and legs black, covered with grayish hairs.

Is found throughout the United States and Canada, but more abundant northward and westward of the Carolinas, extending to near the base of the Rocky Mountains. In the south it is replaced by *lemniscata*, a species closely resembling *vittata*, but differs in having another white stripe. This species has been tested, and has been found fully equal to *vesicatoria* as a vesicant.

8. *Epicauta cinerea*—Forster.—Black, closely punctured, and clothed with grayish hairs; beneath clothing dense, upper surface variable. Head sparingly hairy. Thorax densely punctured, sometimes entirely covered with gray hairs, often with a large triangular central space black, divided by a grayish line along the middle. Wing-cases finely punctured, and either entirely grayish or margined with grayish all around.

Occurs all over the United States east of the Rocky Mountains, and in many parts of Canada. In the Southern States it becomes larger, with the wing cases entirely gray; fully equal in strength to *vesicatoria.*

9. *Cantharis vesicatoria*—Linn.—Colour, above and below, a beautiful shining golden green; head, thorax and wing-covers closely punctured; antennæ black.

Found most abundant in Spain, Italy and the south of France; also found in all the temperate parts of Europe, and in the west of Asia.

10. *Cantharis vulnerata*—Lec.—Body black; head orange yellow, sometimes with a broad black stripe down the middle; wing-cases black.

Extremely abundant throughout the entire Pacific region west of the Sierra Nevadas. Dr. Horn has seen bushels of this insect in some localities literally strewing the ground; also very common on a species of *Baecharis;* he has experimented with them and found them powerfully vesicant, and producing strangury very readily when taken internally in the form of tincture.

11. *Cantharis Nuttalli*—Say.—Head deep greenish or golden green; antennæ black; thorax golden green with a polished surface, and a few small scattered punctures. Wing-cases golden purple, striped with green. Body beneath green, polished; thighs purplish, feet black. This large and beautiful insect is extremely abundant in Kansas and Colorado.

12. *Pyrota mylabrina*—Chev.—Entire body and legs dull ochre yellow. Thorax with two, sometimes four black spots; wing-covers with three transverse black bands, divided in the middle by the suture, the anterior one being sometimes further divided into four spots; knees and feet black.

Found from Kansas to Mexico, and is abundant throughout the whole region.

13. *Tergrodera erosa*—Lec.—Body and legs black; head and thorax reddish, the former with a deep groove; wing-covers bright yellow, their surface roughened with coarse reticulations, with a median and apical black band, which in some specimens are wanting. Abundant in Southern California and peninsula of Lower California, on a low herbaceous plant with a blue flower.

In all these species the female is more valuable than the male, especially when well distended with eggs, owing to the relatively larger proportion of the soft parts. Eggs have the same power as the other soft parts; the blood Dr. Horn believes to be more active than any other portion.

Having referred in detail to the perfect insects, it is now proposed to sketch their history, as far as known, through the earlier stages of their existence.

The life history of *Meloe*, which has been well worked up in Europe, may be taken as a type of all the species mentioned, since all the facts accumulated on this subject point to a similarity in the character of the transformations and habits, which in the vesicating insects are very remarkable.

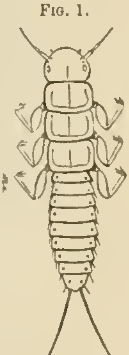
In the 20th volume of the "Linnean Transactions," there is a memoir on the natural history of *Meloe*, from which many of the following facts are derived.

The *Meloe* beetles, when fresh from their pupa cases in spring, are feeble, move slowly, and have their bodies small and contracted, but after feeding a few days these enlarge greatly, the abdomen of the female expanding to twice its original size, owing to the enormous quantity of ova within its body in process of development. The abdomen will then measure an inch or more in length, and appears to be dragged along with difficulty. They are fond of basking in the hot sunshine, and are said to be most active during the early and middle parts of the day. When confined in boxes for the purpose of observing their habits, it is necessary to expose them much to the sun, and supply them with an abundance of food ; they are then quite at home, and their proceedings may be easily watched. They drink freely of water, and require their food to be well wetted. In a few days after leaving their winter quarters they pair.

The eggs are deposited in the earth. A small excavation is made by the female, sometimes as much as two inches in depth, into which, when finished, she projects her body, with the head just perceptible at the entrance. After remaining in this position ovipositing for about two hours, the body is withdrawn, and the earth raked with her feet into the hole until it is entirely closed. These burrows are commonly made among the roots of grass in a dry soil and a sunny spot ; often on the margins of a dry footpath. The female always deposits two, and sometimes three or four separate layings of eggs, at intervals of from two to three weeks. The first is always the most abundant, amounting usually to three or four thousand. After each deposit the abdomen seems to be almost entirely emptied ; the insect then feeds voraciously, and fresh ova are soon developed.

The eggs when first deposited are about one-twentieth of an inch in length, slightly conical, obtuse at both ends, and of a bright orange colour. They are placed in such a way that they may be parallel to each other, and adhere together at their sides, with one end directed to the entrance of the burrow. The duration of the egg stage is greatly influenced by temperature, averaging from four to five weeks.

Fig. 1.



From the egg there escapes a little active, agile creature, somewhat resembling a *pediculus* in habits ; in fact, the larva of one of the European species was described by so eminent an Entomologist as Kirby, in 1802, as *Pediculus melittæ*, This young larva, a magnified illustration of which is given in Fig. 1,* is of a bright yellow colour, and of an elongated form, with fourteen segments. The three segments which constitute the trunk are strong and powerful, for the attachment of the legs, which are furnished with sharp-pointed claws, especially adapted for clinging securely to any object. The anal segment on its under surface is developed into a pair of short prolegs. It moves with great celerity with its six true legs ; it can also make use of its anal prolegs, and thus climb a nearly smooth and vertical surface.

The young larvæ of most insects, if food is not supplied to them within a day or so of the time of their escaping from the egg, will die of starvation ; but these young creatures will live from two to three weeks without food and maintain their activity, a wonderful adaptation to the circumstances in which they are placed. When hatched, they crawl to the surface and run up the stems of various plants, and often lodge themselves in the flowers and there await the visits of bees and other insects who alight to collect pollen or honey. They watch their opportunity, and attach themselves with great readiness to any of these insects who may come within their reach. It is astonishing with what celerity they fasten themselves to their victim the instant any part of its body is accessible, and with what tenacity they adhere to it, seizing it by the leg, wing, or hairs of the body, and crawling up and adhering aroung the insertion of its legs between the head and thorax or the thorax and abdomen, exciting the greatest possible uneasiness in the winged insect, who vainly endeavours to detach them from its body.

Some observers are of opinion that the parasite draws nourishment from the bee on which it fastens, but the main object of this instinctive attachment seems to be to get access to the cells in which the young and food are stored. Once here, the young larva of *Meloe* is said to attack the larva of the bee or other hymenopterous insect whose nest is thus invaded, and being furnished with strong mandibles, they thrust them into the soft parts of their victims, and prey on their substance through the wounded integuments, while the young bee is nourished with the stored pollen and honey. In this state, having no longer any use for their active limbs, they are gradually reduced to mere tubercles, and after a change of skin, the once active and sprightly creature assumes the form of a

* The small outline alongside shows this larva of the natural size.

thick, fleshy maggot. In this form it continues to feed on the young bees or the bee bread and honey stored for their use, and after passing through some remarkable changes while in the larval condition, first changing to a semi-pupa, then to another form of larva, it subsequently assumes the true pupa state, in which condition it remains in its snug retreat until the following spring, when it bursts its bonds and appears as a beetle.

The young *Meloe* larvæ often attach themselves to the hairs of insects which construct no cells and do not store up food for their young; and in such cases, which must be very numerous, they necessarily perish. In the light of this fact we can appreciate the importance of the great fecundity of the females.

The larva of *Cantharis vesicatoria* is almost identical in form with that of *Meloe*, but soon after escaping from the egg it changes from a yellow to a darker hue, and finally to a deep black.

The history of our American species is as yet very fragmentary. Dr. Packard has observed the larva of *Meloe angusticollis*, and found it to differ but little from its European congeners. In a recent number of the *Canadian Entomologist*, Mr. W. Brodie, of Toronto, gives some highly interesting observations on this species, extending over a series of years. He says:—

"According to my experience, *Meloes* make their appearance in the perfect state about the end of August or beginning of September, when they feed greedily on *Ranunculus acris*. Later in the season, when the abdomens of the females are much enlarged, they pair, and later still—sometimes after the first frost—they deposit their eggs and invariably die that season.

"The larvæ emerge from the eggs early the following spring, and I think attach themselves to bees generally on the blossoms of the willow. I presume this because I often find females about to oviposit near to willow bushes, but I have detected the young larvæ in the flowers of *Caltha palustris*, and suppose they will take to any early flowering plant.

"In confirmation of these statements I submit the following from my notes on *Meloe* in the vicinity of Toronto, dating from 1870.

"Although *Meloe* is common here, I have never found them much further to the north, and as I am pretty well acquainted with all parts of the county, I would say they are not found in the central nor in the northern portions of the County of York. This is curious, as in the better wooded sections the storing Hymenoptera are more numerous than about Toronto.

"1870—Aug. 30th. In early morning saw several *Meloes* descending a white oak tree, in St. James' Cemetery, which tree was afterwards blown down and proved to be a *bee tree*. This would indicate that *Meloe* pupates in the hive, and when perfect, deserts it during the night.

"1871. *Meloes* first seen Aug. 10th.

"1872—Aug. 20th. *Meloes* feeding on *R. acris*.

"1873—Aug.-Oct. *Meloes* very numerous, feeding on *R. acris*; found many females ovipositing in a cold, wet situation, after first fall frost.

"1874—Aug. 29th. Found about forty *Meloes* closely huddled in a ball; they were not fighting, and although both sexes were present, do not think they were pairing. None of the females had large abdomens, and when disturbed they all quickly ran away.

"Sept. 1st—10th. Found about sixty *Meloes*, of both sexes, many of them pairing; feeding on *R. acris*, on a small miry patch, about one-fourth acre, bounded on the right by a small stream which they could not cross; on the left, about 150 yards up a bank, were six hives of neglected bees. This is the same situation where, in 1873, I found females ovipositing after frost.

"1875—Aug. Found *Meloes* in same localities as last season. Captured several females; fed them on *R. acris*; they began ovipositing Sept. 20th. Oct. 20th, all dead. The eggs were of an orange colour, and placed in a hole about ¾ inch deep, and large enough to receive the abdomen.

"1876—Aug. 15th. *Meloes* first seen. Sept. 1st, found about fifty in a ball as I had found them in 1874. Do not think they were either fighting or pairing; could not make out what they were doing; when disturbed they soon ran away. This season they were about as numerous as in 1875, in same localities at same dates.

"From these notes, from my own recollections and from the recollections of my children, I infer that *Meloes* make their appearance about the middle of August, that they pair and oviposit before the winter sets in, and that they never survive the winter; and that they are very seldom, if ever, found under stones in the neighbourhood of Toronto."

Prof. Riley has made some observations on *Epicauta vittata*. He describes the eggs of *vittata* as follows: Length, 0·08 inch, five times as long as wide, elliptical and so uniform in diameter that it is difficult to say which is the anterior end, though there is a slight difference. Egg sometimes very slightly curved. Colour, very pale whitish yellow, smooth and shining.

The young larva is yellowish-brown, borders of head and thorax and of joints somewhat more dusky than general surface; tip of jaws and eyes dark brown. Legs and venter paler; venter not corneus except at sides and across segments eleven and twelve. About ten stiff hairs visible superiorly on the posterior border on the middle segments, with a cone-like prominence at the base of each, and six minor bristles in front of them. There are also rows of fainter ventral bristles.

The curious history of these insects throws some light on the fact that while in some localities they are enormously abundant one season, they will be very scarce another. It is to be expected that there would be an alternation between the abundance of certain species of hymenopterous insects and cantharides. When the insects they prey on are abundant the blistering beetles multiply amazingly, and during this immense multiplication exhaust the stock of material on which they feed to such an extent that a year of great abundance in any given locality can scarcely fail to be followed by a season of corresponding scarcity. In other, and sometimes adjacent localities, where the same causes have not operated to a like extent, the insects may be common enough. The great abundance of the sociable and solitary bees in the great plains of the West will probably always afford food sufficient to admit of the maturing of large broods of cantharides.

The Destructive Locust of the West.

By Rev. C. J. S. Bethune, M. A.

Fig. 2.

b

Caloptenus femur-rubrum.

In our last two Reports—those for 1874 and 1875—we devoted a considerable portion of our space to the consideration of the history, ravages, etc., of the destructive Locust of the West. As a supplement to the accounts that we then laid before the reader, we now beg to draw his attention to the following excellent summary of the migrations of this most noxious insect, and the suggestions that are made for the alleviation of the plague. The article is taken from the current number of the *American Naturalist*, and is from the pen of Prof. A. S. Packard, Jr.—one of the ablest American Entomologists of the day.

"The following remarks concerning the probable causes of the migrations of the western locust are extracted from a forthcoming report on this and other injurious insects in Prof. F. V. Hayden's Annual Report of the United States Geological and Geographical Survey of the Territories for 1875. The facts and theories were in part suggested by observations made by myself in Colorado, Utah, and Wyoming, in 1875, while attached for a few weeks to the Survey, and in part by the reports of Prof. C. V. Riley, State Entomologist of Missouri, and by the statements of Prof. Cyrus Thomas, State Entomologist of Illinois, and Hon. W. N. Byers of Denver, and others.

"In dealing with this fearfully destructive insect, which has attracted so much notice from the public, and in seeking for remedies against its devastations, it is of prime importance to have a thorough knowledge of its breeding places, the frequency and extent of its migrations, and to seek for the connection between the direction of the winds and other meteorological phenomena, and the flights of the locust.

"The locust is quite or nearly as destructive in Africa, Asia, and Southern Europe, as in this country, but the laws of their migrations and their connection with meteorological phenomena have never been studied in those regions, and it remains for the United States, with its Weather Signal Bureau, to institute in connection with the scientific surveys of the West investigations regarding the nature of the evil, and the best means to overcome it.

"In endeavouring to trace the connection between the migrations of the locusts and the course of the winds at different months, the writer has been led into some theoretical considerations which seem to be supported by the facts presented in the unpublished report, and which may be confirmed or disproved by future investigations.

"*History of the Migrations of the Locust.*—The following table, compiled from the reports of A. S. Taylor, the late Mr. B. D. Walsh, Prof. C. V. Riley, Prof. C. Thomas, Mr. G. M. Dawson, and the observations of Mr. W. N. Byers, will show the years when the locust was excessively abundant and destructive in the different territories and states, and also serve to roughly indicate the frequency and extent of the migrations of the destructive locust of the West. The dates which are starred are years when the progeny of the locusts of the preceding year abounded, and when in most cases there were no fresh incursions from the westward. The species referred to under the head of California, Washington and Oregon may be some other than *Caloptenus spretus*.

Manitoba.	Minnesota and Western Iowa.	Montana and Dakota.	Wyoming and Idaho.	Utah.	Colorado.	Nebraska, Kansas, and Western Missouri.	Indian Territory and Texas.	California.	Washington and Oregon.
1818	1818								1827 or 1828
1819	1819								1834 or 1835
	1820					1820 or 1821		1838	
			1845				1845		
						1846?			
			1852	1852			1849		1852
	1855	1855 ?	1855?	1855	1855?	1855	1855	1855	1855
	1856*			1856*			1856*	1856*	
1857				1857					
1864	1864	1864			1864				
					1865*				
						1866	1866		
1867	1867			1867	1867	1867	1867		
1868*				1868*	1868	1868*			
1869						1869*			
1872									
	1873	1873	1873	1873?	1873			1873	
1874	1874	1874	1874		1874	1874	1874	South	
?	1875	1875	1875		1875*	1875*	1875	Cal.	
	1876	1876	1876		1876	1876	1876		

"This table and the data on which it is based are necessarily very imperfect, owing to the vast extent of the territory over which the locusts swarmed, and the fact that the greater portion is uninhabited, while the inhabited portions have been settled only within comparatively few years.

"*The Theory of Migrations.*—(1) *The immediate cause of the migration of the locust from its original breeding places is the unusual abundance of the species during certain years.* It has been found in some cases that the exceptional years when the locust migrates are periods of unusual heat and dryness, conditions unusually favourable to the excessive increase of insect life. As may be seen in the accounts of the eastern locust, the grass army worm, the grain aphis, the chinch bug, and other less destructive insects, when the early part of the season, the spring and early weeks of the summer, are warm and dry, without sudden changes of temperature, insects abound and enormously exceed their ordinary numbers. When two such seasons occur, one after the other, the conditions become still more favourable for the undue development of insect life. Now it is well known that in the Eastern States the summers of 1860 and 1874, preceding the appearance of the army worm and grain aphis, were unusually warm and dry, and favourable not only for the hatching of the eggs laid the year previous, but for the growth and development of the larvæ or young. Look now at the conditions for the development of locust life on the hot and dry plains, chiefly of Dakota, Montana, Wyoming, and Idaho. We have no meteorological records from these regions at hand, but it is more than probable that the years preceding the migrations of the locusts were exceptionally warm and dry, when the soil was parched with long-sustained droughts, as we know that the corresponding species east of the Mississippi River abounds during dry summers following dry and warm springs.

"Given, then, the exceptional years of drought and heat and the great extent of territory, and we have as the result vast numbers of young hatched out. The year previous having, perhaps, been warm and dry, the locusts would abound, and more eggs than usual would be laid. These would, with remarkably few exceptions, hatch, and the young soon consume the buffalo grass and other herbage, and move about from one region to another, following often a determinate course in search of food. In this way large broods may migrate a long distance, from perhaps twenty to fifty miles. In about six or seven weeks they acquire wings. Experience shows that the western locust, as soon as it is fledged, rises up high in the air, sometimes a thousand feet or much higher. They have been seen to settle at night on the ground, eat during this time, and towards noon the next day fill the air again with their glistening wings. As more and more become fledged, the vast swarm exhausts the supply of food, and when the hosts are finally marshalled, new swarms joining perhaps the original one, the whole swarm, possibly hundred of miles in extent, begins to fly off, borne by the prevailing westerly and north-westerly winds, in a general easterly and south easterly course.

"(2.) *The secondary cause of the migration is the desire for food, and possibly the reproductive instinct.* The fact that in their migrations the locusts often seem to select cultivated tracts, rapidly cross the treeless, barren plains, and linger and die on the prairies and western edge of the fertile valleys of the Missouri and Mississippi, indicate that the impelling force is due primarily to the want of food, and that the guiding force is the direction of the prevailing winds, for they have no leaders, and we do not believe in the existence of a "migratory instinct" in the locust any more than in the grass army worm, or the cotton army worm, which it is sufficiently evident migrate from field to field, simply in search of more abundant food. Meanwhile the reproductive system of the locusts is maturing, the eggs ripening, and the uneasiness of the locusts during the course of their travels may be unconsciously stimulated by the sexual instincts and the desire to discover suitable places for egg-laying—a long and tedious operation.

"It has been sufficiently shown that a swarm of locusts observed by Professor Robinson near the entrance to Boulder Cañon, Colorado, travelled a distance of about six hundred miles to Eastern Kansas and Missouri. Though the swarm was first observed at some distance north of Denver, Colorado, it was then on its way from the north, and may have come from some part of Wyoming two or three hundred miles north-westward or northward. Though the winds may vary, and counter-currents exist, and storm gusts from due north, such as often sweep over the plains, and local southerly breezes may retard their flight, the course is either eastward or south-easterly. We know enough of the winds in the Western States and Territories to lay down the law that the general direction of the winds in July and August, along the eastern slope of the Rocky Mountains and on the plains, is from the west and north-west, and accords with the eastward course of the locust swarms. The relations between the average direction of the winds and the migrations of the locust have, however, never been sufficiently studied, either, so far as we are aware, in Europe or in this country. And yet, if we would intelligently study the causes of the excessive increase and migrations of the locust, we must examine the meteorological features of the country, ascertain the periods of drought and undue rainfall, the average direction of the wind for the different months, in order to learn how far they correspond with the phenomena of insect life. That there are meteorological cycles, dry and hot seasons recurring at irregular intervals, while the general average may remain nearly the same century after century, is supported, though it may be vaguely, by observed meteorological facts.

"The question then arises: *Can meteorologists predict the coming of seasons of undue heat and drought? and consequently can we predict insect years? that is, the migrations of locusts and the undue increase of the chinch bug and the army and cotton worm?* I believe that we shall, after the lapse of years, be able to foretell with a good degree of certainty locust invasions, and be able to provide against the losses thus incurred.

"On the frontier of the Western States, in Colorado, or in the Territories of Wyoming, Montana, and Utah, where the losses from the ravages of the locust cannot easily be made up by importations from contiguous territories, it seems the most practicable mode to provide in years of plenty against years of want. We should imitate on a grand scale the usage of the ancient Egyptians under Pharaoh, who laid up in time of unusual harvests stores of grain for times of famine. It is said that this has been done on a small scale by the Mormons. If this were done in the far West, in seasons immediately preceding insect years, which had been predicted by entomologists in conjunction with the meteorologists, we should be saved the distress, destitution, and even loss of life from starvation, which have resulted from ignorance of the laws regulating the appearance of destructive insects, especially the western locust.

"*The Return Migration.*—By simultaneous observations for a number of years over the region liable to be visited by migratory hordes of locusts, added to the knowledge we already possess, it will not only be possible to predict the course of certain swarms from their breeding-places, and their probable destination, so that when a swarm starts from Montana or Wyoming, its arrival in Colorado a week or a fortnight later may with some certainty be predicted, and again, its arrival in Kansas and adjoining States be announced with a certain amount of precision, as has already been done by Dr. Riley, but we shall be able to foretell the course taken in the return flight of their progeny in the succeeding year. I will confess that, previous to my visit to Kansas and Colorado, in 1875, I was sceptical as to Dr. Riley's opinion that there was a general movement in a north-west course of the young of the previous year, broods from Missouri and adjoining regions north-westward. The facts and resulting theory have already been stated in full by Dr. Riley and others. It remains to determine the causes of this return migration, this completion of the 'migration-cycle,' as Professor Dawson terms it. It is evident that in this case the desire for food is not the cause, for food is many times more abundant in the Mississippi Valley than on the plains whither they return. The solution of the problem, I think, must be sought in the direction of the prevailing winds during the middle of June, the time they become winged. It may be fonnd after a series of careful meteorological observations, that the prevailing winds at this early season are southerly and south-easterly. It has been shown by meteorologists, as I learn from Prof. C. Abbe, that during May and June the winds blow inwards towards the heart of the continent from the Atlantic Ocean and Gulf of Mexico. On application to Gen. A. J. Myer, Chief of the Signal Service of the United States Army, for the meteorological data necessary to confirm this hypothesis, I promptly received a full summary of data observed by the officers of the Weather Signal Bureau for periods of from two to five (usually the latter) years between 1871 to 1876, which show that the prevailing winds in June, in Davenport, Dodge City and Keokuk, Iowa; St. Paul and Breckenridge, Minnesota; Yankton and Fort Sully, Dakota; Omaha, Leavenworth, and Fort Gibson, Indian Territory—all within the locust area—are from the south-east and south. This fact may be sufficient to account for the prevailing course of the return migrations of the locust from the eastern limits of the locust area.

"Let us therefore grant this setting-in of southerly and easterly winds, which may last until the locusts are winged. When they rise on the wing into the air they are known to move in a general north-west direction. It is highly probable that they are borne along by these generally south-easterly winds, and pass over on to the plains. The cause is seen, then, to be entirely independent of subsistence; possibly the reproductive instinct causes them to become uneasy, restless, to assemble high in the air, and seek the dry, hot, elevated plateau of the north-west. Should this be so the cause of the migrations is probably purely mechanical. Abundant testimony is at hand to show that they are wholly at the mercy of the prevailing winds, and that, as a rule, the course of their migrations is quite dependent on the direction of the winds, while the course of the winds depend more or less on the season of the year. We may expect that future research over sufficient territory will show that the June migrations, from the eastern limits of the locust area, will be towards the north-west, and the July, August, and early Septembar migrations, from the Rocky Mountain plateau, will be in a general easterly and south-easterly direction.

"It is not only of great scientific interest, but of high practical importance, to collect all facts bearing on the return migrations, in order to know where the locusts go in their return migrations the second year, as we only know that they do fly a certain distance northwestward. We want to ascertain the extreme western limits of this return migration. We also want to learn whether they return to their original breeding-places on the eastern slopes of the Rocky Mountains, or whether the westerly winds, if they are westerly, drive them back and scatter them, so that they do not breed extensively.

"It will be seen by the reader that all grounds for a reliable working theory of locust migrations are based on the work of our Signal Bureau and local observers, and that the observations of the meteorologists and entomologists must go hand in hand. The government has provided a well-organized corps of meteorological observers, and we submit that a number of competent entomologists should take the field, under government auspices. Not only should the border States, especially Texas, Kansas, Nebraska, Minnesota, and Iowa, employ competent entomologists, following the liberal policy of Missouri, which for eight years has had a state entomologist, whose reports have proved of incalculable practical value, as well as of great scientific interest, but the habits of the locust need first of all to be thoroughly studied in the Territories, particularly those of Wyoming, Montana, Idaho, Dakota, Utah, New Mexico, Arizona, and in the State of Colorado. A commission of entomologists should be appointed to make a thorough detailed study for several successive seasons of the habits of the locusts in the Territories mentioned. It would seem that the recommendations made at the recent meeting of Western Governors at Omaha, that an appropriation be made by Congress, and a commission be attached to the existing United States Geological and Geographical Survey of the Territories, is the most feasible and economical method of securing the speediest and best results.

Let us for a moment look at the losses sustained in the United States from the attacks of insects. The annual agricultural products of this country by the last census amounted in value to $2,500,000,000. Of this amount we in all probability *annually* lose over $200,000,000 from the attacks of injurious insects alone. Dr. Riley avers that the losses during 1874 in Missouri from locusts—and it will be remembered that only the western third was invaded—exceeded $15,000,000. This would make the losses in other parts of the West at least twice as much more, or $45,000,000 in all. The estimated money loss occasioned by the chinch bug in Illinois in 1864 was over $73,000,000 , in Missouri, in 1874, it is estimated by Dr. Riley to have been $19,000,000. The annual losses from the chinch bug are greater, Mr. Riley says, than from any other insect. The average annual loss to the cotton crop from the attacks of the cotton army worm alone is estimated at $50,000,000. Adding to these the losses sustained by the attacks of about a thousand other species of insects which affect our cereals, forage and field crops, fruit trees and shrubs, garden vegetables, shade and ornamental trees, as well as our hard and pine forests, and stored fruits, and it will not be thought an exaggeration to put our annual losses at $200,000,000. If the people of this country would only look at this annual depletion, this absolute waste, which drags her backward in the race with the countries of the Old World, they might see the necessity of taking effectual preventive measures in restraining the ravages of insects. With care and forethought based on the observance of facts by scientific men, we believe that from $50,000,000 to $100,000,000, or from one quarter to one half of this annual waste, could be saved to the country. And the practical, most efficient way is for the States to co-operate with the general Government in the appointment of salaried entomologists, and of a United States commission of entomologists, who should combine the results of the State officials, and issue weekly, or, if necessary, daily bulletins, perhaps in combination with the Weather Signal Bureau, as to the conditions of the insect world, forewarning farmers and gardeners from week to week as to what enemies should be guarded against and what preventive and remedial measures should be used.

"The Weather Signal Bureau, first suggested and urged by the late I. A. Lapham, was not instituted without ridicule and opposition, but it has saved millions to our commerce and agriculture. The maintenance of an entomological commission and the appointment of State entomologists would involve comparatively little expense. Already, owing to the full information regarding the invasion of Missouri by the locust in 1874, contained in the reports of Prof. C. V. Riley, the people of that State will be well prepared from the direful experience of the past, to deal more intelligently and efficiently with the locust for the future.

ON SOME OF OUR COMMON INSECTS.

BY W. SAUNDERS, LONDON, ONTARIO.

The Luna Moth (*Actias luna*, Linn).

In our Report last year, there was an interesting article on this beautiful insect, by Mr. R. V. Rogers, of Kingston, Ontario. At the time that appeared, we were unable to supply an illustration of the moth, but lately we have succeeded in obtaining a very beautiful one, drawn and engraved expressly for our pages.

Fig. 3.

This moth (Fig. 3) measures when its wings are spread from $4\frac{3}{4}$ to $5\frac{1}{2}$ inches. The wings are of a delicate green colour, thickly covered with pale hairs as they approach the body. There is a purplish brown stripe along the front margin of the fore wings, which stretches also across the thorax, while a small branch of the same is extended to the eye spot near the middle of the wing. The eye spots are transparent in the middle and margined with rings of white, yellow, blue and black. The hinder edges of the wings are bordered with purplish brown.

The head is white while the beautifully pectinated antennæ are of a brownish tinge. The thorax and abdomen are whitish or greenish white, thickly clothed with a woolly down, the former crossed by the purplish brown stripe already mentioned. The legs are purplish brown.

This lovely creature is not at all common in the neighbourhood of London; indeed it can scarcely be called common anywhere in Ontario, although it is very widely and generally distributed. Seldom a season passes without some being captured in our midst, and occasionally we have had them fly in at the windows at night, attracted apparently by the light.

The larva, which is of a bluish green colour, feeds on Hickory, Walnut, Butternut, and sometimes on Beech and Oak, and closely resembles that of *polyphemus*, from which it may be distinguished by its having a pale yellow lateral stripe, bands of the same between the segments, and a brown V-shaped mark on the terminal segment.

For fuller details, we refer our readers to Mr. Rogers' excellent paper.

Deilephila Chamœnerii and Lineata.

Both these members of the Sphinx family are found more or less plentifully in nearly all portions of the Provinces of Ontario and Quebec; *lineata*, as far as we have been able to learn, is more abundant in Ontario and *chamœnerii* in Quebec. They are both very handsome moths, and so strong and active when on the wing that it is difficult to capture them without injury. About twilight or a little later their period of activity begins, when they may be seen flitting about with spectre-like rapidity, hovering like the humming bird over flowers, into which their long and slender tongues are inserted in search of the nectar there stored.

They are much alike. In both the ground colour of the fore wings is of a rich greenish olive, crossed about the middle by a pale buff stripe or bar, extending almost the whole length to the tip, while along the outer margin there is another band or stripe nearly equal in width, but of a dull ashy colour. The hind wings are small, with a wide rosy band, which covers a large portion of the wing, while above and below, the colour is almost black, the hinder margin being fringed with white. In the markings on the bodies they also resemble each other very much. There is a line of white on each side, extending from the head to the base of the thorax, and other less prominent longitudinal lines of white on the thorax. The abdomen is of a greenish olive, having a reddish hue on the sides and spotted with white and black.

Fig 4.

Fig. 5.

There are differences, however, which would enable the most casual observer to separate them without difficulty. There is a difference in size, *lineata* (Fig. 5) being the largest, measuring when its wings are spread about three and a half inches, while *chamœnerii* (Fig. 4) rarely exceeds two and three-quarter inches. The central band on the fore wings in *chamœnerii* is wider and more irregular, but the most striking point of difference between the species is that the veins of the fore wings in *lineata* are distinctly margined with white, a character entirely wanting in *chamœnerii.* These differences will be readily appreciated by reference to the figures.

In our Report for 1874, we gave a short description of *D. lineata*, known also as "the white lined morning sphinx;" but since some of our readers may not have access to that report, we have reproduced some of the figures then used. The beautiful figure of *D. Chamœnerii* has been drawn and engraved expressly for this report.

Fig. 6.

Fig. 7.

The caterpillars of *lineata* vary much in appearance. In Fig. 6 we have a representation of the most common form, while another form is shown in Fig. 7. They are said to feed upon purslane, turnip, buckwheat, watermelon, also on grape and apple leaves. Mr. Pile, of Dundas, Ont., has found them feeding on the common plantain. They are found in the larval condition during the month of July, and when full grown they are said to descend into the ground, where they change into light brown chrysalids, and appear as moths in September.

The following description of the larva of *D. chamænerii* was made from three examples found feeding on grape leaves on the 5th of July :—

Length, two and a half inches, tapering towards each end : head small, rather flat in front, slightly bilobed, and of a dull pinkish colour, with a black stripe across the front at the base ; basal half of palpi yellow, upper half black ; mandibles black, with a patch of yellow between them and the black stripe.

Body above deep olive green, with a brownish tinge and a polished surface. Second segment with a cervical shield similar in colour to head, its sides dull greenish, with two yellow dots. There is a pale yellowish dorsal line terminating at the base of the caudal horn ; each segment from 3rd to 12th, inclusive, has a pale yellow spot on each side of the dorsal line, about half way towards the stigmata, those on 3rd segment small and almost crescent-shaped, on the 4th larger and nearly round, 5th still larger, nearly round, 6th, 7th, 8th, 9th, 10th and 11th about equal in size, nearly oval and larger than those on 5th. On 12th segment the spot is more elongated, and extending upwards, terminates at the base of the caudal horn. There is a wide but indistinct blackish band across the anterior part of each segment, in which the yellow spots are set ; the sides of the body below the spots are thickly sprinkled with minute raised yellow dots. Caudal horn long, curved backwards, red, slightly tipped with black, and with a roughened surface ; terminal segment dull pinkish ; stigmata oval, yellow, shaded around with dull black.

Under surface much paler, colour dull pale pinkish green, the pink colour predominating from 5th to terminal segments inclusive, and with a number of very minute raised yellowish dots placed chiefly along the sides. Feet black ; pro-legs pink, with a patch of black on the outside of each. One specimen spun a light web, binding a portion of the leaf in the manner of *pampinatrix*, within which it changed to chrysalis on the 10th of July, and from this the imago appeared on the 28th of the same month. The other two larvæ died before completing their transformations.

The Black Swallowtail Butterfly (*Papilio asterias*).

This is one of our commonest butterflies, and is found in nearly all parts of Canada and the United States. It is a very handsome species, with the wings of a black or deep blackish brown colour, with yellow and blue markings. Across the wings there are two bands of yellow spots ; those composing the inner one in the male are large and distinct, while in the female they are smaller and sometimes almost obsolete. In Fig. 10, also

Fig. 8.

engraved expressly for this report, we have an excellent representation of the female. The spots forming the outer band are smaller and near the margin. Besides these, the fore wings have one or two spots towards the upper margin and the hind wings, which are tailed, have a series of seven blue spots or patches, and near their hinder angle an eye-like spot of an orange colour, with a black centre.

The under surface of both wings is paler, with the spots arranged nearly as above, excepting that those on the hind wings are tinted with orange. The body is black, with longitudinal rows of yellow spots. The wings, when spread, measure from three and a-half to four inches across.

The caterpillars, when fresh from the egg, do not measure more than a tenth of an inch in length, are black with a broad white band across the middle, and another on the hinder segments, while the body is studded with small black projecting points. After the first skin is cast the white band is restricted to the sixth and seventh segments, and around the base of the black projecting points are spots of an orange colour, while low down on the sides is a row of white spots ; there are also two of the same colour on the top of the first segment, and a larger one on the hinder segment. With each moult these caterpillars alter in colour and appearance, and before they are half grown the projecting points, white band, and spots entirely disappear, the skin becomes smooth and of a delicate green colour, rather paler at the sides and whitish below, and each ring is crossed by a band composed of alternate black and yellow spots. When irritated they push forth, from a slit in the first segment of the body, a pair of soft, orange-coloured horns, united at their base, and shaped somewhat like the letter Y ; from these, when extended, a disagreeable odour is given off, which serves to defend the caterpillars from the attack of their enemies. They feed on parsley, rue, carrot, parsnip, carraway, and several other plants, both wild and cultivated. When full grown the caterpillar measures an inch and a half in length, it then leaves off eating, and seeks a sheltered spot in which to pass the chrysalis state. Here it first spins a little web of silk against the surface of the spot selected, to which its hind feet are firmly secured, it then spins a loop or girth of silken threads to furnish a support to the body, after which it casts its caterpillar skin and appears as a chrysalis. In this state it continues from ten to fifteen days in summer, the time varying with the temperature, when the butterfly escapes.

NOTES OF THE YEAR.

BY WM. SAUNDERS, LONDON, ONT.

THE ARMY WORM (*Heliophila unipuncta*).

This troublesome insect has appeared in several sections of our Province during the past year, and although it has not occurred in such hordes as in times past, yet its numbers were sufficiently great during the latter part of the season to excite apprehension of the probability of a more severe invasion during the coming summer. Towards the end of the warm weather the moths were very abundant, and could be captured by hundreds by preparing a bait of molasses and beer, and painting it on fence boards or trees early in the evening.

The moth, when its wings are spread, measures nearly an inch and three-quarters. It is of a yellowish drab colour, approaching russet, with a small white dot on the forewings near the middle, and a dusky oblique stripe near the tip, and a few blackish dots over their surface. The hind wings are darker, with a silky lustre, and almost semi-transparent. The fore part of the body is similar in colour to the fore-wings, the hinder part a little darker than the hind wings.

The worm when full grown, measures about an inch and a half in length, is of a dark grey colour, with yellowish and dusky longitudinal stripes. They sometimes appear in immense swarms, devouring whole fields of grain and other grasses during their progress.

THE GOOSEBERRY FRUIT WORM (*Pempelia grossularia*).

This troublesome pest is increasing rapidly from year to year, and committing great havoc among the gooseberries. We have had many complaints from fruitgrowers during the past season of their destructiveness, with inquiries as to the best methods of counteracting their ravages. One of our correspondents, Mr. B. Gott, of Arkona, has so well explained the workings of this insect, that we think it best in this connection to quote his own words. He says "for some time past we have suffered from the depredations of a worm upon our gooseberries, and not having observed anything in type treating upon this particular insect, I thought it advisable to acquaint you with the facts of the case. While the gooseberry is yet young and tender, say about the size of a pea, a small worm appears and eats its way into the heart of the berry and becomes of a greenish colour. After living there for some time and scooping clean the contents of that berry, it will attack the next nearest berry and secure itself effectually against accident or danger by a sort of net or web-work thrown around and over those berries, at the same time growing in length and strength and prospering everyway as satisfactorily as insect could desire. About the time that gooseberries are nearly ripe, say during the latter part of July, it has attained its full dimensions as a devouring larva, and is about one inch or one and a quarter in length with six claw-like feet towards the head. By this time it has enclosed some ten or twelve berries in its capacious web to satisfy its voracious and increasing demands, scooping all out thoroughly.

"The worms work by thousands on our plantations of a few hundred bushes and destroy from one-half to two-thirds of the entire crop of berries. Now as this fruit is of considerable value and importance, this insect depredation is felt to be something more than a benefit. It amounts to more than thinning; it is an actual loss to the grower, and the trouble is an ever increasing and rapidly growing one. What can be done to counteract the workings of this enemy to gooseberry culture?"

This worm is the progeny of a small grey moth (see Fig. 9), which lays its eggs upon the gooseberries as soon as they begin to form. The moth, when its wings are expanded, measures nearly an inch across. Its fore wings are pale grey with dark streaks and bands. There is a transverse diffuse band a short distance from the base of the wing, enclosing an irregular whitish line which terminates before reaching the front edge of the wing. Near the outer edge is another transverse band enclosing a whitish zig-zag line. There is also a row of blackish dots within the outer margin; the veins and their branches are white. The hind wings are paler and dusky. The head, antennæ, body and legs are all pale grey, more silvery underneath than above.

Fig. 9.

This insect passes the winter in the chrysalis state, enclosed in a brown papery-looking cocoon (see Fig. 9), hid amongst leaves or other rubbish on the surface of the ground, and escapes from the chrysalis, and appears as a moth during the latter part of April. Shortly after they seek their mates, and the females are ready to deposit their eggs as soon as the fruit is sufficiently advanced in growth, these are probably attached singly to the fruit, where in a few days they hatch, producing worms, which burrow in the fruit as our correspondent has described.

When full grown, the worms lower themselves to the ground by silken threads which they spin at will, and there construct their little silken cocoons amongst the dried leaves and rubbish, and remain in this inactive state until the following spring; hence there is only one brood during the year.

The infested fruit soon indicates the presence of this larva, by becoming discoloured and withered. We have found them attacking currants also, both white and red, and occasionally infesting the black currant.

The most satisfactory remedy we know of, is hand-picking. The evidences of their presence are not difficult to detect. Any berries found colouring prematurely, should be examined, and as the larvæ slip out and fall to the ground very quickly care must be taken that they do not escape in this manner. We have tried dusting the bushes with fresh air-slacked lime late in April, with good results, the moths seeming to avoid almost entirely bushes so dusted. We would also suggest keeping the ground under the bushes clean, so as to afford them no hiding-places, also the use of some ashes or lime strewed under the bushes. It is said that, if chickens are allowed the run of the gooseberry patch after the fruit has been picked, they will greatly lessen their numbers by devouring the chrysalids. The mode of life adopted by this insect prevents the successful use of any poison applied to the bushes as may be readily done when the larva feed on the leaves of the bush they infest.

The Cabbage Butterfly (*Pieris rapæ*).

While we regret to have to record the onward march of the Cabbage Butterfly which has now spread over the whole of western Ontario, destroying yearly tens of thousands of cabbages, we are at the same pleased to be able to state that its natural enemy the little ichneumon parasite, *Pteromalus puparum*, described in our previous reports, is closely following in its wake—out of a large number of chrysalids of the butterfly found about London, a considerable proportion have been found upon examination to be infested with these parasites.

This friendly insect is a tiny four-winged fly, about one-eighth of an inch long, with a golden coloured body and greenish head. The female spends her time in searching for the chrysalids of the butterfly, into which she drills little holes and therein deposits her eggs; these hatch into tiny maggots, which prey upon the substance of the chrysalis and finally devour it.

BENEFICIAL AND INJURIOUS INSECTS.

(Chiefly of the Order Hymenoptera.)

BY JOSEPH WILLIAMS, LONDON, ONT.

1. The Common Bee (*Apis mellifica.*)
2. The Bee-moth or Wax-worm (*Gallerea cereana*) Fabr.
3. The Bee-killer (*Trupanea apivora*) Fitch.
4. The Ring-legged Pimpla (*Pimpla annulipes*) Br.
5. The Pigeon Tremex (*Tremex columba*) Linn.
6. The Sigalphus Circulio Parasite (*Sigalphus curculionis*) Fitch.
7. The Porizon Curculio Parasite (*Porizon conotracheli*) Riley.

To the student of insect life, and even to the most ordinary observer, there is no class of insects more interesting and wonderful than the Hymenoptera (membranous winged insects), as our readers will no doubt admit when we say that to this order belong the Bees, Humble Bees, Wasps, Ants, Gall Flies, and many other less familiar forms. Naturalists, as well as poets and thinkers of all ages, have been led to admire them for their wonderful powers of architecture, their economic foresight, their marvellous instincts, and their admirable social organizations, all of which prove a very high order of intelligence. Two living entomologists—Dana and Packard—place them at the head of their lists in their systems of classification, considering them the most perfect insects. Dana says of them, "They exhibit the *normal size* of the insect type, which is between eight and twelve lines in length, and two and a half or three in breadth." Packard ascribes to them "instincts and a kind of reason differing, perhaps, *only in degree* from that of man.

The metamorphoses of the Hymenoptera are complete, that is, in their development they pass through the four stages of a typical insect, viz.: the egg, the larva, the pupa or chrysalis, and the imago or perfect insect.

They have small but powerful membranous wings well adapted for long sustained flights.

We propose to compile such information, from scattered authors, as may be at once interesting and instructive; and will commence with the common Honey Bee.

THE HONEY BEE (*Apis mellifica*).

This valuable little insect has been known from the times of the ancients, and at present it is cultivated over the entire civilized world, and in many uncivilized and thinly peopled countries is found wild; it was introduced into America during the seventeenth century.

In a complete hive of bees there are three very distinct kinds of individuals—the female, mother, or queen bee,—the neuters or working bees which are incompletely developed females—and the males or drones.

A still further subdivision may be made: "There have been observed amongst bees two sorts of females or queens, a large one and a small. Needham first observed the latter: and their existence, P. Huber tells us, has been confirmed by several observations of his father. They are bred in cells nearly as large as those of the common queens, from which they differ only in size. Though they have ovaries, they have never been observed to lay eggs. Reamur observes that some queens are much larger than others; but he attributes this difference of their size to the state of the eggs in their body. There are two descriptions of males—one not bigger than the workers, supposed to be produced from a male egg laid in a worker's cell. The common males are much larger and will counterpoise two workers. The workers are divided into the *wax workers* and the *nurse bees*; the latter are smaller than the former; their stomach is not capable of such distension; and their office is to build the combs and cells after the foundation has been laid by the wax workers, to collect honey, and to feed the larvæ. The nurse bees, however, do secrete wax, but in very small quantities." (Kirby and Spence's Entomology.)

The working bees are the crowd, the masses, the living force ; they greatly outnumber other individuals. The worker is smaller than either the queen or drone ; it has three pairs of legs as have the others, but the hindermost pair of the worker's legs is developed in a peculiar manner to enable it to perform the duties belonging to it ; the leg is much enlarged near its farther end, and resembles a long triangle in outline ; a set of sharp points or many strong spines, which are regularly distributed, form a kind of rake toward the extremity, and this implement enables the bee to seize the waxy plates that are between its abdominal segments. The first joint of the tarsus or foot succeeds the leg and attains a great size, when compared with that of the other members of the structure. Being articulated with or jointed to the leg by its internal angle, the free external portion forms, with the leg, a true pair of pincers ; moreover two small spines render the arrangement all the more perfect. This joint is square in outline, and is perfectly smooth on the outside, whilst it is furnished on the inside with many transverse sets of stiff hairs of equal size. The limb acts capitally as a trowel and as a brush. The fertile female or queen, which never works, has the traces of this arrangement, and the males also ; but neither of them has the pinching and brushing structures : these are restricted to the workers.

The worker or neuter possesses a pair of movable mandibles or jaws which close the mouth on the side ; its trunk or proboscis consists of four horny like scales which enclose a tongue about the size of a hair, which when magnified appears to be formed of successive rings. One pair of these sheathing scales is provided with a fringe of hairs, intended, no doubt, to brush off and secure the honey which is found in the cups of flowers, and a more efficient and beautiful instrument we could not conceive of. This tongue is not used for sucking as in the case of butterflies, but for lapping ; when not in use it is folded in a small compass. The antennæ are twelve jointed and terminate in a knob ; they probably serve as a means of communication, and as delicate organs of touch. The abdomen consists of six joints or rings, and under the scaly coverings of the four middle ones are situated the receptacle for the wax. Neither the queens nor the drones have any provision for the collection of pollen or the secretion of wax, as their duties are of another kind. The abdomen of the worker is terminated by a straight sting ; the drone has none ; that of the queen is curved. The wings of the worker and those of the drone, cover the abdomen entirely, whilst those of the queen cover only one-half. Other characteristics and the relations of these creatures to each other will be best shown by an examination of their social life, and their division of labour, which are among the strongest arguments for ascribing powers of reason to these insects.

A colony of bees consists, besides the young brood, of one queen, several hundreds of males or drones, and many thousand workers or neuters.

In the summer time, a bee hive is truly a busy place : all is bustle without confusion : each insect has its appointed work to do, and all are diligent. At the door stand the watchful sentinels ready to challenge rash intruders, while passing in and out are hundreds of busy workers, some carrying their sweet burdens to the common store-house, whilst others are setting off in search of new supplies. Here we see a worker engaged in a contest with a venturesome stranger, and there are others performing the last sad offices for a dead companion. Their industry is remarkable and has become proverbial, as can testify many a lagging urchin who has been referred to the bee to find incitement to industry.

> " How doth the little busy bee,
> Improve each shining hour," &c.

When a colony takes possession of a hive, be it an artificial one or a natural cavity, the first operation is to stop up all the openings, except one, which is to form the door. The substance used in this process is called *propolis*, and is an odorous gum resin taken from the buds of the poplar, pine, fir, and beech trees. It is said that bees sometimes use this propolis for embalming the dead bodies of enemies which cannot be removed fromt he hive, and which are in this way prevented from decomposing. If so, the Egyptians lose a trifle of their celebrity in this regard. After the hive is properly prepared, the next step is to lay the foundation for the cells which are to form the comb. The material necessary, is wax. Wax was formerly supposed to be derived from the pollen of flowers alone, but it has been proved that bees fed solely on pollen do not secrete wax, but do when saccharine matter is supplied. A detachment of workers is sent to the fields to collect supplies and soon return loaded. One now attaches itself to the roof, allowing its body to hang down; another fastens its front legs to the hinder ones of the first; and this operation is repeated until a large cluster is formed, suspended from the top of the hive. The bees remain in this position about twenty-four hours, during which time the food they have collected is altered by some process into wax, and appears under the joints of the abdomen. One now separates itself from the mass, and forcing its way to the roof, clears a space of about an inch in diameter, in which it can move freely: it then suspends itself, and, seizing one of the laminæ of wax with a pincer formed by two joints of the hind leg, withdraws it from beneath the abdominal ring, and carries it to its mouth. Here it masticates it, mixing it with the frothy saliva; during the operation the tongue assumes many forms: now it is flattened like a spatula; then like a trowel; at other times it resembles a pencil terminating in a point. The saliva mixed with the wax gives it a whiteness and opacity which it had not before, and another object of the admixture is doubtless to give it that ductility and tenacity which it possesses in its perfect state The bee next applies the ribands of wax which result to the vault of the hive, disposing them with its mandibles in the direction which it wishes them to take: it continues these manœuvres until it has employed all the laminæ of wax it has elaborated. At length it leaves its work, and is lost in the crowd of its companions. Another succeeds and resumes the employment; then a third; all follow the same plan of placing their little masses, and if any by chance gives them a contrary direction, another coming removes them to their proper place. The wax-makers having thus laid the foundation of a comb, are succeeded by the nurse bees, which are alone competent to model and perfect the work. The former are the labourers who convey the stone and mortar; the latter the masons who work them up into the form which the intended structure requires. One of the nurse bees with its mandibles moulds in the wall a cavity which is to form the base of one of the cells. When it has worked some minutes it departs, and another takes its place, deepening the cavity, heightening its lateral margins by heaping up the wax to the right and left, by means of its teeth and fore feet. More than twenty bees successively employ themselves in this work. At a certain time other bees begin on the yet untouched and opposite side of the mass, and commencing the bottom of *two* cells, are in turn relieved by others. The wax-makers bring fresh supplies from time to time for the use of the nurse bees. After having worked the bottom of the cells of the first row into their proper forms, they polish them, while others begin the outline of a new series. The cells or prisons are next constructed, and engrafted on the borders of the cavities, and the length of the tubes is so perfectly proportioned, that there is no observable inequality among them. It is to be remarked that although the general form of the cells is hexagonal, the first begun are pentagonal. "When one has well examined," says Reamur, "the true shape of each cell, when one has studied their arrangement, geometry seems to have guided the design for the whole work. One finds that all the advantages which could have been desired are here combined. The bees seem to have had to solve a problem containing conditions which would have made the solution appear difficult to many geometricians. The problem may be thus enunciated: given a quantity of matter, say of wax, it is required to form cells which shall be equal and similar to each other, of a determined capacity, but as large as possible in proportion to the quantity of matter employed, and the cells to be so placed that they may occupy the least possible space in the hive. To satisfy this last condition, the cells should touch each other in such a way that no angular spaces remain between them."

That the bees have fully solved the above problem is evident, and the judgment they use renders it impossible for us to view them as mere organized machines, whose instinct is their spring of action: we are forced to concede to them intelligence—(Figuieur).

The two rows of cells placed back to back form the comb, and the combs are so arranged that the bees have just space to pass between them. The size of the cell varies, but the majority of them are small, some are slightly larger, and a few are of considerable size, and those usually at the ends of the combs. The smallest are for the larvæ of the workers, the next will be filled by those of the male,-and the largest cells will contain queens or fertile females.

As soon as the cells are finished the queen or fertile female runs over the surface of the combs and lays an egg in each cavity, and she is attended by a host of workers who take care that only one egg is dropped into each cell. Should two fall in, one is pulled out and destroyed. When the laying is finished the work of the queen is at an end, and she does not concern herself in any way about the larvæ. The eggs are not long in being hatched. From the moment when the larva comes out of the egg until that of its metamorphosis into a pupa, it keeps in its cell, motionless as an Indian idol. The working bees visit it from time to time. In from three to five days the larvæ are developed; they have absorbed all their pap, and have no need from that time of any nourishment, for they are now about to change to pupæ. The nurses now pay them a last attention, they wall them up in their cells, closing the openings with a waxen covering. In thirty-six hours they have spun for themselves a silken cocoon in which they undergo their transformation. The perfect insect is ready in seven or eight days to appear in broad daylight; it breaks through the thin transparent covering in which it is swathed; then with its mandibles it pierces the door of its prison and issues forth. It soon becomes strong, and if it is a worker it is not long in getting to work and mixing with its companions in labour. Queens require sixteen days from the laying of the egg before they are ready to emerge from their cells; workers require twenty; and drones require twenty-four. The rearing and birth of the queen differs from that of others. In proportion as their larvæ increase in size do the workers enlarge the cells which contain them, and then again gradually diminish their size as the moment of their last change approaches. A special and peculiar food is given to the larvæ that are to form the queens, it is heavier and sweeter than that given to the other larvæ. The food and the situation appear to be the causes which decide the nature of the forthcoming insect, as when the hive becomes in any way queenless the workers choose a larva which, in ordinary circumstances, would become a worker, and by alterations in its dwelling and by supplying it with royal food ultimately produces a perfect female or queen. As soon as they have quited their cradles, the young queens are ready for flight; but the workers and males are less strongly organized, they require a rest of about a day before taking part in the sports and labours of the older ones.

When hatching has begun, each day adds some hundreds of young bees to the population of the hive, which soon becomes too small, and then occur those remarkable emigrations called swarms. When this remedy becomes necessary, the inhabitants become excited, drop their work, and the agitation becomes general; the queen runs from place to place, but does not receive her customary homage; the workers are no longer attentive to the young brood; the hum increases in intensity, and as if panic striken the bees rush from the hive, led or accompanied by a queen. The swarm flies about and soon settles on a suitable branch, forming a dense mass of living animals supporting each other by the claws of their feet. Sometimes it happens that two queens go out with the same swarm; and the result is that the swarm at first divides into two bodies, one under each leader but they usually unite again, and when the whole are housed the question of sovereigntyis settled by the stronger queen destroying the weaker. Until this great question is decided, the bees do not settle to their usual labour. Two queens in the same hive is something that cannot be endured, and there are many accounts of the singular duels which decide such matters.

When the colony is thoroughly organized, and the members are beginning to accumulate provisions, a most singular tragedy takes place. The drones or males are no longer wanted, and they must be got rid of. The massacre is performed by the workers, who seize the drones, pull them by their legs, wings, or antennæ, and finally kill them with their stings. The pitiless executioners do not spare even the larvæ and pupæ of the males. The slaughter goes on for several days or until all the males are killed, they not being able to defend themselves as they have no stings. In two cases the drones are not destroyed—when the queen lays only male eggs, and when the hive is without a queen. But we have said little as yet about the most familiar product of the bee—we mean honey. Let us accompany them on their excursions into the fields. On these occasions the principal object of the bees is to furnish themselves with three different materials: the nectar of flowers from which they elaborate honey and wax; the pollen, or fertilizing dust from the anthers of the flowers, of which they make what is called the bee-bread, serving as food both to old and young; and the resinous substance called *propolis*, which we have described in speaking of the preparation of the hive in the first place. The nectar is a fluid secreted by the flowers, and is extracted by the bees by means of their long tongues they do not take up this fluid by suction but by a lapping motion; the juice is then conveyed into the first stomach or honey bag, which is small when empty, but when filled becomes swelled to a considerable size. In the honey-bag the fluid is changed into honey, and from this bag the bee ejects it into one of the cells on her return to the hive. Honey is never found in the second stomach, which is reserved for the bee-bread. In collecting honey, bees do not confine themselves solely to flowers; they will sometimes very greedily absorb the sweet juices of fruits, they are also fond of sugar; though the great mass of the food of bees is collected from flowers, they do not wholly confine themselves to a vegetable diet; for, besides the honeyed secretion of the aphides, the possession of which they will sometimes dispute with the ants, upon particular occasions they will eat the eggs of the queen; they are also very fond of the fluid that oozes from the cells of the pupæ, and will suck eagerly all that is fluid in their own abdomens after they are wounded by their rivals. Although bees in some instances appear to know and do avoid many flowers yielding poisonous honey, yet they have been known to collect poisonous honey in large quantities. In the autumn and winter of the year 1790, an extensive mortality was produced amongst those who had partaken of the honey collected in the neighbourhood of Philadelphia. The attention of the American Government was excited by the general distress, a minute inquiry into the cause of the mortality ensued, and it was satisfactorily ascertained that the honey had been chiefly extracted from the flowers of *Kalmia latifolia*—known by the common names of Mountain Laurel or Calico Bush—a plant possessing strong narcotic properties. History informs us that honey found at Trebizond, on the Black Sea, threatened fatal effects to such of the Greek army, as partook of it, in the celebrated retreat after the death of the younger Cyrus; those soldiers who ate it in small quantities appeared as if intoxicated, while such as partook of it freely appeared as if mad or about to die, numbers lying on the ground as if after a defeat. Pliny observes that this honey was collected from a species of *Rhododendron*.

When the stomach of the bee is filled with nectar, it next, by means of the feathered hairs with which its body is covered, pilfers from the flowers the fertilizing dust of the anthers—the pollen, which is equally necessary with the honey to the society, and may be named the ambrosia of the hive, since from it the bee-bread is made. Sometimes the bee is so discoloured with this powder as to look like a different insect, becoming white, yellow or orange, according to the flowers in which it has been busy. Reamur was urged to visit the hives of a gentleman who, on this account, thought his bees were different from the common kind. He suspected, and examination proved, that the circumstance just mentioned occasioned the mistaken idea. When the body of the bee is covered with farina, with the brushes of its legs, especially its hind ones, it wipes it off; not as we do with our dusty clothes; to dissipate and disperse it in the air, but to collect every particle of it, and then to knead it and form it into two little masses, which she places, one in each, in the baskets formed by hairs on her hind legs.

Reamur seems to think that bees fly indiscrimately from one species of flower to another, but the testimony of many other naturalists is, that they collect only from the same species on each trip, as they have been observed to pass over numerous others in search of flowers similar to that with which they began. It seems not improbable that the reason why the bee visits the same species of plant during one excursion may be this: her instinct teaches her that the grains of pollen which enter into the same mass should be homogeneous, in order perhaps for their more effectual cohesion; and thus Providence also secures two important ends—the impregnation of those flowers that require such aid, by the bees passing from one to another; and the avoiding of the production of hybird plants, from the application of the pollen of one kind of plant to the stigma of another.

When a bee has completed her lading she returns to the hive to dispose of it. The honey is disgorged into the pots or cells destined to receive it, being discharged from the honey-bag by its alternate contraction and dilation. A cell will contain the contents of many honey-bags. Bees, when they bring home the honey do not always disgorge it; they sometimes give it to such of their companions as have been at work within the hive. Some of the cells are filled with honey for daily use, and some with what is intended as a reserve, and stored up against bad weather or a bad season ; these are covered with waxen lids.

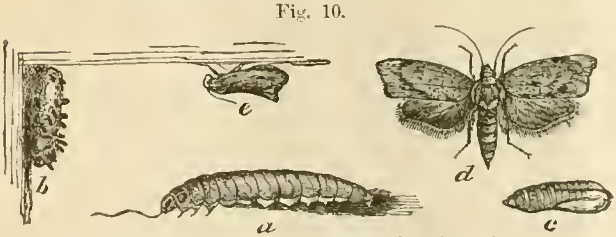
The pollen is employed as circumstances direct. When the bee laden with it arrives at the hive, she sometimes stops at the entrance, and very leisurely detaches it by piecemeal, devours one or both the pellets on her legs, chewing them with her jaws, and passing them then down the little orifice before noticed. Sometimes she enters the hive, and by a peculiar noise produced by beating her wings she attracts to her three or four of her companions who relieve her of the supply and devour it.

Very much more might be said about bees, especially in regard to such points as their love, anger and hate, their foresight, and the numerous expressed theories as to their possession of more than mere sensation as their guide. Such topics, although very interesting, are of a nature too speculative for the present, but those desirous of pursuing the subject in that direction can obtain abundance of literature. We will conclude by describing, in the next two articles, two insect enemies of the bee, although they are not members of the Hymenopterous order. It is well known among cultivators that bees-hives are subject to the attacks of large hawkmoths, and even mice are known to enter a hive. Bees are also afflicted by parasites. But by far the worst enemy the bee-keeper has to contend with is—

THE BEE-MOTH OR WAX WORM. (*Gallerea cereana*) FABR. (*Lepidoptera*, *Tineidæ*).

The following is from Riley's First Annual Report for Missouri :—

Fig. 10.



"This insect is so well known to bee-men generally, that it scarcely needs a description. It is well illustrated above (Fig. 10) in all its shapes, *a* showing the full-grown worm, *b* the cocoon which it spins, *c* the chrysalis to which it changes, *d* the female with wings expanded, and *e* the male moth viewed from the side with the wings closed. It suffices to say, that the colour of the moth is dusky gray, the fore wings which are scolloped at the end, being more or less sprinkled and dotted with purple brown. The female is generally a good deal larger than the male, though there is not so much difference between the sexes as some writers have supposed. The worms which produce these moths are of an ash-gray colour above, and yellowish white beneath.

"The Rev. L. L. Longstroth, in his excellent work on the Honey Bee, which every bee-keeper should possess, has given such a complete account of theBee-moth, that it is only necessary for me to mention a few of the most important facts with regard to it, my object being principally to show that there can be no such thing as a *moth proof hive* ; that wire gauze contrivances are of no avail, and that the man who pretends to sell a moth proof *hive*, may usually be set down as a know-nothing or as a swindler.

"The Bee-moth was first introduced into this country from Europe about the commencement of the present century, and it was in all probability imported with the common bee-hive. There are two broods of the moth each year, the first brood appearing in May or June, and the second, which is the most numerous, in August. During the daytime these moths remain quietly ensconced in some angle of the hive, but as night approaches they become active, and the female uses her best endeavours to get into the hive, her object being to deposit her eggs in as favourable a place as possible. Wire gauze contrivances are of no account to keep her out, as she frequently commences flying before all the bees have ceased their work. But even if she were entirely prevented from entering the hive, she could yet deposit her eggs on the outside, or by means of her extensile ovipositor [thrust them in between the slightest joint or crack, and the young worms hatching from them would readily make their way into the hive. The moment the worm is hatched, it commences spinning a silken tube for its protection, and this tube is enlarged as it increases in size. This worm cuts its channels right through the comb, feeding on the wax, and destroying the young bees on its way. When full-grown it creeps into a corner of the hive or under some ledge at the bottom, and forms a tough white cocoon of silk intermingled with its own black excrement as in figure *b*. In due time the moth emerges from this cocoon.

"A worm-infested hive may generally be known by the discouraged aspect which the bees present, and by the bottom board being covered with pieces of bee-bread mixed with the black gunpowder-like excrement of the worm. It must not be forgotten, however, that in the spring of the year, pieces of bee-bread at the bottom of the hive, *when not mixed with the black excrement*, is not necessarily a sign of the presence of the worm, but, on the contrary, may indicate industry and thrift. If a hive is very badly infested with the worm, it is better to drive out the bees and secure what honey and wax there may be left than to preserve it as a moth-breeder to infest the apiary. If put into a new hive, the bees may do something, and if they do not there is no loss, as they would have perished finally from the ravages of the worm.

"It should invariably be borne in mind that a strong stock of bees is ever capable of resisting, to a great extent, the attacks of the worm; while a starved or queenless swarm is quite indifferent to its attacks. In a common box-hive, a good way to entrap the worms after they are once in a hive is to raise the front upon two small wooden blocks, and to put a piece of woollen rag between the bottom board and the back of the hive. The worms find a cozy place under the rag, in which they form their cocoons, and may there be found and killed from time to time. Much can be done in the way of prevention, by killing every morning the moths which may be found on the outside of the hives. At this time of the day they allow themselves to be crushed, with very good grace, and if two or three are killed each morning, they would form an important item at the end of the year, especially when we recollect that each female is capable of furnishing a hive with at least 300 eggs. In conclusion, I give it as my conviction that immunity from the ravages of the bee-worm can only be guaranteed where a thorough control is had of both hive and bees: hence the great importance of the movable frame hive."

THE BEE-KILLER (*Trupanea apivora*), FITCH (*Diptera, Asilidæ*).

Fig. 11.

The following is also from Riley's First Annual Report:—

"In the last chapter of his ninth Report, Dr. Fitch describes a fly by the name of of the 'Nebraska Bee-killer,' which he received from Mr. R. O. Thompson, of Nursery Hill, Otoe County, Nebraska, and which the latter named gentleman had found preying upon the bee in North Nebraska in the summer of 1864. Mr. Thompson has since removed from Nebraska to North Missouri, and in conversation with him he informed me that he had met with this bee-killer each year since 1864, and that it seemed to be increasing. At a later day, in a communication to the *Rural World*, of Sept. 12th, 1868, he states that it made its appearance in such numbers in North Missouri last summer that it, to a great extent, prevented the bees from swarming. I present above, at Fig. 11, a life-size portrait of this voracious insect, its general colour being yellowish-brown or yellowish-gray. This figure will enable its ready recognition, and those who wish a very full and detailed description of it will find it in the report of Dr. Fitch, above referred to. It belongs to the *Asilus* family of two-winged flies, which have been very aptly termed the hawks of the insect world. Last July I found these flies quite common in Mr. Shaw's beautiful gardens in St. Louis, and I watched them by the hour, and found, to my amazement, that though other insects were flying all around, as well as other species of bees, yet they never seized any other species but the common honey-bee. They capture the bee on the wing, pouncing on it with lightning-like rapidity, and grasping it securely with the fore legs, they alight upon some plant, or even upon the ground, and rapidly suck out the inside of the bee, with the stout and powerful proboscis which is shown in the figure, leaving the empty shell when they get through. Mr. Thompson says that beneath some favourable perch that is near the apiary, hundreds of these bee-shells may be found accumulated in a single day, while he has watched and found that a single fly on one of those perches destroyed no less than 141 bees in that period of time.

" The habits of these flies are little known, and until they are better understood no feasible way of protecting the bees from their attacks can be given. Those which are known to haunt the apiary should be captured, and this can best be done by means of a net. It is almost impossible to catch them while on the wing, though as soon as they have settled with their prey they are caught with comparative ease. It will pay thus to catch them, for they are, doubtless, the cause of much of the non-swarming which we hear of."

In addition to the Bee-moth and the Bee-killer, there are several small insects which are parasitic on the Honey Bee, but which, although very numerous in Europe, are not very familar in America, We give here a few notes from Packard's work entitled " Our Common Insects."

In Europe, one of the most formidable foes of the hive bee is the Phora, a small fly about a line and a-half in length : it is found in the summer and autumn flying slowly about flowers and windows, and in the vicinity of bee hives. When impelled by instinct to provide for the continuance of its species, the Phora enters the bee-hive and gains admission to a cell, when it bores with its ovipositor through the skin of the bee larva, laying its long oval egg in a horizontal position just under the skin. The embryo of the Phora is already well developed, so that in three hours after the egg is inserted in the body of its unsuspecting and helpless host, the embryo is nearly ready to hatch. In about two hours more it actually breaks off the larger end of the egg-shell and at once begins to eat the fatty tissues of its victim, its posterior half still remaining in the shell. In an hour more it leaves the egg entirely, and buries itself completely in the fatty portion of the young bee. The maggot moults three times. In twelve hours after the last moult it turns around with its head towards the posterior end of the body of its host, and in another twelve hours, having become full-fed, it bores through the skin of the young, eats its way through the brood-covering of the cell, and falls to the bottom of the hive, where it changes to a pupa in the dust and dirt. Twelve days after the fly appears.

The young bee, emaciated and enfeebled by the attacks of its ravenous parasite, dies, and its decaying body fills the bottom of the cell with a slimy, foul-smelling mass, called " foul-brood." This gives rise to a miasma which poisons the neighbouring brood, until the contagion (for the disease is analogous to typhus, jail, or ship fever) spreads through the whole hive, unless promptly checked by removing the cause and thoroughly cleansing the hive.

Foul-brood sometimes attacks an American hive, and, though the cause may not yet be known, yet from hints given above, we hope to have the history of our species of Phora cleared up, should our disease be found to be sometimes due to the attacks of such a parasite fly.

Another foe is the Bee-louse of Europe, *Braula cœca*, a singular wingless spiker-like fly, allied to the wingless sheep-tick, the wingless bat-tick, and the winged horse-fly. The head is very large, without eyes or ocelli (simple eyes), while the ovate hind-body consists of five segments, and is covered with stiff hairs. It is one-half to two-thirds of a line long. This spider fly is " pupiparous," that is, the young, of which only a very few are produced, is not born until it has assumed the pupa state, or is just about to do so. The larva is oval, eleven-jointed, and white in colour. The very day it is hatched, it sheds its skin, and changes into an oval puparium of a dark brown colour. Its habits resemble those of a flea. Indeed, should we compress its body strongly, it would bear a striking resemblance to that insect. It is evidently a connecting link between the flea and the two-winged flies. Like the former, it lives on the body of its host, and obtains its food by plunging its stout beak into the bee and sucking the blood. It has not been noticed in this country, but is liable to be imported on the bodies of Italian bees. Generally one or two of the Braulas may be detected on the body of the bee : sometimes the poor bees are loaded down by as many as a hundred of these hungry blood-suckers. Assmuss recommends rubbing them off with a feather, as the bee goes in and out of the door of its hive.

Among beetles, the *Trichodes apiarius* has long been known in Europe to attack the young bees. In its perfect or beetle state, it is found on flowers, like our *Trichodes Nuttallii*, which is commonly found on Spiræas in August, and which may yet prove to enter our bee hives. The larva devours the brood, but with the modern hive its ravages may readily be detected.

The Oil-beetle, *Meloë angusticollis* is a large dark-blue insect found crawling in the grass in the vicinity of *Andrena*, *Halictus*, and other wild bees in May, and again in August and September. (Our readers will find this Meloë fully described in another part of this Report, by Mr. Saunders.)

Fabre has also, in a lively and well-written account, given a history of the *Sitaris*, a European beetle, somewhat resembling Meloë. He says that Sitaris lays its eggs near the entrance of bees' nests, and at the very moment the bee lays her egg in the honey cell, the flattened, ovate Sitaris larva drops from the body of the bee upon which it has been living, and feasts upon the contents of the freshly laid egg. After eating this delicate morsel, it devours the honey in the cells of the bee, and changes into a white, cylindrical, nearly footless grub; and after it is full-fed, and has assumed a supposed "pupa" state, the skin, without bursting, incloses a kind of hard "pupa" skin, which is very similar in outline to the former larva, within whose skin is found a whitish larva which directly changes into the true pupa. In a succeeding state, this pupa in the ordinary way changes into a beetle which belongs to the same group of Coleoptera as Meloë.

The history of *Stylops*, a beetle allied to Meloë, is no less strange than that of Meloë, and is in some respects still more interesting. On June 18th, I captured an *Andrena vicina* which had been "Stylopized." On looking at my capture, I saw a pale reddish brown triangular mark on the bee's abdomen: this was the flattened head and thorax of a female Stylops. On carefully drawing out the whole body, which is very extensible, soft and baggy, and examining it under a high power of the microscope, we saw multitudes, at least several hundreds, of very minute larvæ, like particles of dust to the naked eye, issuing in every direction from the body of the parent now torn open in many places, though most of them made their exit through an opening on the under side of the head thorax. The Stylops, being hatched while still in the body of the parent, is therefore viviparous. She, probably, never lays eggs. It appears that the larvæ are hatched during the middle or last of June from eggs fertilized in April. The larvæ then crawl out on the body of the bee, on which they are transported to its nest, where they enter, according to Peck's observations, the body of the larva, on whose fatty parts they feed. Previous to changing to a pupa, the larva lies with its head turned towards that of its host, but before assuming the perfect state (which they do in the late summer or autumn), it must reverse its position. The female protrudes the front part of her body between the segments of the abdomen of her host. This change, Newport thinks, takes place after the bee-host has undergone its metamorphoses, though the bee does not leave her earthen cell until the following spring. Though the male Stylops deserts his host, his wingless partner is imprisoned during her whole life within her host, and dies immediately after giving birth to her numerous (for Newport thinks she produces over two thousand) offspring.

As in the higher animals, bees are afflicted with parasitic worms which induce disease and sometimes death. The well known hair-worm, Gordius, is an insect parasite; the adult form is about the size of a slender knitting needle, and is seen in moist soil and in pools; it lays, according to Dr. Leidy, "millions of eggs connected together in long cords." The microscopical, tadpole-shaped young, penetrate into the bodies of insects frequenting damp localities; fairly ensconced within the body of their unsuspecting host, they luxuriate on its fatty tissues, and pass through their metamorphoses into the adult form, when they desert their living house and take to the water to lay their eggs. In Europe, Siebold has described *Gordius subbifurcus*, which infests the drones of the honey-bee, and also other insects. Professor Siebold has also described *Mermis albicans*, which is a similar kind of worm, from two to five inches long, and of a whitish colour; this worm is also found, strangely enough, only in the drones, though it is the workers which frequent watery places to appease their thirst.

The Ring-legged Pimpla (*Pimpla annulipes*) Br.

In a previous Report (1874) occur descriptions and illustrations of two insects which are parasitic on the larvæ of the Codling-moth, which descriptions were from the fifth

Annual Report of Mr. Charles V. Riley; these two insects are the Ring-legged Pimpla, which will be described in this article, and the Delicate Long-sting will follow.

"The Ring-legged Pimpla is a black fly, varying considerably in size, the female sometimes measuring but ¼, others fully ½ inch, exclusive of ovipositor, the male somewhat smaller. The genus Pimpla was briefly characterized in my last report, p. 43, where it was shown that this same species attacks the Walnut Case-bearer (*Acrobasis juglandis*, Le B. I annex a lateral outline of a female Pimpla, Fig. 12). The male has a more slender abdomen, which is unarmed.

Fig. 12.

"Pimpla annulipes is black, the abdomen rough punctured above, with the borders of the joints polished and inclined to brown. The tegulæ are white, and the legs are reddish, with the exception of the middle and hind tibiæ which are dusky, especially the hind pair, and have a broad white annulus, sometimes indistinct on the middle pair, the posterior tarsi are dusky, especially the tip, the palpi are pale yellow. Cresson says it may be distinguished from the other species of this genus, by the scutellum being black, the tegulæ white, and the anterior coxæ yellowish red.

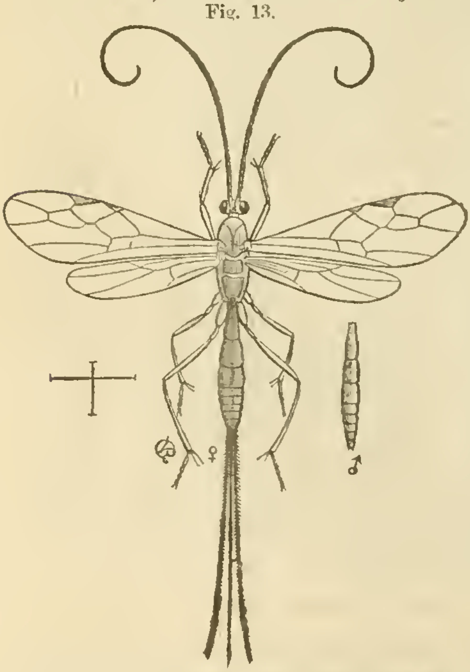
"This fly eats its way through the chrysalis and cocoon of the Codling-moth, without having previously made any cocoon of its own. It was quite abundant last summer, as from one lot of one hundred and sixty-two *Carpocapsas*, I obtained twenty-one parasites, all of them females but one. It is a widely distributed and common species."

The second parasite may be ealled the

Delicate Long-sting (*Macrocentrus delicatus*) Cress.

"It has recently been described by Mr. E. T. Cresson (Trans. Am. Ent. Soc. iv., p. 178), and is a somewhat variable species, occurring throughout the eastern, middle, and western States, and in Mexico. I subjoin a description drawn up from my bred-specimens,

Fig. 13.



Male. Length 0·25; expanse 0·45, inch slender, colour pale, polished, honey yellow; uniformly and sparsely pubescent; tinged with brown superiorly, the basal joint of the abdomen and a medio-dorsal line on the other joints being quite black. Head, with the eyes (except at disc), and a spot between ocelli, brown-black; palpi long and almost white; antennæ one fourth-longer than the whole body, about 48 joints, exclusive of bulbus, curled at tip, the ends of basal joints and the whole of joints dusky. Thorax, with the sutures well defined, and two small triangular black spots behind front tegulæ, the metathorax strongly trilobed; legs very long, pale honey yellow, with tips of tibiæ and tarsi faintly dusky; wings yellowish, hyaline and iridescent, with the veins luteous and the stigma pale honey yellow.

"Female, rather larger and with abdomen somewhat paler, otherwise similarly marked. Ovipositor yellow, $\frac{1}{5}$ longer than body, the sheaths quite pilose, and inclining to fuscous, described from two females and one male.

"It is a graceful fly with very long antennæ and legs, and the female with a long ovipositor, (Fig. 13) the hair lines at the side of the figure show the natural size of the fly. The colour is pale honey yellow inclining to brown above. The unfortunate apple worm is probably pierced while yet in the fruit, as it always succumbs soon after forming its cocoon, and before changing to chrysalis; while in the case of *Pimpla*, it is probably attacked either while leaving the fruit or after having spun its cocoon. The larva of the Delicate Long-sting forms for itself, within the cocoon of its victim, a sufficiently tough, thin, oblong-oval, shiny, brown cocoon, from which the perfect fly issues by cutting open a lid at one end.

"As both these parasites transform within the cocoon of the *Carpocapsa*, it is next to impossible and quite impracticable to separate friend and foe in removing and destroying the contents of the bandages; but where it is desired to disseminate the parasites they may be bred by enclosing large numbers of the *Carpocapsa* cocoons in some tight vessel."

On the 13th of August, 1873, Mr. Saunders took a number of chrysalides of the Codling-moth under a bandage on an apple tree, and among them there was one which was infested by ichneumons. The chrysalis, when emptied, was found to contain six of the parasitic larvæ, of which the following description was taken:—length, a little over one-tenth of an inch; body, tapering almost to a point towards the head; colour, dull, yellowish white, with a tinge of yellow along the dorsal region, very transparent, the internal organs showing plainly through. On each segment is a transverse row of short, whitish spines; terminal segment encircled with stouter whitish spines; no proper feet or prolegs, but in moving the mouth parts attach first with a sucker-like disc, and the hinder parts of the body are drawn gradually forward, different portions of the under surface being furnished with small fleshy prominences, which are attached, and in turn withdrawn from the surface on which the larva is moving: the principal points of attachment, however, seem to be the first and terminal segments; under the latter, when viewed sideways, there appears a fleshy projection much larger than any of those on the other segments, and this projection expands into a flattened disc, which holds the larva firmly to the place of attachment.

Mr. Saunders did not succeed in rearing these larvæ: after the chrysalis which contained them was broken open, they, one after another, died, in spite of all efforts for their preservation. Whether this would have proved distinct from the species last described by Mr. Riley, and thus make a third parasite on this pest (the Codling-moth), we are at present unable to determine.

THE PIGEON TREMEX (*Tremex columba*), LINN.

This insect has been found injurious to the pear, button-wood, and elm-trees.

The following is from Harris's "Injurious Insects":——

"The body of the female is cylindrical, about as thick as a common lead-pencil, and an inch and a half or more in length, exclusive of the borer, which is an inch long and projects three-eighths of an inch beyond the body. The latter rounds upwards like the stern of a boat, and is armed with a point or short horn. The head and thorax are rust-coloured, varied with black. The abdomen, or hinder and longest part of the body, is black, with seven ochre-yellow bands across the back, all of them but the first two interrupted in the middle. The horned tail, and a round spot before it, impressed as if with a seal, are ochre-yellow. The antennæ are rather short and blunt, rust coloured, with a broad black ring in the middle. The wings expand two inches and a quarter, or more; they are smoky-brown and semi-transparent. The legs are ochre-yellow, with blackish thighs. The borer, awl, or needle, is as thick as a bristle, spear-pointed at the end, and of a black colour; it is concealed, when not in use, between two narrow rust-coloured side-pieces, forming a kind of scabbard to it.

"This insect is figured and described in the second volume of the late Mr. Say's 'Entomology.' The male does not appear to have been described by any author; and, although agreeing in some respects with the two other species represented by Mr. Say, is evidently distinct from both of them. He is extremely unlike the female in colour, form and size, and is not furnished with the remarkable borer of the other sex. He is rust-coloured, variegated with black. His antennæ are rust-yellow or blackish. His wings are smoky, but clearer than those of the female. His hind body is somewhat flattened, rather widest behind, and ends with a conical horn. His hind legs are flattened, much wider than those of the female, and of a blackish colour; the other legs are rust-coloured, and more or less shaded with black. The length of his body varies from three-quarters of an inch to one inch and a quarter, and his wings expand from one inch and a quarter to two inches or more.

"An old elm tree in this vicinity (Cambridge, Mass.) used to be a favourite place of resort for the *Tremex columba*, or Pigeon Tremex, and around it great numbers of the insects were often collected, during the months of July and August and the early part of September. Six or more females might frequently be seen at once upon it, employed in boring the trunk and laying their eggs, while swarms of males hovered around them. For fifteen years or more, some large buttonwood trees in Cambridge have been visited by them in the same way. The female, when about to lay her eggs, draws her borer out of its sheath, till it stands perpendicularly under the middle of the body, when she plunges it, by repeated wriggling motions through the bark into the wood. When the hole is made deep enough she then drops an egg therein, conducting it to the place by means of the the two furrowed pieces of the sheath. The borer often pierces the bark and wood to the depth of half an inch or more, and is sometimes driven in so tightly that the insect cannot draw it out again, but remains fastened to the tree until she dies. The eggs are oblong oval, pointed at each end, and rather less than one twentieth of an inch in length. The larva, or grub, is yellowish white, of a cylindrical shape, rounded behind, with a conical horny point on the upper part of the hinder extremity, and it grows to the length of about an inch and a half. It is often destroyed by the maggots of two kinds of Ichneumon flies (*Pimpla atrata* and *Pimpla lunator*. Fabr.) These flies may frequently be seen thrusting their slender borer, measuring from three to four inches in length, into the trunks of trees inhabited by the grubs of the tremex, and by other wood-eating insects; and like the female tremex, they sometimes become fastened to the trees and die without being able to withdraw their borers."

In the *Canadian Entomologist*, November 1868, Vincent Clementi reports the capture in North Douro, Ontario, of several specimens of the Pigeon Termex; they were taken from an oak tree, which had been cut for cordwood, and were all found to be females.

The Sigalphus Curculio Parasite (*Sigalphus curculionis*) Fitch.

To those whose plum trees have been repeatedly ravaged by the Plum curculio and whose efforts have only been slightly successful in preventing the wholesale destruction of fruit, it will not be uninteresting to know that there are two known parasites of the curculio of which the following descriptions and illustrations are taken from Riley's Report, of 1870, for the State of Missouri.

"In 1860, in his address on the curculio delivered at the annual meeting of the N. Y. State Agricultural Society, Dr. Fitch gave an account, accompanied with a figure, of a small Ichneumon-fly which he named *Sigalphus curculionis*, and which he believed was parasitic on the curculio. Before that time no parasite had been known to attack this pestilent little weevil, and even to the present time (1870), it is currently believed that no such parasite exists; for unfortunately the evidence given by Dr. Fitch was not sufficient to satisfy some of our most eminent entomologists. These parasites were in fact received by him from Mr. D. W. Beadle, of St. Catharines, C. W., who had bred them from black-knot, from which he bred at the same time a certain number of curculios; but as other worms besides those of the curculio are likewise found in black-knot, we had no absolute proof that this fly was parasitic on the insect in question; consequently we find that Mr. Walsh, in his report as acting State Entomologist of Illinois rather ridicules the idea of its being a curculio parasite and endeavours to show that it is parasitic instead on the larva of his plum-moth (*Semasia prunivora*). But I have this year not only proved that poor Walsh was himself wrong in this particular inference, but that he was equally wrong in supposing his little plum-moth, so called, to be confined to plums; for I have bred it from galls (*Quercus frondosa*, Bassett), from haws, from crab-apples and abundantly from apples.

"To be brief, Dr. Fitch's *Sigalphus* is a true parasite on the plum curculio and I have bred hundreds of the flies from curculio larvæ. The first bred specimens gave me much pleasure, for as soon as I saw they belonged to the same genus as Dr. Fitch's fly, I felt assured that another disputed question was settled. but to make assurance doubly sure, I repeatedly half filled large jars with pure earth, finely sifted so that no living animal remained in it. Into these jars I placed curculio larvæ from day to day as they issued from peaches that were thrown into another vessel, and in due time the parasitic flies began to issue from the ground along with the perfect curculios. Nay, more than this, I soon learned to distinguish such curculio larvæ as were parasitised, and after they had worried themselves under the gronnd—seldom more than half an inch—I would uncover them, and on several occasions had the satisfaction of watching the gnawing worm within reduce its victim until finally nothing was left of him. As soon as the curculio larva is destroyed by the parasite, the latter (Fig. 14 *a*) encloses itself in a tough little yellowish cocoon of silk (Fig. 14 *b*.) then gradually assumes the pupa state (Fig. 14 *c*.) and at the end of about the same length of time that the curculio require to undergo *its* transformations and issue as a beetle, this, its deadly foe, gnaws a hole through its cocoon and issues to the light of day as a black four winged fly (Fig. 15 *a*, male; *b*, female). In the vicinity of St. Louis, this fly was so common the past season that after very careful estimates, I am satisfied three-fourths of all the more early developed curculio larvæ were destroyed by it. On the 17th and 18th of April, in that locality a severe frost killed the peach buds on all but a few of the young and most vigorous trees of Hale's Early and Crawford, so that instead of a large and abundant crop of peaches to depredate on, the little Turk had to concentrate his attacks on the few peaches that were left; and no one expected any fruit would be saved. Yet, the work of this little parasite was so effectual that, wherever fruit set, a fair crop was gathered even by those who made no effort at all to protect their trees.

Fig. 14.

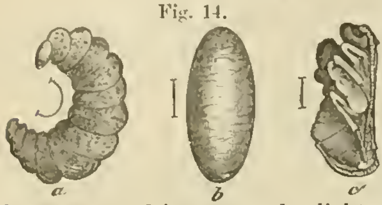
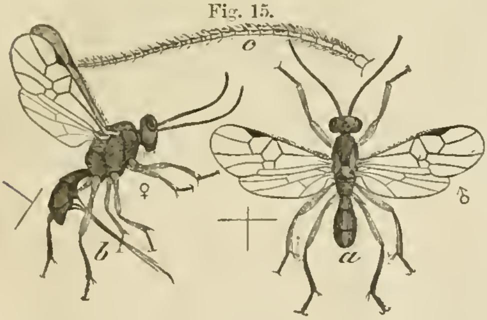


Fig. 15.



"While visiting Dr. Fitch last August, at his house in Salem, N. Y., I compared my bred specimens with his species, and found them identically the same; but a full description will be found below, and it is not necessary at present to dwell upon its characters.

"As Mr. Walsh bred this same parasite from the larva of his little plum-moth, it doubtless attacks other soft-bodied insects, and does not confine itself to the plum curculio. This is the more likely as it would scarcely pass the winter in the fly state. The female, with that wonderful instinct which is exhibited in such a surpassing degree in the insect world, knows as well as we, great lords of creation, what the little crescent mark upon the peach or plum indicates; and can doubtless tell with more surety, though she has never received a lesson from her parents, whether or not a curculio larva is drilling its way through the fruit. When she has once ascertained the presence of such a larva by the aid of her antennæ, which she deftly applies to different parts of the fruit, and which doubtless possess some occult and delicate sense of perception, which, with our comparatively dull senses, we are unable to comprehend—then she pierces the fruit, and with unerring precision deposits a single egg in her victim by means of her ovipositor.

"Now there is, as I shall shew in the description, a variety (*rufus*) of this parasite, with the ovipositor nearly one-fifth of an inch in length; but in the normal form the ovipositor is only twelve-hundreths of an inch long, and the curculio larva must be reached soon after it hatches, or while yet very young. Consequently we find that the earliest curculio larvæ or those which hatch while the fruit is yet small, are the most subject to be parasitised, and while from larvæ obtained early in the season, I bred more parasites than curculios, this order of things was reversed a little later in the year. Some persons will no doubt wonder how such a large fly can be developed from a curculio larva which is stung while so young; but we do not know how long the parasite egg remains unhatched, and it must be remembered that it is a rule, wisely ordained and long known to exist in insect life, that the parasitic larva does not at first kill outright, but subsists without retarding growth, upon the fatty portions of its victim, until its own growth is attained. Thus the first worm derives its nourishment from the juicy fruit and grows on regardless of the parasite which is consuming its adipose substance until the latter is sufficiently developed, and the appointed time arrives for it to destroy its prey by attacking those parts more vital.

"This parasite, which I will now proceed to describe, belongs to the second subfamily (*Braconides*) of the Ichneumon flies (*Ichneumonidæ*), and the venation of its wings, and the three-jointed abdomen, place it in the genus *Sigalphus*. Westwood (Synopsis, p. 63), gives three cubital panes or areolets in the front wings as characteristic of the, genus; but Brulé (p. 510) and, as Mr. Cresson informs me, Westmael in his *Braconides de Belgique*, give only two, which is the number in our insect.

"*Sigalphus curculionis*, Fitch—Imago (Fig. 15 *a*, male; *b*, female). *Head*, black, subpolished and sparsely covered on the face with short whitish hairs; ocelli touching each other; labrum and jaws brown; palpi pale yellow; antennæ (Fig. 15 *c*) twenty-seven-jointed, filiform, reaching when turned back, to middle joint of abdomen or beyond, the bulbous and small second joint rufus and glabrous, the rest black or dark brown, though 3-10 in many specimens are more or less tinged with rufous; 3-14 very gradually diminishing in size; 14-27 sub-equal. *Thorax*, black, polished, the metathorax distinctly and broadly punctate, and the rest more or less punctate or rugose, with the sides sparsely pubescent. *Abdomen*, pitchy-black, flattened, the dorsum convex, the venter concave, and the sides narrow-edged and slightly carinated; the three joints distinctly separated and of about equal length; the first joint having two dorsal longitudinal carinæ down the middle; all densely marked with very fine longitudinally impressed lines, and sparsely pubescent (Dr. Fitch in his description published in the *Country Gentleman*, under date of September, 1859, states that these lines leave 'a smooth stripe along the middle of its second segment, and a large smooth space on the base of the third;' which is true of a few specimens, but not of the majority in which the impressed lines generally cover the whole abdomen). Ovipositor longer than abdomen, but when stretched in a line with it, projecting backwards about the same length beyond; rufous, with the sheaths black. *Legs*, pale rufous, with the upper part of hind tibiæ and tarsi, and sometimes the hind femora, dusky. *Wings*, sub-hyaline and iridescent, the veins pale rufous, and the stigma black. Length, female .15-.16 inch, expanse, .30; male differs only in his somewhat smaller size, and in lacking the ovipositor. In many specimens the mesothorax and the eyes are more or less distinctly rufous.

"Described from 50 females, and 10 males, bred June 23rd—July 29th, 1870; from larvæ of *Conotrachelus nenuphar*, and 2 females obtained from Dr. Fitch."

"*Larva* (Fig. 14 *a*), white, with translucent yellowish mottlings. *Pupa* (Fig. 14 *c*, female), .17th inch long, whitish, members all distinct, the antennæ touching hind tarsi, the ovipositor curved round behind, reaching and touching with its tip the third abdominal joint, which afterwards forms the apical joint of imago; five ventral joints which in the imago become much absorbed and hidden, being strongly developed. *Cocoon* (Fig. 14 *b*), composed of one layer of closely woven yellowish silk."

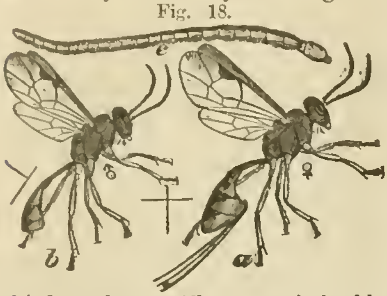
"*Variety Rufus.*—Head, thorax and most of the first abdominal joints entirely rufous, with the middle and hind tibiæ dusky, and the ovipositor three times as long as abdomen, and projecting more than twice the length of the same beyond its tip. Described from three females bred promiscuously with the others. This variety is slightly larger, and differs so remarkably from the normal form that, were it not for the absolute correspondence in all the sculpturing of the thorax and body, and in the venation of the wings, it might be considered distinct. The greater length of the ovipositor is very characteristic, and accompanies the other variation in all three of the specimens."

THE PORIZON CURCULIO PARASITE (*Porizon conotracheli*).

This parasite of the plum curculio is also described in Mr. Riley's Report for 1870, from which the following account is taken :—

"The present insect, instead of issuing the same summer as a fly, remains in its somewhat tougher and more yellowish cocoon all through the fall and winter, and does not issue in the winged state until the following spring. This parasite was first discovered by Dr. Trimble, who sent me the cocoon, from which I subsequently bred the perfect fly. It belongs to the first sub-family (*Ichneumonides*) of the Ichneumon-flies, and apparently to the genus Porizon, of which it forms a new species. It is only necessary here to state that it differs from the previous species in its reddish-brown abdomen, as well as in form, which may be seen by referring to the figures (*a*, female ; *b*, male ; *c*, antenna).

Fig. 18.



Porizon conotracheli, N. Sp.—Head : pitchy black, opaque, the ocelli triangularly placed, and close together. Eyes : oval, polished and black. Face : covered with a silvery white pubescence ; labrum rufous, with yellowish hairs ; mandibles and palpi, pale yellowish brown ; antennæ inserted in depressions between the eyes, reaching to metathorax when turned back, filiform, 24-jointed ; black with basal joints 6-1 becoming more and more rufous, the bulbus always distinctly rufous ; bulbus rather longer and twice as thick as joint 3 ; joint 2 about one-third as long. Thorax : pitchy-black, opaque, the sides slightly pubescent with whitish hairs, the mesothorax rounded and bulging anteriorly, the scutellum slightly excavated and sharply defined by a carina each side ; metathorax with the elevated lines well defined, and running parallel and close together from scutellum to about one-fourth of their length, then suddenly diverging, and each forking about the middle. Abdomen : glabrous, polished, very slender at base, gradually broader and much compressed from the sides at the apex, which is truncated ; peduncle uniform in diameter, and as long as joints 2 and 3 together ; joints 2–5 sub-equal in length ; colour rufous, with the peduncle wholly, dorsum of joint 2, a lateral shade of joint 3, and more or less of the two apical joints superiorly, especially at their anterior edges, black ; venter more yellowish ; ovipositor about as long as abdomen, porrect when in use, curved upwards when at rest, rufous, with the sheaths longer, and black. Legs, including trochanters and coxæ, uniformly pale yellowish-brown, with the tips of tarsi dusky. Wings subhyaline and iridescent, with veins and stigma dark brown, the stigma quite large, and the two discoidal cells sub-equal, and, as usual in this genus, joining end to end, but with the upper veins, which separate them from the radial cell, slightly elbowed, instead of being straight, thus giving the radial cell a quadrangular rather than a triangular appearance. Male differs from female only in his somewhat smaller size and unarmed abdomen. Expanse female 0·32 inch, length of body, exclusive of ovipositor, 0·22 ; expanse male 0·28, length 0.18.

"Described from 3, two females one male, bred May 26th-27th, 1870, from cocoons received from Dr. I. P. Trimble, of New Jersey, and 1 female subsequently received from the same gentleman—all obtained from larvæ of *Conotrachelus nenuphar*.

INDEX.

—o—

A

B

C

D

E

F

G

H

L.

M.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1877.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of Canadian Entomologist.

REV. C. J. S. BETHUNE, M, A.,

Head Master of Trinity College School, Port Hope.

B. GOTT,

Arkona, Ontario,

AND

JOSEPH WILLIAMS,

London, Ontario.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY HUNTER, ROSE & CO., 25 WELLINGTON ST. WEST.
1877.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1877.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of Canadian Entomologist.

REV. C. J. S. BETHUNE, M, A.,

Head Master of Trinity College School, Port Hope.

B. GOTT,

Arkona, Ontario,

AND

JOSEPH WILLIAMS,

London, Ontario.

Printed by Order of the Legislative Assembly.

Toronto:

PRINTED BY HUNTER, ROSE & CO., 25 WELLINGTON ST. WEST.

1877.

INDEX.

———:o:———

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1877.

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

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of Canadian Entomologist.

REV. C. J. S. BETHUNE, M, A.,

Head Master of Trinity College School, Port Hope.

B. GOTT,

Arkona, Ontario,

AND

JOSEPH WILLIAMS,

London, Ontario.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR 1877.

To the Honourable the Commissioner of Agriculture:

SIR,—In accordance with the provisions of our statute of incorporation, I have the honour to submit for your consideration the Report of the Entomological Society of Ontario, for the year 1877, in which you will find a detailed statement of the receipts and disbursements of the year, all of which are duly audited.

The annual meeting of the Society was held at the City of London, during the time of the exhibition of the Agriculture and Arts Association, when the various reports were read and the officers elected for the ensuing year.

The *Canadian Entomologist*, our monthly organ, appears regularly, and fully maintains its high standing. Its pages during the past year, have been enriched by many articles of the highest practical importance from leading entomologists. The numerous learned and original investigations and discoveries in Entomological science, which have been announced in the pages of the *Canadian Entomologist* have gained for it a high reputation in foreign countries, as is shown by the largely increased list of exchanges.

I have also the pleasure in submitting a Report on some of the noxious, beneficial and other insects of this Province, prepared on behalf of the Society by Mr. William Saunders, Rev. C. J. S. Bethune, M.A., B. Gott, and myself. This Report is well supplied with illustrations of the insects described, and will, we believe, prove valuable and interesting.

I have the honour to remain, sir,

Your obedient servant,

JOSEPH WILLIAMS,

Secretary-Treasurer of the Entomological Society of Ontario.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The seventh annual meeting of the Entomological Society of Ontario, was held in London, at the rooms of the Society, on Wednesday evening, September 26th.

The President, W. Saunders, in the chair.

Present :—D. W. Beadle, St. Catharines ; Professor Buckland, Toronto ; P. C. Dempsey Albury, B. Gott, Arkona ; Rev. R. Burnet, London ; Chas. Arnold, Paris ; David Boyle, Elora ; Colonel McGill, Oshawa ; E. B. Reed, London ; J. M. Denton. London ; Charles Chapman, London ; A. Puddicombe, London, and others.

After calling the meeting to order, the President expressed his regret that the Society had during the year lost the valued services of one of its officers. Owing to pressing business engagements, the Secretary-Treasurer, Mr. J. H. McMechan, had found it necesary to resign. Pending the appointment of a successor, Mr. J. Williams had kindly consented to act as Secretary *pro tem.*, and in this capacity had rendered most valuable and timely assistance.

The report of the Treasurer showed a very satisfactory state of the finances, there being a balance to the credit of the Society at the close of the financial year of two hundred and thirty-six dollars.

FINANCIAL STATEMENT OF THE SECRETARY TREASURER.

Receipts.

To Balance from 1876	$185 60
" Members' fees	194 55
" Sales of cork, pins, labels, &c	101 17
" Government Grant	750 00
	$1,231 32

Disbursements.

By Canadian Entomologist, printing, &c	347	75
" Paper for	102	76
" Printing labels	11	75
" Mail list and stamping	13	50
" Travelling expenses to Annual Meeting	6	00
" Sundry small expenses	50	70
" Postage, express and duties	46	82
" Library	77	52
" Engravings	20	04
" Merchandise, pins and cork	89	00
" Insurance	10	63
" Editor's salary	100	00
" Secretary-Treasurer's salary	50	00
" Expenses of Annual Report	68	00
" Balance	236	85
	1,231	32

We certify the above as a correct statement of accounts for the year ending September 26th 1877, as shown by the Treasurer's books, and with vouchers for the same.

John M. Denton, }
Charles Chapman. } *Auditors.*

REPORT OF THE COUNCIL, 1877.

In presenting the seventh annual report, the Council feel highly gratified at the success that has attended the labours of the Society during the past year.

We are happy to note the return of the Society's Centennial collection of insects, which reached London in good condition shortly after the close of the International Exhibition. This collection, which was noticed in your last annual report, is now placed in the Rooms, where it will in future be available for reference. As this beautiful collection was made up largely from the cabinets of individual members of the Society, who generously loaned the insects for the purpose of exhibition, it was thought that if the immediate return of the loaned specimens was insisted on, the value of the series would be greatly impaired ; but we are happy to state that the parties concerned have in most cases given their consent to allow the specimens to remain on deposit in the Society's Rooms, so that we still retain the Centennial Collection of Canadian Insects almost intact, a monument to the zeal and industry of those members of the Society who were actively engaged in this work.

We may add that this collection was placed on exhibition at the Rooms on several occasions after its return, when some of the members were present to assist visitors, and from the interest manifested then by the public in the matter, we would recommend that the Rooms be thrown open occasionally to all who may desire to visit them, and that public notice be given of the same

The Canadian Entomologist has almost completed its ninth volume, and fully maintains its reputation as a record of the latest investigations and discoveries in scientific and practical Entomology. We would return our heartiest thanks to all those who have so kindly contributed to the pages of the Entomologist, and request that they will continue to favour the Editor with the results of their observations and experiments. Although we have reason to feel gratified at the efforts of the Society to excite in the general public an interest in Entomology, yet we would respectfully suggest that our successors may be able in some measure to improve on the means adopted in the past to render the Entomologist even more useful to beginners in this interesting science, either by more frequent descriptions and illustrations of our common insects, and perhaps by referring to the insects that are likely to appear in each month of the summer, and the manner of their capture and preservation, or in any other method that may appear suitable.

We are happy to note a steady increase in the number of members. The Branch Societies, especially in London and Montreal, are progressing favourably.

The funds of the Society are in a gratifying state ; by economical management we have been enabled to sustain and successfully carry out all the operations we have undertaken ; for details we refer to the report of the Secretary-Treasurer.

The Library has been enriched by a number of valuable scientific works, and others of more general interest, but which bear on Entomological subjects. Among the additions we may mention the *Encyclopedia Britannica,* as far as at present published, which will prove invaluable as a means of reference. Our stock o engravings and electrotypes has been slightly increased, but in this line we are greatly restricted by want of means, and are obliged generally to content ourselves with electrotypes of other illustrations. We believe that a much larger sum than is annually given for this purpose might be profitably expended in procuring original illustrations.

Submitted on behalf of the Council by

JOSEPH WILLIAMS,
Secretary-Treasurer.

The President read his annual address, which received a vote of thanks. Rev. R. Burnet, in seconding the motion of vote of thanks, took occasion to speak highly of the value of the labours of Mr. Saunders, and suggested that his address appear in the daily papers as well as in the Annual Report, which was approved of.

ANNUAL ADDRESS OF PRESIDENT.

GENTLEMEN,—At the close of another year it is my duty and privilege to offer you a few remarks relating to our progress as a Society, and also to the general advancement of that department of natural science in which we all feel so deep an interest.

The progress of the Entomological Society of Ontario during the past year has been steady and continuous. Every season witnesses an infusion of new blood into our ranks, mainly from among the young, who, when entering on the pursuit of this charming study, bring with them all the enthusiasm and ardour of youth. Our membership is thus gradually increasing, and our influence and sphere of usefulness yearly extending. The importance of the study of Entomology is gradually becoming more deeply impressed upon the public mind. The Entomologist needs no longer to apologize for the trivial character of his pursuits, for small and apparently insignificant as the operations of the individual destructive insect may appear, yet when multiplied, as they usually are, by millions, their work is so disastrous and so desolating that the study of their life and history, with the view of combatting more effectually their enormous increase, becomes of the most vital importance.

We have to note the prevalence during the past year of several insect pests. Early in June our gardens, orchards, and even our forests in the western portion of Ontario were frightfully devastated with the Forest Tent Caterpillar, *Clisiocampa sylvatica.* There were millions upon millions of them, and so enormous were their numbers, and so persistent their attacks, that after fighting them bravely for a week or two, many gave up the contest in despair, weary of the slaughter. Many an orchard was rendered bare and leafless, and in some instances the woods were so void of foliage as to remind one of winter. This was particularly the case about London, and our orchards and gardens here were saved from destruction only by the most persistent effort. For several weeks caterpillars were swarming everywhere, so that the timid scarcely dared venture out under the shade of trees for fear of bringing them home on their clothing or persons. By the end of June they had nearly all become chrysalids, and it was interesting to observe the strange looking deformities they occasioned among ornamental shrubs and flowers by twisting the leaves into suitable forms in which to enclose their cocoons. On the trees the few fragments of leaves remaining were put to a similar purpose, and thus sewed up and hanging pendant with the weight of sometimes two or three cocoons huddled together, they looked very odd.

On examining a number of these chrysalids, a large proportion of them were found to be infested with parasites, which materially lessens the chances of their being so very numerous again next year ; still we fear that enough of them passed safely through all their preparatory stages to give us some trouble another season.

The Cabbage Butterfly, *Pieris rapæ*, is still progressing westward. This year it has extended its domain as far as Chicago, where a few of the advance guard have been captured. In the neighbourhood of London their larvæ have been very destructive this summer, so disfiguring and destroying the cabbages in many instances as to render them entirely worthless. The history of the introduction of this pretty little pest forms an interesting chapter in our Entomological annals. During the time of the Trent difficulty in 1861, a quantity of fresh vegetables were sent along with other stores to Quebec for the sustenance of the gallant little army which was despatched to our shores. As the Cabbage Butterfly is said to have made its appearance shortly after this period, it is presumed that it was accidentally introduced with the stores for the troops. In 1863 specimens were sent to us from this district for determination, which was the first intimation we had of their existence in this country. By 1866 the butterfly had spread further west than Montreal, and east as far as the Saguenay River. In 1869 it was reported as common in New Jersey, and by 1871 it had travelled east as far as Halifax, Nova Scotia, and west to the middle of the State of New York It now embraces an area bounded by the shores of the Atlantic from the River St. Lawrence to Virginia, and has overrun the whole country westward as far as Chicago. A few days since, while on a visit to the Muskoka District, I was surprised to find them plentiful, in company with the Colorado Potato Beetle, as far north as the head of Lake Rosseau.

The wonderful manner in which this insect has adapted itself to the varying climatic characteristics embraced within this wide area, is a matter of astonishment. It seems to thrive alike in the cold north and sunny south, and in every place where it established itself it has multiplied so rapidly as to become in a very short time the commonest of all butterflies. The little parasite, *Pteromalus puparum*, which has also fortunately been introduced from Europe, and which is finally destined to keep this pest within reasonable bounds, is on the increase here, but is not yet sufficiently numerous to fulfil its mission as successfully as we could wish.

The Colorado Potato Beetle, as predicted, has at last found its way across the Atlantic, and founded colonies on the Continent and in the British Isles. Their arrival and settlement has caused a commotion almost as great as would the approach of a hostile army. According to newspaper accounts, large patches of ground where the enemy has been seen lurking have been saturated with benzine and fired, while in the search, the whole surface has been turned over with the spade and shovel as carefully as if each specimen were a nugget of gold or a diamond. Cargoes of all sorts in which it was suspected the intruders could find a hiding place have been submitted to the most rigid examination by government officials, and various edicts were promulgated, with a view to strangle this evil in its infancy ; but the beetle is heedless of enactments, however prohibitory, and we fear that no vigilance, no matter how persistent, will prevail in preventing the spread of this little intruder, and that before long the potato grower in Europe will be obliged to regularly adopt measures for poisoning this pest similar to those so successfully carried out by our own people.

Since I was last privileged to address you, the Congress of the United States, in view of the enormous losses yearly inflicted on agriculture by destructive insects, have appointed an Entomological Commission composed of eminent Entomologists, who shall devote their whole time for several years to a study of the habits of the various insect pests, and the thorough testing of the efficiency of such remedies as have been or may be devised for their destruction, and to report progress from time to time. A liberal appropriation to defray the expense of this work has been made, and the labourers are now actively engaged in the field.

Early in the year, your President was requested by the Chief of this Commission, Prof. C. V. Riley, to bring this important matter before our Government and ask their influence towards furthering the objects in view. Accordingly, at a meeting of the Council of Agriculture, held in June last, the writer introduced a resolution urging the co-operation of our Government with that of the United States in this undertaking, which was unanimously adopted by the Board and transmitted to the proper authorities. I am pleased to be able to state that the Minister of Agriculture, in his reply, assured us that this subject had already engaged their serious attention, and that every effort would be made to aid the Commission in its work. This season is being spent by these savans in especially studying the habits and breeding places of the destructive Locusts of the West, and already they have made extended observations, not only in the western territories of the United States, but also in some of the adjoining portions of our Dominion.

The Entomological Club of the American Association for the Advancement of Science held its annual meeting in Nashville, Tenn., commencing on the 30th of August, when many interesting subjects were discussed. An important paper was read by A. R. Grote. Esq., of Buffalo, N. Y., on a new insect, destructive to the red and white pine trees, the sources of our valuable lumber trade. From the details given of the work of this insect we fear it may prove a formidable foe to the future growth of our pine forests. Our Society has usually been represented at these annual gatherings, but on this occasion, owing to other pressing and unavoidable engagements, those of us who have usually attended were prevented from being present.

We cannot better illustrate the recent progress made in Entomological science than by referring to one department, namely, that of the study of our night-flying moths. This has been greatly stimulated by the general practice of sugaring, by which immense numbers of these insects have been attracted, and their capture in good condition made an easy matter. This practice in America was but little followed until 1874, when an English Entomologist, Mr. George Norman, visited Canada, and, after having faithfully carried out the process of sugaring for a season, he published the result of his labours and his mode of operating, in our journal. His success was so unprecedented, and so many rare, or hitherto unknown species captured, that collectors everywhere were induced to imitate his example, and in the short time that has since elapsed an immense number has been added to the list of known species, and our collections have been enriched by this means with an extensive series of hitherto rare specimens.

Our monthly journal, the CANADIAN ENTOMOLOGIST, is still well sustained, its pages being regularly filled with interesting and original contributions. Did time permit, I might have occupied your attention at considerable length by referring to the many valuable points brought out in these papers. I cannot, however, refrain from adverting to the contributions of Mr. W. H. Edwards, of West Virginia, on the life history of some of our butterflies, in which it has been shown that not a few of our so-called species are merely dimorphic forms of other species, and attention drawn to the important influence of cold in modifying these forms. By exposing the chrysalids to the influence of this agency by laying them for varying periods on ice, or placing them in an ice house, some of these dimorphic forms have been produced at will, thus throwing much light on the causes of variation in species.

I would also call your attention to the many recent valuable additions to Entomological literature in America, especially to the beautifully illustrated work of Dr. A. S. Parkard, on the Geometrids of North America; to the continuation of Edwards' magnificent work on North American Butterflies; to the learned and elaborate treatise on the Rhyncophora of America north of Mexico, by Drs. LeConte and Horn; to the excellent works of Prof. Townend Glover, of Washington, on American Diptera, Orthoptera, and Hemiptera; to the valuable reports of the State Entomologist of Missouri, and many other excellent works. But I must not trespass longer on your patience. Thanking you for your kind partiality in honouring me as you have done,

I have the honour to be,

Yours very sincerely,

WM. SAUNDERS.

London, Ontario, September 25th, 1877.

The election of officers then took place, with the following results:—

President.—W. Saunders, London.

Vice-President.—E. Baynes Reed, London.

Secretary-Treasurer.—J. Williams, London.

Council.—Wm. Couper, Montreal; Rev. C. J. S. Bethune, Port Hope; J. Pettit, Grimsby ; J. M. Denton, London ; Rev. R. Burnet, London ; R. V. Rogers, Kingston ; Ja. Fletcher, Ottawa.

Editor of Canadian Entomologist.—W. Saunders, London.

Editing Committee.—Rev. C. J. S. Bethune, Port Hope ; E. B. Reed, London ; and G. J. Bowles, Montreal.

Library Committee.—The President, Vice-President, Secretary-Treasurer, and J. M. Denton.

Auditors.—Chas. Chapman and A. Puddicombe, of London.

During the time allotted for miscellaneous business, Mr. D. W. Beadle, of St. Catharines, spoke of the ravages of the Cabbage Butterfly, *Pieris rapæ*, and of the great benefit that would be conferred on gardeners by the discovery of some remedy which might be safely used for this pest. He also referred at length to the great success which had attended the labours of the Entomological Society, and of the high reputation it had acquired in America and foreign countries.

The President, in reply, referred to the rapid increase of the small parasite Pteromalus puparum, which preys on this species, and the gratifying prospect of a speedy diminution n numbers of the cabbage butterfly from this cause.

Mr. P. C. Dempsey, of Albury, stated that hot water had been successfully used in his neighbourhood to destroy the *Pieris* larva ; that experiment had shown that the cabbage would bear the application of water heated to 200° Fahrenheit, without injury, while water at a somewhat lower temperature than this would effectually destroy the larva. The hot water may be applied through a rose sprinkler, or by the use of a dipper. He also stated that a cold infusion of Quassia, in the proportion of two or three pounds to a barrel of water, had been found effectual in destroying the worm, and more convenient in its application than hot water. This solution may give a slightly bitter taste to the vegetable, unless thoroughly washed, but it is perfectly harmless to the human system.

Mr. Chas. Arnold, of Paris, referred to the increasing ravages of the Codling worm (*Carpocapsa pomonella*), and stated that he had scarcely a sound apple in his orchard this year. This was, doubtless, partially due to the small crop, and he hoped that the scarcity of apples this season would so far starve out this insect that we might enjoy some immunity from its attacks for a year or two.

Rev. Dr. Burnet, President of the Fruit Growers' Association, expressed his pleasure at being present, and his high appreciation of the labours of the active members of the Society, and referred to the great benefits which fruit growers had derived from the publication of the results of their investigations on noxions insects injurious to fruits.

Prof. Buckland, of the Department of Agriculture, Toronto, spoke of the great utility of the work carried on by the Society in diffusing information in reference to the various insect pests which afflict the farmer and fruit grower, and of the flattering notices he had seen in foreign journals concerning the CANADIAN ENTOMOLOGIST. He believed the Society well deserved the cordial support of all those interested in agriculture.

The President, in confirmation of these remarks, alluded to the fact that the CANADIAN ENTOMOLOGIST numbers on its exchange list many periodicals of the highest standing, English, American, French and German.

ANNUAL MEETING OF THE LONDON BRANCH

The Annual Meeting of the London Branch of the Entomological Society of Ontario, was held on January 23rd, 1877, at the rooms of the Society.

The following officers were elected for the year 1877 :—

President.—Chas. Chapman.

Vice-President.—J. M. Denton.

Secretary-Treasurer.—J. Williams.

Curator.—A. Puddicombe.

Council. —Messrs. H. P. Bock, W. Saunders, and J. Williams.

The Annual Report of the Secretary-Treasurer was read and adopted ; it showed that a small balance remained after all expenses had been met.

REPORT OF THE COUNCIL.

The Council of the London Branch of the Entomological Society of Ontario, beg to submit the following :—

The prospects of the Branch are very good ; the meetings have been well attended, excepting during the heat of the summer, and many valuable additions have been made to our collections.

The experiment of placing the Centennial Collection on exhibition at the rooms was so favourably received by the public, that it has been decided to take steps to the more frequent admittance of non-members, and in this way it is hoped and believed something may be done to create a wider and deeper interest in our favourite branch of science. This is a matter of great importance, and we have no doubt our members will acquit themselves creditably in it.

Submitted on behalf of the Council, by

JOSEPH WILLIAMS,
Secretary-Treasurer.

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Fourth Annual General Meeting of this Branch was held on Tuesday, 1st of May at 8 o'clock p.m., at the residence of H. H. Lyman, Esq., the President, in the chair.

The following report was read and adopted :

REPORT.

Your Council beg to present the Fourth Annual Report of the Society's operations.

They would refer with pleasure to the satisfactory progress of the Society in the study of our science, evinced by the steadiness with which the monthly meetings have been kept up, and the interesting and valuable papers read at these meetings. Solid progress has been made in the identification and classification of the insects of Montreal, and much preliminary work has been accomplished, the value of which will appear hereafter. The only cause for regret is that our number continues so small, but the zeal and perseverence of the present members go far to compensate for their paucity in number. Your Council entertain the hope that at no distant day our membership will be augmented by the addition of at least a few more students of our useful and interesting branch of natural history.

Twelve meetings were held during this year, at which the following papers were read and presented to the Society :

G. J. Bowles—"List of Eggs and Larvæ Described in the Seven Volumes of the CANADIAN ENTOMOLOGIST."

H. H. Lyman—"Notes on the Occurrence of *Argynnis idalia.*"

F. B. Caulfield—"List of the Geometridæ of Montreal."

W. Couper—"On *Phyciodes tharos.*"

H. H. Lyman—"List of some of the Geometridæ of Montreal."

F. B. Caulfield—"Notes on some Species of *Chrysomelidæ* Occurring on the Island of Montreal."

F. B. Caulfield—"Notes on the Species of *Meloe* in Canada."

H. H Lyman—"Entomological Rambles, Including Notes on Entomology at the Centennial Exhibition."

G. J. Bowles—"The Noctuidæ of Quebec."

G. J. Bowles—"Notes on D'Urban's Paper in the *Canadian Naturalist*, Vol. v., with Identifications of the Species."

Some progress has been made during the year in the compilation of the "Montreal Catalogue," and the names of 790 identified species are now entered on the list, comprising 385 Lepidoptera, 367 Coleoptera, 4 Diptera, 15 Orthoptera, 16 Hymenoptera and 3 Hemiptera. The earnest co-operation of the members is requested by your Council in this work. There is no doubt but that it will be of immense value to future students and will form a lasting memorial of our labours.

The finances of the Society have engaged the earnest attention of your Council. They would recommend that the cash on hand be expended in books for our Library, under the direction of the new Council.

The whole respectfully submitted.

GEO. JNO. BOWLES,
President.

Montreal, 1st May, 1877.

The following were then elected to office for the ensuing year:

G. J. Bowles, President, (re-elected); H. H. Lyman, Vice-President; G. B. Pearson, jr., Secretary and Treasurer (re-elected); C. W. Pearson Curator (re-elected); Council—F. B. Caulfield, Robert Jack, W. Hibbins, jr.

After a pleasant conversation on Entomological subjects, and the examination of numerous specimens, the meeting adjourned.

G. B. PEARSON, Jun.,
Secretary.

EXPERIMENTS ON THE COLORADO POTATO BEETLE.

By W. Brodie, Toronto.

The following interesting paper giving details of experiments on the Potato Beetle was read at a recent meeting of the Toronto Entomological Society:—

GENTLEMEN,—I herewith submit for your consideration a synopsis of a series of experiments, conducted by myself, intended to determine certain facts in the life-history of *Doryphora* 10 *lineata*, about which there is a good deal of popular misconception.

The experiments were made in cages, where the natural conditions of temperature, light, and moisture were maintained as nearly as possible; the same cages in which I had successfully reared larvæ of *Papilio trolius* and other delicate lepidoptera.

To secure greater accuracy nearly every experiment was repeated, or two or more conducted simultaneously, and the results carefully compared and recorded.

The more important propositions supported by these experiments are:

First.—The potato is the only plant in Ontario on which the beetle can feed so as to become very numerous.

Second.—Food is necessary to the imago, in order to develope the reproductive functions.

Third.—If not supplied with food the imago will die in a short time—perhaps never exceeding two weeks.

Fourth.—The advent in Toronto of *Lydella doryphoræ*, by far the most reliable and valuable of all the enemies of *D.* 10 *lineata*.

It is so generally conceded that *D.* 10 *lineata* will not feed on the leaves of any of our forest trees neither on any of our grasses, nor cyperaceous plants; that proofs of this need not be submitted nor discussed. The plants experimented upon, you will see, are mainly those which have been named as food plants by newspaper men, farmers and others.

Experiment 1.—Thirty mature beetles, after being kept without food for twenty-four hours, were supplied with leaves of carrot, parsnip, beet, pumpkin, lettuce, sunflower, sage, *Panicum crus galli*, and cabbage, for eight hours; none eaten; when supplied with potato leaves, all ate freely.

Experiment 2.—Thirty mature beetles, after being kept without food for thirty-two hours, were supplied for sixteen hours,—in addition to the plants named in experiment 1.—with red root, (*Amarantus hybridus*), sheepbur, (*Cynoglossum officinale*), burdock, (*Lappa officinalis*), small bur, (*Echinospermum lappula*), sour dock, (*Rumex crispus*), *Lobelia syphilitica* and *L. inflata*, lambs quarter, (*Chenopodium album*), mullein, (*Verbascum thapsus*); none eaten; when supplied with potato leaves all ate freely. This experiment was also repeated three times, with uniform result.

Experiment 3.—Thirty mature beetles, after being kept eleven days without food, were, in addition to the plants used in the second experiment, supplied with leaves of milk weed (*Asclepias cornuti*), arrow head (*Saggittaria variabilis*), Canada thistle (*Cirsium arvense*) water parsnip (*Sium lineare*), golden rod (*Solidago nemoralis*), fleabane (*Erigeron Canadense*), cat mint (*Nepeta Cataria*), common plantain, (*Plantago major*), *Apocynum androsæmifolium.* None were eaten. When supplied with potato leaves, all ate freely.. This experiment was repeated three times with unvarying results.

The solaneceous plants found in Ontario, outside of cultivation, on which it is generally admitted Doryphora will feed are the *Hyoscyamus niger*, *Physalis viscosa*, *Nicandra physaloides*, *Solanum nigrum*, *Solanum dulcamara*, *Datura stramonium.* It is very doubtful if Doryphora, either in the lavræ or imago state, will feed on the last two named. They are, however, all late plants, and would afford no food in the spring season, and so scarce that they would not feed the July brood for one hour.

Experiment 4.—Aug. 8. Took in fifty mature D. 10 lineata larvæ, forty-five of which had changed to beetles on Aug. 26, while five had died in the pupating stage. These forty-five beetles were kept without food ; four died on the fourth day, thirty-seven were dead on the fifth day, thirty-nine on the eighth day, forty-two on the tenth day, forty-five on the eleventh day. Over 75 per cent. died within five days, the males dying first. No pairing took place, no ova were deposited, and no disposition to hybernate was evinced.. This is the average of three cases conducted simultaneously, and which varied but little.

Experiment 5.—Aug. 8. Took in thirty mature beetles all of which had partaken of food, and kept them without food. Two were dead in fourteen days ; eight in nineteen days ; thirteen in twenty-three days ; sixteen in twenty-seven days ; twenty-four in forty-seven days. Twenty per cent. survived forty-seven days' fasting ; pairing occurred, and ova were deposited to a small extent during the first ten days. This is the average of three cases conducted simultaneously.

There is a very marked difference between this result and that of Experiment 4, where the beetles had never partaken of food.

Experiment 6.—Aug. 15. Twenty pairs *Doryphora*, after being well fed were kept in a dry situation ; thirty two were dead in twelve days ; all dead in twenty-two days ; the males died first ; a few ova were deposited during the first week. This experiment was repeated three times.

Experiment 7.—As to the rate of feeding, five experiments were tried. The beetles numbered fourteen to twenty-one, and the times from 3½ to 168 hours ; the average of the five trials was, one beetle will eat one square inch of potato leaves in thirty hours ; the maximum rate was ten hours, minimum was thirty-seven hours. It may be stated that one beetle during its imago life will defoliate one plant of potatoes.

Experiment 8.—Aug. 20. Took in fifty beetles which had been well fed ; eleven immediately buried themselves in the sand. September 6. All dead above ground ; turned out the sand and found the eleven alive ; replaced sand, also beetles ; eight at once buried themselves. September 15. Three remaining on surface dead. September 20. Found all on surface of sand, which I found quite dry ; on wetting sand all went down, are now alive October 16.

Experiment 9.—September 1. Took 100 *Doryphora* larvæ, some immature, fed them on potato. Sept. 10, all pupating. Sept. 20, 15 beetles out. Oct. 1, beetles all dead. On turning out the sand found that none had hybernated. This agrees with the results of seven experiments, and shows that there was no disposition to hybernate until after the middle of August, and then only by beetles which had fed.

The date of hybernation will vary according as the season is warm or cold, but I think it pretty certain that beetles which have not fed will not survive the winter.

A result of experiment 4 was the finding of a pupa case of *Lydella doryphora* under conditions which were fully narrated to you at our September meeting, and which you all agreed were conclusive as to the advent of this farmers's friend in Toronto.

It is hoped the publication of this will elicit evidence of its occurrence in other counties in Ontario, but it must be borne in mind that the very general use of Paris green by potato growers, has hitherto prevented the increase of this as well as other natural enemies of D. 10 lineata ; has, in fact, rendered their existence almost impossible.

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

Room 56, Maxwell House, NASHVILLE, TENN., Aug. 31, 1877.

Mr. Grote was called to the chair, and congratulated the meeting that there were found members from the South interested in the science of Entomology, and regretted the absence of the President of the Club and other officers. A letter was read from President LeConte as follows:

PHILADELPHIA, AUG. 24TH, 1877.

Secretary of the Entom. Club Am. Assoc. Adv. Sci. Nashville, Tenn.:

DEAR SIR,—I beg that you will express to the Entomological Club of the Association my great regret that I am not able to attend the meeting at Nashville. It was my intention to be present, but I find now at the last moment that it will be extremely inconvenient for me to leave this city. I greatly wished to take part in the discussion on nomenclature, but I have already expressed myself so strongly as against such changes as are produced by the rehabilitation of forgotten or disused names, that I think my opinions are fully understood by my colleagues.

Very truly yours,
JOHN L. LECONTE.

The Secretary's report of last year's meeting was received and adopted.

The chair drew the attention of the Club to the report of Capt. Dall on the subject of Zoological Nomenclature made at this meeting, and deprecated any separate action on the part of the Club.

The following resolutions were then passed:

Resolved—That since the Association has under consideration the subject of Nomenclature, the present Committee of the Club on that subject, consisting of LeConte, Riley, Saunders, Scudder and Grote, be continued to report at next meeting.

Resolved—That a request be made on the part of the Club to the Standing Committee of the Association, that copies of Capt. Dall's report on Zoological Nomenclature be printed and distributed to all active members of the Club before the issuance of the Nashville volume, so that the matter may be duly considered before the next meeting of the Club.

The meeting then entered into an election for officers for the next meeting, with the following result:

President: James A. Linter, of Albany, N. Y.

Vice-President: Wm. Saunders, of London, Ontario.

Secretary: B. Pickman Mann, of Cambridge, Mass.

Mr. Grote exhibited specimens in all stages of the New Pine Moth, *Nephopteryx Zimmermani.* He referred to Mr. Meehan's remarks after the reading of the paper before the Association on Thursday last, that this was probably the insect so destructive to the Scotch Pine about Philadelphia.

Prof. Nicholson stated that he thought from Mr. Grote's description and specimens that this insect was the one noticed as attacking the Scotch Pine near Knoxville. The trees had been imported from the north.

Mr. Grote alluded to the migratory habits of the Cotton Worm, and stated that in his original paper (Hartford Meeting) he had shown that the moth hybernated, but died before it could find cotton on which it could oviposit the ensuing year. Where the moth state was not reached the chrysalis perished in cold winters over the cotton belt. The broods were irregular, occurring in the same locality some years as early as June, some years as late as September.

Prof. Stubbs stated that in the main Mr. Grote's theory of a progression from south to north was, he was satisfied, correct. At the same time he called attention to occasions where the moth appeared in small areas, and thought it possible that in some cases the insect might succeed in holding over.

Mr. Grote stated that he thought that in localities where the circumstances were favourable, Southern Florida and along the coast of Georgia, that this might occur. He had in his original paper alluded to this, and he thought it more likely that the irregular patches on the cotton belt were partial colonizations from the southward or from the sea coast of Florida or Georgia. The first brood was more irregular in distribution. He further said that Prof. Tutwiler, of Ala., had told him that the observations made in his locality were to the effect that the south wind brought the worm ; in the present year the prevailing winds were from the north and they had been free rom the worm in Northern Alabama. Mr. Grote concluded by urging the creation of a scientific commission to look into the facts of the case. It was one that was most important to the agricultural interests of the South.

Prof. Nicholson stated that he had observed a few specimens of the Colorado Beetle near Knoxville ; the seed had been brought from the north.

Judge Bell stated that this year he had seen the Potato Beetle at Exeter, New Hampshire.

Mr. Grote exhibited some rare Celeoptera eollected at Buffalo, N. Y., by Mr. Ottomar Reinecke. Adjourned.

(Signed) A. G. Wetherby,
Secretary, pro. tem.

A NEW LEPIDOPTEROUS INSECT

INJURIOUS TO VEGETATION.

BY A. R. GROTE, BUFFALO, N. Y.

(*Read before the Am. Asso. Adv. Sci., August* 30, 1877.)

In the months of June and July the Red Pine (*Pinus resinosa*) and the White Pine (*Pinus Strobus*), show by the exuding pitch that they are suffering from the attacks of an insect. The wounds occur on the main stem below the insertion of the branch. On cutting into the bark the injury is found to be caused by a small larva, which, when full grown, measures 16 to 18 millimetres. The head is shining chestnut brown with black mandibles. The body is livid or blackish green, naked, with series of black dots, each dot giving rise to a single, rather stout, bristle, The prothoracic shield is blackish. The larva has three pair of thoracic or true jointed feet, and four abdominal or false feet, besides anal claspers. This larva, eating on the inner side of the bark, and making furrows in the wood, causes the bleeding which, when the depletion is excessive or continuous, and especially in the case of young trees, has proved fatal.

In July the worm spins a whitish, thin, papery cocoon in the mass of exuding pitch, which seems to act as a protection to both the larva and the chrysalis. The chrysalis contained in the cocoon is cylindrical, smooth, narrow, blackish-brown, about 16 millimetres in length. The head is pointed, there being a pronounced clypeal protuberance ; the segments are unarmed ; the anal plate is provided with a row of four spines, and two others, more slender, on either side of the mesial line, below the first. It gives the moth in ten to fourteen days. The perfect insect expands on an average 30 millimetres. An examination of the veins of the wing show that vein 7 of the primaries is wanting, while vein 1 is simple. On the hind wing the cell is closed or very nearly so. It belongs thus to the *Phycidæ*, a subfamily of the *Pyralidae*. The male antennæ are bent a little at the base, the joints inconspicuous ; the maxillary palpi in the same sex are not brush-like, and the hind wings are 8 and not 7 veined. We may refer the moth, then, to the genus *Nephopteryx*. Veins 3, 4 and 5 spring nearly together from the outer extremity of cell of the hind wings (though 5 seems to be nearly independent while running close to 4) ; vein 2 is not far removed from 3. On the primaries veins 4 and 5 spring from a common stalk, so that we must refer the moth to the sub-genus *Dioryctria* of Zeller. In colour the moth is blackish gray, shaded with reddish on the basal and terminal fields of the fore wings, There are patches or lines of *raised* scales on the basal field and on the anterior and darker portion of the medium space. The median lines are prominent, consisting of double black lines enclosing pale bands. The inner line at basal third is perpendicular, W-shaped or dentate. The outer line at apical fourth is once more strongly indented below costa. The black component lines do not seem to be more distinct on one side than on the other of the pale included bands or spaces. The median field is blackish, becoming pale towards the outer line, it shows a pale, sometimes whitish cellular spot, surmounted with raised scales. It can be seen that these raised scales (easily lost in setting the insect) accompany the median lines as well as forming the discal mark and the linear patch on the basal field. The terminal edge of the wing is again pale or ruddy before the terminal black line. The fringes are blackish. The hind wings are pale yellowish white, shaded with fuscous on costal region and more or less terminally before the blackish terminal black line ; the fringes are dusky. Beneath the fore wings are blackish, marked with pale on costa ; hind wings as on upper surface. Body blackish gray, with often a reddish cast on thorax above and on the vertex. The eyes are naked, the labial palpi long, ascending with moderate terminal joint. Tongue rather long. The gray abdomen is annulated with dirty white, the legs are pale dotted. The species differ from the European *abietella* by the raised scale tufts on the wings, and Prof. P. C. Zeller, who has kindly compared examples for me, declares it to be quite distinct from any European species. The pupa seems to differ from that of *abietella* by the clypeal prominence, which appears entirely absent in the European species, judging from Ratzburg's excellent figures. The larvæ is found to attack also various imported conifers; for this reason I supposed it might be an imported parasite. It has been noticed on the Scotch, Austrian and Russian Pine, and it will be found, I fear, a grave enemy to the cultivation of this genus of trees.

Since the insect is not noticed yet in any scientific publication, I propose to name it *Nephopteryx (Dioryctria) Zimmermani*, after Charles D. Zimmerman, of Buffalo, who has made many excellent observations on our noxious insects, and to whom I am greatly indebted for help in getting the present facts with relation to the species. He has kindly spent much time in climbing large trees and cutting out pupæ and larvæ and rearing the perfect insect.

The larvæ *abietella* is described by Ratzburg as living in the cones chiefly of various species of *Pinus*. Nevertheless he speaks of one instance in which it is found under similar circumstances to those which are usual with *Zimmermani*, which latter I have not yet noticed attacking the fruit. The European species is said to winter in pupa state. In the vicinity of Buffalo our species seems to be single brooded. I have not yet ascertained the winter state. Ratzburg recommends cutting off infested branches, but especially on small trees. I find the larvæ of *Zimmermani* usually infesting the main stem at the insertion of the branches. From the fact that the pitch of the trees offers a protection, I do not think that any washes would reach the insect. The knife, then, seems the only remedy.

Our species has a natural enemy in a small hymenopterous parasite with which I have found certain of the chrysalids to be filled.

THE UNITED STATES ENTOMOLOGICAL COMMISSION.

The enormous losses occurring yearly to agriculture in America from destructive insects are gradually awakening public attention in this direction, and also to the necessity of careful observations on the habits of these pests, with a view to their destruction or limitation. We were much gratified to learn that the late Congress of the United States, recognizing the importance of this subject, made a liberal appropriation to provide for the appointment of a commission of practical Entomologists to investigate and study the habits and life history of these insect pests, and thoroughly test such measures as have been or may be suggested with a view of lessening their ravages, the investigations to be carried on for several consecutive years. The Government has been particularly fortunate in securing the services of three eminently practical Entomologists to undertake this work, Prof. Riley, State Entomologist of Missouri, Dr. A. S. Packard, of Salem, Mass., and Prof. Thomas, State Entomoligist of Illinois. Prof. Riley has been designated Chief; Dr. Packard, Secretary, and Prof. Thomas, disbursing agent. While the destructive Rocky Mountain Locust, *Caloptenus spretus*, will specially engage the attention of the Commission during this year, careful observations will at the same time be made on other destructive pests. We desire to call particular attention to Dr. Packard's request in this present issue, for specimens in all stages of the Hessian Fly, Joint Worm and Wheat Midge, and trust that all our members will endeavour to aid the Commission in their labours in every possible way.

The headquarters of the Commission will be at St. Louis, Mo.; there will also be an office, with a clerk to attend to certain routine business, at the rooms of the Geological and Geographical Survey of the Territories, at Washington, D. C., Dr. F. V. Hayden in charge.

The locust area assigned to each Commissioner the present year is as follows:—

1. Prof. Riley takes for his field the region east of the mountains and south of the 40th parallel, the west half of Iowa, and, conjointly with Dr. Packard, British America west of the 94th meridian, where the principal source of the devastating swarms will probably be found.

2. Dr. Packard will take for his field West Wyoming, Montana, Utah, Idaho, and the Pacific Coast.

3. Prof. Thomas takes all the region east of the mountains not enumerated, including Nebraska, Minnesota, etc.

The publications will consist of circulars, bulletins, memoirs, and the annual report of doings and results of the work of the Commission.

To Prof. Riley are assigned more particularly the following divisions of the subject: Biology, or Natural History; Insect Enemies and Parasites; Remedies and Devices for Destruction.

To Dr. Packard: Anatomy and Embryology.

To Dr. Packard and Prof. Thomas, conjointly: Meteorological Bearings and Migrations.

To Prof. Thomas: Geographical Distribution, Enemies not Entomological, Agricultural Bearings of the Subject.

The Commission expects to secure co-operation with the United States Signal Bureau in affording meteorological data in connection with a study of the migrations of the locust; also, hopes to secure the aid of the Canadian Government in co-operating with it in its investigation in British America.

It is the determination of the Commission to confine its operations more particularly to the practical bearings of the subject, with a view to ascertain all possible remedies against these destructive insects. All else will be made subservient to the great object for which the appropriation was made, to wit:—

1. The best means of fighting the plague as it occurs in the States to which it migrates, but in which it is not indigenous.

2. The thorough investigation into its habits in its native home, with a view of preventing, if possible, its migrations therefrom.

The following are the topics on which data are requested from observers in all parts in reference to the destructive locust:—

1. Date, and time of day of the arrival of swarms.
   - 1*a*. Direction and force of the wind at the time.
   - 1*b*. Temperature and character of the weather at the time (clear or cloudy).
   - 1*c*. Direction of the flight, density, height and extent of the swarms.

2. Date and time of day of the departure of the swarms.
   - 2*a*. Direction and force of the wind at the time.
   - 2*b*. Temperature and character of the weather at the time.
   - 2*c*. Direction of the flight, density and extent of the swarms.

3. Date when the first eggs, if any, were deposited the present year.
4. Date when the eggs were most numerously hatching the present year.
5. Date when the eggs were most numerously hatching in previous years.
6. Proportion of eggs that failed to hatch the present year, and probable causes of such failure.
7. Nature of the soil and situations in which the eggs were most largely deposited.
8. Nature of the soil and situations in which the young were most numerously hatched.
9. Date at which the first insect acquired full wings.
10. Date when the winged insects first began to migrate.
11. Estimate the injury done in your County and State.
12. Crops which suffered most.
13. Crops most easily protected.
14. Crops which suffered least.
15. The prevailing direction in which the young insects travelled, and any other facts in relation to the marching of the young.
16. The means employed in your section for the destruction of the unfledged insects, or to protect crops from their ravages, and how far these have proved satisfactory.
17. The means employed in your section for the destruction of the winged insects, or to protect crops from their ravages, and how far these have proved satisfactory.
18. Description, and, if possible, figures of such mechanical contrivances as have proved useful in your locality for the destruction of either the young or the winged insects.
19. If your section was not visited in 1876, please state this fact.
20. If visited any previous year, please give the dates.

21. To what extent have birds, domestic fowls, and other animals, domestic or wild, been useful in destroying these insects?

As the successful prosecution of this work is as deeply important to the western portions of our Dominion (where immense damage is often inflicted by this destructive foe) as to any part of the United States, it is hoped that our Government will render all possible aid to the work of this Commission, either by instructions to parties engaged in surveys and other Government work in the western regions, to make the necessary observations, or otherwise by appointing suitable co-operating agencies to aid in the work.

No official report of the results of the labours of this important Commission has yet appeared, but the following telegraphic summary of the work of the season has lately been printed in the public newspapers:—

U. S. ENTOMOLOGICAL COMMISSION.

Report of its Labours in the North-West.

The Rocky Mountain Locust—His Parasites and Winged Enemies.

HOW THE GRASSHOPPER PLAGUE MAY BE STOPPED.

St. Louis, Nov. 12.—The labours of the United States Entomological Commission, appointed by Secretary Shurz last spring, to investigate the grasshopper plague, are drawing toward a conclusion. The Commission consists of Prof. C. V. Riley, State Entomologist of Missouri; Cyrus Thomas, State Entomologist of Illinois; and Prof. A. S. Packard, Jr., a Professor in the Peabody Academy of Science, of Salem, Mass.

The commissioners were appointed on the 20th of March, and a couple of weeks later the three members were out on their exploring tour. Prof. Riley took the States of Texas, Kansas, Iowa, and Colorado, and the British possessions as far north as the Saskatchewan Valley, and his investigations were to be directed more particularly to the biology of the grasshopper, generally called Rocky Mountain locust by entomologists, its entomological enemies and parasites, and remedies and devices for the prevention of the grasshopper plague. Prof. Packard's field was Montana, Utah, Idaho, the Western part of Wyoming, and the Pacific Coast, and he made a study of the anatomy and embryology of the grasshopper. The territory assigned to Prof. Thomas, embraced Minnesota, Nebraska, the eastern part of Wyoming, and all the other states and territories west of the Mississippi not taken by Profs. Riley and Packard; and the special subjects assigned to him were the geographical range of the grasshopper, his enemies not entomological, and the agricultural bearings of the subject. The original bill prevailed for a commission of five, and an appropriation of $25,000. Congress cut the money down to $18,000, and reduced the number of commissioners to three. Prof. Riley says all the commissioners met with unexpected success in their investigations. They met with the most cordial receptions among the people of the west and south-west everywhere, and were furnished by the farmers with a vast amount of valuable information which they never could have obtained if the informants had not felt themselves personally interested in the work of the commission. The U. S. signal bureau also aided the commissioners materially in furnishing them with accurate meteorological data, very necessary in the study of the migrations of the grasshoppers and their ova-deposits, as also the effect which climatic changes have upon them. Prof. Riley spent six weeks in the country in which the principal armies of grasshoppers are hatched, and which they leave as soon as the short, dry grass of the country, on which they principally subsist, is gone. The country is very thinly settled, but the professor was afforded every possible assistance in his investigations by the authorities of the Canadian Government, including Governor Morris and the Ministers of Agriculture and the Interior. Remaining in the British possessions about six weeks, Professor Riley closed his investigations and returned to Chicago, where he again met his fellow commissioners, Profs. Packard and Thomas, just returned from the districts visited by them. Notes were again compared, views interchanged, and statistical and other matter exchanged, and the commissioners separated once more, returning this time to their respective homes to write up the results of their investigations. Prof. Riley has been at home now five or six weeks, and has been engaged on the report ever since his return. He expects to complete the report by the middle of next month, and Profs. Packard and Thomas are to have theirs completed about the same time, when the commission will convene again and submit their labours as one work to the Government.

The result of the investigation of the commission has verified previous reports of Prof. Riley's individual investigations, and the commissioners are all of the opinion that a recurrence of the grasshopper plague can be prevented. They have found the native home of the insects; they know on what they feed, and when and under what conditions they migrate, the direction they take, and the distance they go, and the length of time they remain before they commence their homeward flight again. They know, also, the fatal effect that heavy rains and sudden changes of weather have on them, and that smoke will kill them as quickly as fire. They know, too, the parasites which live on the grasshoppers, and the birds—particularly the grackle and the English rook—that feed upon them. Knowing all this, they believe that the migration from British America can be, in a great measure, stopped, and that in case they do visit the fields of Missouri, Kansas, and other States of the union, the farmers can be forewarned in time to prepare for them with fire and water. The commission will recommend measures to Congress, looking to a Governmental treatment of this plague at its next occurrence.

NOTES ON LARVÆ—FONDNESS FOR WATER—HINTS TO BEGINNERS.

BY C. G. SIEWERS, NEWPORT, KY.

(*From the Canadian Entomologist.*)

Last spring, while collecting beetles under the bark of decayed logs, I met with numbers of the larvæ of *Arctia isabella* (hairs brown in the middle, black at each end of larva), about to spin up. Not knowing their hybernating habits, they had always baffled me, and under the impression that they would require another season to mature, had been turned loose. I collected some twenty, put them into a box with cotton and paper scrap, and they at once spun up, all but four. These wandered up and down for a week, having some want, and wasting away. It struck me they might want water. Wetting a sable, I proffered a drink. They all drank greedily, grasping the brush with their fore-legs, and even following it around. I watered them two or three days but tired of this and threw them out. The same day they were found spinning up on the fence. This spring I collected another lot, and gave them some curved bark to spin in. About one-half refused to spin. I soused them with water. Two remained contumacious, but another wetting brought them to terms. The black larva of the Great Leopard Moth, *Ecpantheria*, hybernates also, spins up about the first of June, and emerges about the 15th with us. Feeds on Poke-berry plant, and will eat cabbage. I failed to winter some twenty this season. Either they dry up in the house, or mould in the cellar. They should be wintered out-doors, in a box without bottom placed on the ground and half-filled with leaves and brush, exposed to the weather, but having proper drainage. They come out of the leaves in the spring distended by moisture. Whether they feed before spininng is uncertain. I collect them in the fall at the foot of willow trees, when digging up the pupa of *Smerinthus geminatus*.

It is generally claimed that moist leaves will induce scouring in the *Bombix mori*, but out-door larvæ get abundance of rain and dew, and may require it. In confinement they fail to get their full growth. Their food should be sprinkled daily. The great difficulty of keeping the food fresh deters many from rearing larvæ. To such I would say, try tin boxes or glass jars. Clean daily and keep moist. Two or three drops of water are sufficient. I have had a lot of empty fruit cans capped, and have kept food fresh in them for ten days. When the nearest food plant is three miles distant this is some object. I find that they do not require light, and but little air. When they cease feeding, remove to spinning or ground boxes. The ground must be kept moist, or the larva will be unable to remove the skin around the thorax, and strangle. If they find it too dry they will come out and try to escape. Many wander about for a day or two before burying themselves. Covering the ground with sod often expedites matters. When ten days have passed they may be sifted out to give place for others, and laid out in another ground box on top, as it is preferable to have them in sight, on account of vermin. Never pull larvæ from their food, especially when moulting in changing food. Clip the old food off around them, and they will change themselves. Placing some hungry *Apatura clytons* three inches from fresh food, they struck a bee line for it.

Raising larvæ is by far the most instructive feature of Entomology, and very interesting. Entirely too little attention is paid to it. We want the whole life. How utterly ignorant we are, for instance, about the larvæ of *Catocalae?* Let all faulty females be confined, and they may lay impregnated eggs; try the young on willow, walnut, or oak leaves. The female is known by the heavy body tapering to a point; the male terminates in a pair of claspers. Some species are readily determined by their antennæ, the males being more broadly pectinated than the females.

The larvæ of wood-boring beetles can be raised in tin or glass on wet saw-dust (not pine); any mixed hardwood or poplar will do. I have kept them so six and eight months, changing the saw-dust once a month. But they are very tiresome, as one may have to keep them a year or two.

HOW TO DESTROY CABINET PESTS.

BY PROF. JAMES T. BELL, BELLEVILLE, ONT.

(*From the Canadian Entomologist.*)

There is nothing more annoying to the experienced, or more discouraging to the young collector, than to have his specimens destroyed by mites, by the *Anthrenus*, or by the larvæ of *Dermestes*. Against the ravages of these enemies there is no security. Paste and paper fail to exclude them; camphor is only a partial protector; and the only safeguard of our cabinets is constant vigilance, and the instant destruction of the offenders when observed.

For this purpose many methods have been suggested—saturation with turpentine, immersion in alcohol or benzine, exposure to a heat of 210 degrees in a drying closet or oven, &c.; but most of these ways are apt to injure, or even destroy, the specimens, while the last is often ineffective. Having, however, found a certain and rapid method of dealing with these intruders, I desire, through your pages, to make it known to my brother naturalists.

Some two years ago I had a magnificent female *Platysamia (Saturnia) cecropia* measuring $6\frac{7}{8}$ inches across the wings when set out, which came out of a chrysalis in my breeding-box. I succeeded in killing and stretching it without damage, and when dry, transferred it to my interim box, which hung against the wall. In about a fortnight I was annoyed to see its antennæ cut off, the head and thorax denuded of most of their down, and some large holes made in the abdomen. After some consideration, I placed a gallipot, containing about 25 grains of cyanide of potassa roughly bruised, with a very little water, in the bottom of the case. I then introduced six drops of sulphuric acid, and let down the glass. In less than a minute I had the satisfaction of seeing a fine, stout *Dermestes* larva writhing in the death agony on the bottom of the box. Since that time, I have tried the same several times, and always with the same success. It is equally applicable to the destruction of moths, &c., in stuffed birds and quadrupeds as no animate being can inhale this gas and live.

JAMES T. BELL,
Belleville, Ont.

[NOTE.—Great caution would be necessary in using this remedy, not to inhale any of the highly poisonous gas which, by the use of the ingredients named, would be rapidly generated.—ED. C. E.]

RECENT ENTOMOLOGICAL WORKS.

The following brief notices of some of the most valuable Entomological publications which have appeared during the past year, are from the pages of the *Canadian Entomologist* :—

Economic Entomology, by Andrew Murray, F. L. S., London, England. Aptera, 8vo., pp. 433, profusely illustrated with wood-cuts.

This useful volume is the first of a series of hand books which are intended to serve as guides to the different departments of the collection of Economic Entomology in process of formation at the Bethnal Green branch of the South Kensington Museum, and also as practical treatises for the use of the public generally. In order the better to serve its primary purpose of guide to the collection, the contents of the several cases are described in this volume in the order in which they present themselves to the visitor, containing in some instances other specimens than insects. The work opens with a short chapter on Crustaceans likely to be mistaken for insects ; for example, species of *Oniscus*, *Porcellio*, and *Armadillo*. Next in order are the Miriapods—Julidae and Scolopendridae ; then Scorpions and their allies ; Spiders, Mites, Lice, Thysanura (Spring tails) and Lepismidae. Three new genera and thirteen new species are described in this volume.

The descriptions are briefly and plainly written, and the habits and life history of the species are delineated in a pleasing and popular manner. The work is well printed in good, clear type, and most of the illustrations are excellent. Already we have found it very useful, giving in a condensed form a vast amount of information not otherwise readily obtainable. We heartily commend this work to our readers, and trust that the talented author may be spared to complete the series proposed, which will appear in the following order :—2nd vol. Bugs ; 3rd, Locusts, Grasshoppers, Cockroaches, and Earwigs ; 4th, Two-winged Flies ; 5th, Bees, Wasps, &c. ; 6th, The Dragon Flies and May Flies ; 7th, Butterflies and Moths, and lastly, the Beetles.

Ninth Annual Report of the Noxious, Beneficial and other Insects of the State of Missouri. By Chas. V. Riley, State Entomologist, March, 1877 ; 8vo., pp. 129 with 33 illustrations.

We welcome the ninth of this series of valuable reports with much pleasure. The following are the subjects treated of in the order in which they appear ; The Gooseberry Span Worm ; the Imported Currant Worm ; the Native Currant Worm ; the Strawberry Worm ; Abbott's White Pine Worm ; LeConte's Pine Worm ; the Colorado Potato Beetle ; the Army Worm ; the Rocky Mountain Locust ; the Hellgrammite Fly, and the Yucca Borer. The bulk of the report, sixty-seven pages in all, is occupied with details in reference to that terrible scourge of the West, the Rocky Mountain Locust, *Caloptenus spretus*, the other and less important subjects being much more briefly treated of. These reports contain an immense fund of valuable information, and have done much to popularize Entomology in America.

CATALOGUE OF THE LEPIDOPTERA OF AMERICA NORTH OF MEXICO.

By W. H. Edwards.

Part 1—*Diurnals.* (*Published by the American Entomological Society, Philadelphia, 8vo. pp. 68 Price $1 ; interleaved for additions, $1.30.*

This work of Mr. Edward's is conservative in its character, and as such is most refreshing ; after having tried in vain to fathom the innovations with which we have for the past few years been perplexed, this excellent catalogue comes to our rescue, and will, we feel sure, be appreciated by all who do not believe in the excessive multiplication of genera and their establishment on minute and often variable characters. Here the dear old familiar names are nearly all in their places again, and we go back to the time-honoured method of heading our collections with *Papilio*, and embracing in it some 22 species.

For ourselves, we have for some time past been literally at sea in reference to names for butterflies, wandering about without chart or compass to direct us ; we scarcely knew the name of any species, and didn't expect ever to have the time or disposition to master the new names proposed, and hence we have been so discouraged that we have done really nothing to our collection of butterflies for a long time past. We are not disposed to object to changes in nomenclature where it can be made to appear that a *necessity* for such modifications exists, but we have been unable to see any good reason for adopting the wholesale changes which have been proposed, and we believe that the great bulk of working Entomologists hold the same view. With a catalogue now more to our mind, sufficiently progressive, and, at the same time, a most convenient help, we shall be able to classify our species under genera we can comprehend, and go to work with a will again.

In the general arrangement the author, while adopting and incorporating some of the work of later systematists, adheres mainly to the order of Doubleday and his associates in the "Genera of Diurnal Lepidoptera," and where the genera have numerous species, as in *Colias, Argynnis, Thecla, Lycaena, Pamphila*, &c., they are for the sake of convenience divided into sections. In crediting genera the author strictly follows the rules adopted by American Entomologists at the recent meeting in Buffalo, and appends the name of the party who first gave the genus a proper definition. For this reason Hübner's genera are excluded and two of the genera made by Mr. Scudder in the Hesperidæ, *Amblyscirtes* and *Pholisora*, have been credited to Dr. Speyer because his definition of them is the first published. With regard to Mr. Scudder's genera, we think he should have had credit for them. We all know what pains-taking and unsparing effort he has bestowed in labouring to introduce what he conscientiously believes to be needed reforms in Entomological nomenclature, and although the present generation of Entomologists is not disposed to adopt such wholesale reform as he proposes, he is undoubtedly *deserving of full credit* for any of his material which may be used. His work on New England Butterflies, in which all these genera are minutely defined, has long been written, but its expensive character has been an obstacle in the way of its publication. Under these circumstances, *which are very exceptional*, we regret that Dr. Speyer's references of these genera to Scudder have not been followed.

There are 506 species enumerated in this list, embraced in 64 genera. There are also references by the use of a system of special signs to all writers who have treated of the preparatory stages of our butterflies, no matter how briefly ; we regard this as an excellent and valuable feature in the work. The catalogue is in every way well got up, and we hope all our readers will procure a copy of it, and if, after they have given it a careful perusal, they think as well of it as we do, they will set to work and arrange their collections in accordance with it, feeling profoundly thankful to the author for the timely relief he has afforded.

The Rhyncophora of America, north of Mexico, by John L. LeConte, assisted by George H. Horn. From the Proceedings of the American Philosophical Society, Vol. 15.

This work, which fills a volume of 455 pages, is probably the most important contribution which has been made to the Entomology of America for many years. Its production must have been attended with immense labour and long and careful study. In addition to the work of classifying this numerous and difficult group of insects, a very large number of new species are described. We tender our sincere thanks to the authors for their kindness in sending us a copy of this useful and long-needed memoir.

Manuscript Notes from my Journal, or Illustrations of Insects Native and Foreign ; Order Hemiptera, sub order Heteroptera. By Townend Glover, Washington, D. C.

In the 12th No. of Vol. vi., we called the attention of our readers to the issue of a valuable work by the same author on Diptera. The volume now at hand on the Hemiptera is published in similar form and style, quarto, on heavy paper, printed on one side only, and the text a fac-simile of the author's handwriting. In this volume their are ten excellent plates, nine of which are devoted to the illustration of the species to which the notes refer, and one to the figuring of those portions of the insects on which their classification is based. There are figures of 238 species, many of the smaller ones in duplicate, one showing the insect magnified, the other of the natural size. In addition to the plates and there explanatory matter, there are 134 pages of text, 2 explanatory, 17 devoted to the classification of the Hemiptera, and the remainder to notes on the insects themselves, their habits, the animal and vegetable substances they injure, the remedies used for destroying them, &c., all being referred to in alphabetical order.

This work is another evidence of the indomitable perseverance of this energetic Entomologist, and will be a valuable aid to those who desire to study this hitherto much neglected order. The author has again placed us under deep obligation for his kind remembrance of us.

The Rocky Mountain Locust; being report of proceedings of a conference of the Governors of several western States and Territories, together with several other gentlemen, held at Omaha, Oct., 1876, 8vo., pp. 58.

We are indebted to our esteemed friend, C. V. Riley, for a copy of the above pamphlet, which contains much valuable information on the habits of this destructive pest, as well as a summary of the best means yet known for counteracting its ravages.

Packard's Half Hours with Insects, Boston, published by Estes & Lauriat, 1877, 12mo., pp. 384, illustrated, $2.50, which was originally issued in twelve numbers, has lately been published in book form. We desire to correct some typographical and other errors of importance. Page 187, in explanation of Fig. 188, for Bucculating read Bucculatrix; page 289, line 23, for *Disippus* read *Archippus*, and in line 25, for *Archippus* read *Disippus;* page 305, line 13, for sumac, read cottonwood, and on page 306, in explanation of Fig. 236, for sumac gall read vagabond gall. We cheerfully commend this useful work to our readers.

Report upon the Orthoptera collected by the Wheeler Expedition, by Samuel H. Scudder; 8vo., 17 pp. In this paper the author gives much valuable information in relation to the Orthoptera occurring on the eastern slope of the Rocky Mountains; 17 new species are described, and definitions of 8 new genera given. Report of the Hayden Expedition, from the Department of the Interior, containing Brief Synopsis of North American Ear-wigs, with an appendix of the fossil species; 8vo., 12 pp. List of Orthoptera collected by Dr. A. S. Packard, in Colorado, &c., during 1875; 8vo., 7 pp. Notice of a small collection of Butterflies made by Dr. Packard in Colorado and Utah. All by Samuel H. Scudder. We tender our best thanks to the author for copies of these papers.

Harpalus caligenosus from Nature, by Franklin C. Hill; two plates. We are indebted to Mr. Franklin C. Hill, of Princeton College, N. J., for copies of these excellent plates, recently published. They are beautifully finished and conveniently mounted on cards, 5 x 8, with all the organs and divisions both of the under and upper surface, distinctly named. They will prove a valuable help to beginners, and indeed to all who are not already familiar with the names of the different portions of the body of Coleopterous insects.

A FEW COMMON WOOD-BORING BEETLES.

BY THE REV. C. J. S. BETHUNE, M.A., PORT HOPE, ONT.

EXPLANATION OF THE PLATE.

Fig. 1. *Monohammus scutellatus*, Say—A Pine-tree Borer.
Fig. 2. *Clytus speciosus*, Say.—The Maple-tree Borer.
Fig. 3. *Orthosoma cylindricum*, Fab.—A Pine-tree Borer.
Fig. 4. *Clytus robiniæ*, Forst.—The Locust-tree Borer.
Fig. 5. *Chrysobothris femorata*, Fab.—The Buprestis Apple-tree Borer.
Fig. 6. *Saperda candida*, Fab.—The White-lined Apple-tree Borer.
Fig. 7. *Monohammus confusor*, Kirby.—The Pine-tree Borer.
Fig. 8. *Oberea tripunctata*, Fab.—The Raspberry Twig Girdler.

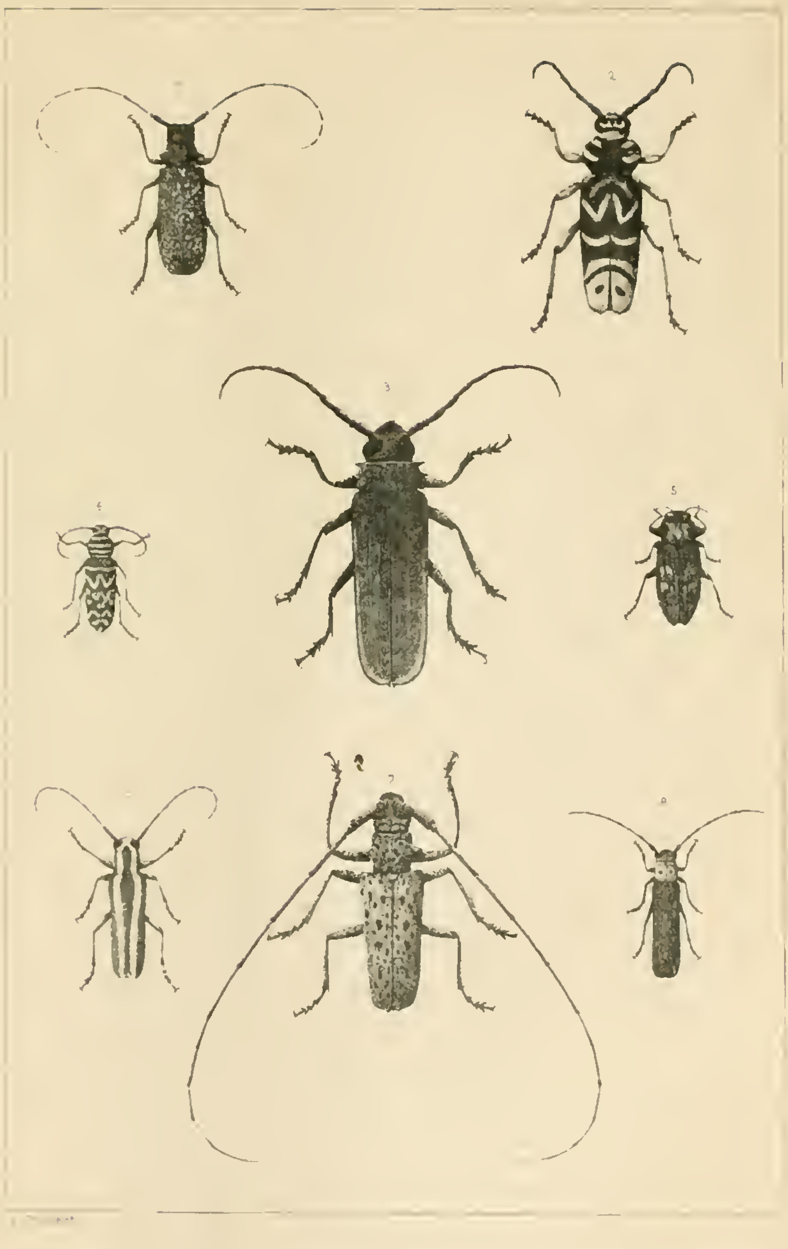
Our Canadian wood-boring beetles, with the exception of a few somewhat minute species, belong to the two great families of Buprestidæ and Cerambycidæ. These include an immense number of different genera and species; in Crotch's List of the Coleoptera of North America (north of Mexico), there are enumerated the names of no less than 169 species of the former family and 552 of the latter, about one-third of these are found in this country. It is evident, then, that to give a bare list of all our Canadian species of wood-borers would occupy no little space, while a detailed description of them, if one were competent for the task, would fill many issues of this Report. We propose, therefore, on the present occasion to merely give a brief account of the eight species depicted on the accompanying plate. These we have selected on account of their frequent occurrence in almost all parts of the country, and the consequent familiarity of their appearance even to non-Entomologists. Our readers will, we are sure, be pleased with the beauty of the figures, which have been admirably drawn upon stone by Mr. L. Trouvelot, of Cambridge, Massachusetts.

Taking the species in the order in which they are numbered on the plate, we come first to

I. Monohammus Scutellatus, Say—A Pine-Tree Borer.

This beetle, which derives its specific name from its conspicuously white scutellum, is of a shining black colour on both the upper and under surfaces, thickly punctured with irregular impressions; on the wing-cases there are, as shown in the figure, a number of scattered whitish spots of various shapes and sizes; these, on close inspection, are found to be composed of dense short white hairs, which often become rubbed off and disappear; the thorax is armed on each side with a thick triangular spine; the antennæ are many-jointed, and about the same length as the body in the male, while in the female they are about twice that proportion. The size of the beetle varies from less than half an inch in the male to over three-quarters of an inch (exclusive of the antennæ) in the female. The larva is a large thick white grub, destitute of legs, divided into a number of well-marked segments; the head armed with a strong pair of jaws. The larva infests the pine, after the timber has been cut or newly fallen, and often causes serious injury to it by boring large oval-shaped holes which extend for long distances through the interior of the log. The perfect insects appear in June, and are sometimes very abundant; we have occasionally found them swarming in great numbers on fallen pine trees. The insect is common throughout Canada and the neighbouring States.

The following general account of the larvæ of the family (*Cerambycidæ*), to which this beetle belongs, taken from Harris's Injurious Insects, pages 93–4, will be of interest, and will enable the reader the more readily to understand the structures and habits of these borers in their earlier stages. "The larvæ hatched from the eggs—which are laid by the parent beetle in holes and chinks of the bark—are long, whitish, fleshy grubs, with the transverse incisions of the body very deeply marked, so that the rings are very convex or hunched above and below. The body tapers a little behind, and is blunt-pointed. The head is much smaller than the first ring, slightly bent downwards, of a horny consistence, and is provided with short but very powerful jaws, by means whereof the insect can bore, as with



a centre-bit, a cylindrical passage through the most solid wood. Some of these borers have six very small legs, namely, one pair under each of the first three rings, but most of them want even these short and imperfect limbs, and move through their burrows by alternate extension and contraction of their bodies, on each or on most of the rings of which, both above and below, there is an oval space covered with little elevations, somewhat like the teeth of a fine rasp ; and these little oval rasps, which are designed to aid the grubs in their motions, fully make up to them the want of proper feet.

"Some of these borers always keep one end of their burrows open out of which, from time to time, they cast their chips, resembling coarse saw-dust ; others, as fast as they proceed, fill up the passages behind them with their castings, well known by the name of 'powder-post.' These borers live from one year to three or perhaps four years before they come to their growth. They undergo their transformations at the furthest extremity of their burrows, many of them previously gnawing a passage through the wood to the inside of the bark, for their future escape. The pupa is at first soft and whitish, and it exhibits all the parts of the future beetle under a filmy veil which enwraps every limb. The wings and legs are folded upon the breast, the long antennæ are turned back against the sides of the body, and then bent forwards between the legs. When the beetle has thrown off its pupa skin, it gnaws away the thin coat of bark that covers the mouth of its burrow, and comes out of its dark and confined retreat, to breathe the fresh air, and to enjoy for the first time the pleasure of sight, and the use of the legs and wings with which it is provided." This account of the larval and pupal state of the long-horned beetles, applies more or less closely to all the insects described in this paper, with the exception of No. 5, *Chrysobothris femorata*, which belongs to the *Buprestidæ*, a totally different family of beetles.

II. Clytus speciosus, Say (genus *Glycobius*, Lec.)—The Maple-tree Borer.*

The colours of this very handsome insect are deep velvety black and bright yellow. The figure represents its shape and markings so accurately that further description is unnecessary ; the size depicted, however, is decidedly above the average. This wasp-like beetle is not very abundant, but may occasionally be found on Maple trees, which its larvæ infest both when growing in the forest and also when cut into cord-wood. The eggs are laid by the parent beetle on the trunk of the Sugar-maple during the middle of summer ; when hatched the grubs penetrate through the bark and make long winding borings through the solid wood. Occasionally they are very destructive to young Maple trees, but on the whole they are not so sufficiently numerous to be objects of dread. Should they at any time threaten injury to these favourite shade trees, the larvæ may be got rid of by passing a somewhat flexible wire into their burrows until it reaches the grub within. The entrance may be discovered by the sawdust that they cast out.

III. Orthosoma cyclindricum, Fab. —A Pine Borer.

This large beetle is the commonest and best known of our wood-borers ; its habit of flying through open windows into lighted rooms during the warm evenings of July, usually to the great alarm of the inmates, has caused its appearance to be very familiar

Fig 1.

to every one. It is one of our largest beetles, measuring oftentimes as much as an inch and a half in length by over a third of an inch in breadth. Its general colour

*A full account of this insect, by Mr. E. B. Reed, will be found in the Report of the Entomological Society for 1872.

is a chestnut brown, approaching black on the head and antennæ. The thorax is armed with three sharp spines on each side; each wing-case has three slightly elevated ridges running lengthwise for nearly the whole length; the eyes, which are situated behind the antennæ, are enormously large and very conspicuous. The larva (Fig 1) is a large fat white grub, with powerful jaws of a darker colour; it feeds upon the wood of the Pine, and from its size often injures the timber very materially. It will, no doubt, however, be considered a decidedly beneficial insect by some of our readers who live in newly-cleared settlements, when we mention that it affects pine-stumps especially, and often aids materially in reducing them to a state of rottenness.

The perfect insect, like most of the long-horned beetles, possesses the power of making a curious creaking noise. In the generality of species this is produced by rubbing the joints of the thorax together, or against the base of the wing-covers; but this species, according to Professor Riley (*Canadian Entomologist*, vol. iv. p. 140), "is a true fiddler, stridulating, like the *Orthopterous Locustidæ*, by rubbing the hind femora against the elytra. If a specimen be carefully examined, the inside of these femora will be found rasped from the base to near the tip by a number of short longitudinal ridges, which, when played against the thin and sharp emarginations of the elytra, produce the rather loud creaking so peculiar to this beetle."

IV. Clytus robiniæ Forst.—The Locust-tree Borer.

(The synonym of this insect has been rather perplexing; it is now included in the genus *Cyllene* Newm.; for a long time we were accustomed to call it *Clytus flexuosus* Fab., but the specific name given above has the priority. It was also long considered to be identical with *C. pictus*, Drury, that bores into the hickory, but the late Mr. Walsh proved satisfactorily that the two species are distinct. The general colour of this insect is deep black with light yellow stripes; on the head and thorax these stripes form narrow transverse bands, but on the wing-covers there is first of all a narrow yellow anterior edging (not shewn in the figure); then a slightly flexuous stripe (not straight as in the figure; this is followed by a narrow zig-zag band forming a letter W across the wings, and three irregularly wavy and broken stripes; there is also a yellow dot at the tip, and broader stripes on the sides of the abdomen of the same colour. The antennæ are long and many jointed, and of a dark brown colour; the legs are long and of a tawny hue. The larva is a whitish coloured grub, about an inch long and the thickness of an ordinary goose quill, and is furnished with six very minute legs. When young it appears to bore chiefly into the sap-wood, but afterwards strides off into the solid wood of the tree, perforating it in every direction. Its presence is early indicated by the little heaps of sawdust extruded from the holes, and accumulated about the base of the tree.

The following account of the habits of this insect, by Dr. Harris, (Injurious Insects, page 103), is so excellent and coincides so exactly with our own observations that we cannot forbear quoting it, though it may be familiar to some of our readers. "In the month of September," he says, "these beetles gather on the locust trees, where they may be seen glittering in the sunbeams with their gorgeous livery of black velvet and gold, coursing up and down the trunks in pursuit of their mates, or to drive away their rivals, and stopping every now and then to salute those they meet with a rapid bowing of the shoulders, accompanied by a creaking sound, indicative of recognition or defiance. Having paired, the female attended by her partner, creeps over the bark, searching the crevices with her antennæ, and dropping therein her snow-white legs, in clusters of seven or eight together, and at intervals of five or six minutes, until her whole stock is safely stored. The eggs are soon hatched, and the grubs immediately burrow into the bark, devouring the soft inner substance that suffices for their nourishment till the approach of winter, during which they remain at rest in a torpid state. In the spring they bore through the sap-wood, more or less deeply into the trunk, the general course of their entrance. For a time they cast their chips out of their holes as fast as they are made; but after a while the passage becomes clogged and the burrow more or less filled with the course and fibrous fragments of wood, to get rid of which the grubs are often obliged to open new holes through the bark. The seat of their operations is known by the oozing of the sap and the dropping of the sawdust from the holes. The bark around the part attacked begins to swell, and in a few years the trunks and limbs will become disfigured and weakened by large porous tumours, caused by the efforts of the trees to repair the injuries they have suffered."

The history of this insect is rather a curious one. For a little over a hundred years it has been known to inhabit the State of New York, its appearance and habits being recorded by some English Entomologists of the last century. About thirty years ago it was found as far west as Chicago, whence it spread throughout the State of Illinois, but it was not till 1863 that it reached Rock Island, about two hundred miles further west, where—Mr. Walsh relates—it suddenly appeared in great swarms and utterly destroyed all the Locust trees. The first record we have found of its appearance in Canada is by Mr. Couper, who states (*Can. Journal*, 1855, p. 377) that he observed some Locust trees attacked by this insect in Montreal in September, 1855. In 1862 it began to be very destructive to the Locusts in Toronto, and for several years was excessively abundant there. In 1867 we found it at Credit, about twenty miles west of Toronto; it almost entirely destroyed all the Locust trees in the neighbourhood. In 1873 Mr. Reed relates its appearance in enormous numbers at London, Ont.; now it appears to be generally distributed throughout this province, and occasionally becomes very injurious to these ornamental trees. The perfect insect, in the localities it frequents, may usually be found in September on the flowers of the Golden-rod (*Solidago*), of which it eats the pollen, as well as upon the trunks of the trees it infests.

It is not easy to apply a remedy for an insect of this kind, still much may be done to save favourite trees in one's garden, provided they are not very large. The most satisfactory plan seems to be to rub over the trunk and large limbs of the tree with strong soap about the end of August; this will prevent the mother-beetle from laying her eggs upon the bark in September. Of course the application will have to be renewed after heavy showers. Dr. Harris suggests that whitewashing, or covering the trees with grafting-wax, would be effective in repelling the female. It would be of benefit also to gather and destroy the beetles wherever they may be found; children might be employed for this purpose to search the flowers of the Golden-rod as well as to carefully examine the trunks of the trees; should they be too high up to reach, a sharp blow with a stick on the trunk of the tree will cause them to fall to the ground. A little familiarity will soon overcome the natural repugnance to handling so wasp-like a creature.

V. Chrysobothris femorata, Fab.—The Buprestis, or Flat-headed Apple-tree Borer.

This insect belongs to the family Buprestidæ, while all the others on our plate belong to the Cerambycidæ; the difference in shape and structure, and especially in the length of the antennæ, is very noticeable in the figures. The accompanying wood cut (Fig. 2), when compared with that of the pine-borer given above (Fig. 1), will show our readers how this insect differs in this larval state, also from the long-horned beetles. The larva is shown at *a*, the chrysalis at *b*, the head and first segments of the larva at *c* and the perfect beetle slightly enlarged at *d*.

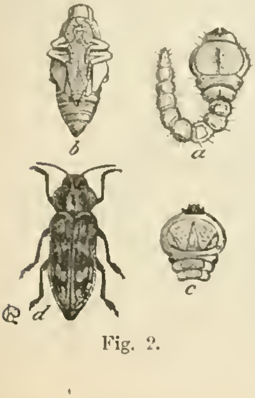


Fig. 2.

The natural history of the insect may be briefly related, as follows: The egg is deposited by the female beetle in the chinks and crevices of the bark some time during the early part of summer; from this the young grub soon hatches, and works its way into the soft sap-wood immediately beneath. Here it eats away, while the cavity inside becomes larger and larger, and it increases in size itself, gradually working upwards until it becomes pretty well grown, when it bores into the solid heart of the wood, and forms a flattish burrow, corresponding to its own flat form. When several attack the same tree, as is generally the case, their burrows, of course approach very near each other, and cause its death; in any case, they very much injure its vitality and bring on decay. In the spring of the year the grub assumes its pupa state, and comes out as a perfect beetle in the end of June, or during July, when it may be found basking on the tree trunks in the hot sunshine. It is very lively when danger threatens, and will take wing instantly if an attempt is made to catch it. Its blackish colour above so much resembles the bark of the tree that it readily escapes the notice of an ordinary observer ; but beneath it is of a beautifully burnished dark copper-colour, looking as if it were made of metal, beneath the wing covers it is bluish. While the figure gives the shape of the insect very correctly, it much exaggerates its size, which seldom exceeds three-eighths of an inch ; the light spots on the wing-cover are also erroneous in being very much too conspicuous.

The presence of the grub in the tree may be detected by the discolouration of the bark, and its flattened, dried appearance. All such spots should be opened with a knife, and the insect at once despatched. The burrows may be discovered by the presence on the bark of the fine sawdust cast out by the larva.

The insect attacks not only the apple, but also different kinds of oak, especially the white oak, and according to Prof. Riley, the mountain ash, linden or bass-wood, box-elder, beech, plum, pear, cherry and peach.

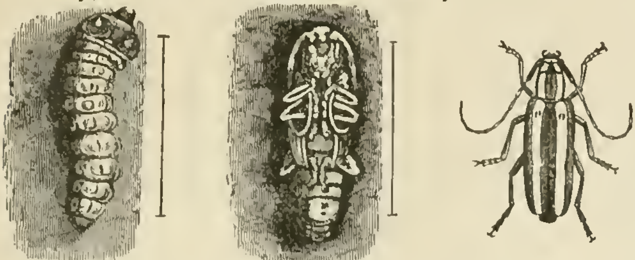
With regard to remedies, one important fact—we quote from Prof. Reily, (7th Missouri Report, page 76) should be borne in mind. The natural breeding place of the insect is undoubtedly in the old decaying oaks of our woods, and I have known it to swarm in old post-oak stumps from which the tops had been felled for a number of years. In fact it prefers partially dead or injured trees to those which are thrifty and vigorous, and partly for this reason, and partly because rough, cracked bark forms a better nidus to lay her eggs, the species is most abundantly found on the south-west side of young apple trees where they are most apt to get injured by sun-scald. Sickliness in the tree, or injury from any cause predisposes to its attacks. It is for this reason that transplanted trees, checked as they are in their growth, usually fare badly. But there is yet one other predisposing cause which few people suspect, and that is reckless and careless pruning, especially of the larger branches. Many a fine orchard tree, and many more city shade trees, receive their death shock from the reckless sawing off of limbs without effort being made to heal the wound by coating with grafting-wax, clay or other protecting substance. Around such an unprotected sawed limb, as around the frustum of a felled tree, the rain and other atmospheric influences soon begin their work of causing decay between the bark and the solid wood ; and this is but the forerunner of greater injury by insects which are attracted to the spot, and which, though hidden meanwhile from view, soon carry the destruction from the injured to the non-injured parts. Among the insects thus attracted, the Chrybothris plays no mean part, where, had the wounded limb been protected, its presence would never have been known. It thus becomes of the first importance in treating this insect, to keep the young trees vigorous and healthy, and the bark as smooth and as free from injury as possible. Young trees are far more liable to be attacked than old ones, and consequently require greater care."

As a preventative against the insects' attacks there is nothing better than coating the trunk and larger branches with soap at least twice a year, once toward the end of May, and again in July or August. The soap is not only obnoxious to the beetle, but it tends to keep the bark clean and smooth, so as to offer no attraction to the female, and is withal beneficial to the tree. The trees should also be examined carefully late in the fall. At this season, or even in the winter time, the young borers which have just commenced work, are easily detected and destroyed by a knife before they have done much harm.

VI. Saperda Caneida, Fab.—The Two-Strited Apple-tree Borer.

This insect, which rivals the foregoing species in the injuries it inflicts upon Apple trees, is a pale-brown beetle with two chalky-white longitudinal stripes running from the head to the apex of the wing-covers ; its under side, legs and face are also chalky-white, and its antennæ a little darker ; its length is about three-quarters of an inch. The larva is of a pale yellow or whitish colour, with a brownish polished head and black jaws ; it is destitute of legs, but like other larvæ of the same family, it is enabled to move in its burrows by the contraction and expansion of its well-defined segments ; when fully grown it is about an inch long. It may readily be distinguished from the preceding species by its cylindrical and more symmetrical shape, as is apparent from the accompanying figure (Fig. 3). The larva is shown at *a*, the pupa or chrysalis at *b*, the perfect beetle at *c*.

The perfect insect (to quote from our Report for 1870) makes its appearance in June and July, but is seldom seen, as it usually remains in concealment during the day, and



a *b* *c*

Fig. 3.

flies only at night. The females deposit their eggs upon the bark of the tree near the base of the trunk, or collar as it is termed. From the eggs are soon hatched out tiny whitish grubs, which penetrate the bark and leave a hole so minute that it soon closes up. For the first year the grub feeds only upon the sap-wood, in which it excavates a round smooth cavity immediately beneath the bark, generally nearly filled, when opened, with the saw-dust-like castings of the worm. These castings may very frequently be observed extruded from the burrow and on the ground at the base of the tree; whenever they are noticed search should at once be made for the borer within. As this borer does not occur in any part of Canada in which we have resided, we have had but little opportunity of investigating its habits, we therefore quote the following excellent account from our friend Mr. Beadle's Prize Essay on the Apple (*Fruit Growers' Report*, 1868, *p.* 172): "When the grub has become about half-grown it ceases to cast the dust out of its cavity, and proceeds to fill it up, at the same time boring a passage or gallery upwards into the heart of the tree. This gallery is continued upwards, of varying length, sometimes not more than two inches, and sometimes twelve inches, and is gradually brought outwards again to the bark of the tree, but not through it. When the grub has completed this gallery, it turns round and returns to that part which is nearest to the heart of the tree; this part it now enlarges by tearing off the fibre from the walls, and with this fibre carefully and securely closes the entrance, so that if some insect enemy should find its way through the hole in the bark at the collar into the chamber where it passed the first part of its life, that enemy could not enter the gallery to its present abode. Meanwhile it crowds its saw-dust like castings into the upper extremity of the gallery against the bark, thus, at the same time, diminishing the danger of attack from that quarter, and keeping its chamber tidy. Having thus perfected its arrangements, it again turns round so as to have its head upward, passes the winter in a torpid state, and in the spring casts off its skin and becomes a pupa, from which in June the perfect insect hatches, climbs to the upper end of the gallery, tears away the fine sawdust, gnaws a hole through the bark and creeps forth." When several of these borers are at work in the same tree, their excavations approach each other so closely as often to girdle the tree and cause its destruction.

Many modes have been proposed for the destruction of this noxious insect, some of them essentially absurd, such as plugging up the holes in the trees which are made by the beetle when taking his departure from the scene of his early life, after he has finished his work of mischief. The simplest and most effectual remedies are: (1) the application of soap (cold made soft soap is especially recommended) to the trunk of the tree early in June and again in July; rub it well over, especially near the base of the trunk, and place a portion in the fork of the tree that it may be washed down into the crevices of the bark by the rains. (2) If the borer has already taken up his abode in the tree, cut into his burrows with a sharp knife and get him out; his presence may generally be detected near the collar of the tree by the discolouration of the bark and by the sawdust castings. This is the most effectual, and by no means difficult remedy; much benefit, however, may also be derived from washing this part of the tree with lye, or any strong alkaline solution, which will penetrate the interstices of the bark and kill any young grubs that may be commencing to make their way inwards. The trees should be carefully examined—especially if young and not long planted out—at different times during the year, as well as in the Spring.

Thus far this most injurious insect has only been found in certain portions of this country, being very abundant in the Niagara district, and in the neighbourhood of Montreal and Quebec, but happily rare, or entirely absent, from almost all other parts. Prof. Bell (in the *Fruit Growers' Report for* 1875) relates that a specimen was captured in the year 1873 near the Town of Belleville; no doubt it was imported, probably in the larval state, in trees from the United States or some other district infested by the insect.

VII.—Monohammus Confusor, Kirby.—A Pine-tree Borer.

This fine beetle, which is especially remarkable for the extraordinary length of its antennæ, is, in our pine regions, one of the most common and destructive of our insect enemies. Its general colour is an ashen grey, mottled with variable darker spots; the scutellum is white; there are also patches of whitish colour on the head, thorax and abdomen. These variations of colour, being due to a covering of very fine short hairs, which oftentimes are rubbed off, are not to be depended upon in the determination of the species. As in *M. scutellatus* (fig. 1,) each side of the thorax is armed with a short thick spine. The length of the insect varied from three-quarters of an inch to an inch and a half—the average size being over an inch; the antennæ of the males vary in length from one and a half to three inches; those of the female are somewhat shorter. The larva is a large, white, somewhat cylindrical grub, destitute of feet. During the summer, the female lays her eggs in crevices of the bark of the white and red pine, selecting for the most part timber that has been scorched by fire, or felled by the wind or the lumberman's axe; the larva when batched soon eats its way into the wood, and before this period of its existence is closed it often burrows immense galleries through and through the solid interior. As it lives a long time in the larval state, the perfect insect is frequently only developed after the timber has been built into a house, and then suddenly emerges from its concealment to the great consternation of the inhabitants of the dwelling. The larva, when burrowing in the wood, makes a loud noise like the boring of an auger, which on a still night may be heard for a considerable distance. The species is very generally distributed throughout Canada and the Northern States; in the pine-growing regions it is often excessively abundant.

A very interesting and valuable account of this insect is given by the late Mr. E. Billings, of the Canadian Geological Survey in the *Canadian Naturalist and Geologist*, for December, 1862, (vol. vii. pp. 440 438). As the work is not likely to be in the hands of more than a very few of our readers, we cannot do better than give some extracts from it. Mr. Billings, from his long residence in the lumbering districts of the Ottawa valley, had more than ordinary opportunities of observing the life and habits of the insect, and may therefore be justly considered an excellent authority upon the subject. "These insects," he relates, "attack dead timber, and also trees which have received some injury, and are in an unhealthy condition. I have never seen the female laying her eggs on a perfectly healthy and sound pine tree. Timber newly fallen is always attacked by them. The first dwellings constructed in the new settlements are generally made of logs with either the whole or a portion of the bark remaining on them. The inside is not plastered, except in the crevices between the logs; if these latter happen to be pine, the *Monohammus* lays her eggs in the bark, on the outside of the house, and for months afterwards the larva may be heard in the stillness of the night, making a noise like the boring of a small augur. The perfect insect sometimes comes out on the inside of the wall, and suddenly drops down upon the floor, the table or the bed, to the great alarm of the inmates, who imagine that an insect with such great horns must bite or sting with proportionate severity.

"For the manufacture of boards or planks, the pine trees are cut up into lengths of from twelve to eighteen feet, and are either drawn or floated to the mill. The logs are got out during the winter, and if they remain in the mill yard one season, they are invariably found to be bored through in all directions by larvæ of these beetles, and the boards greatly deteriorated in value. Where extensive operations are carried on, a single lumberman will sometimes have a license giving him possession of over a hundred square miles of pine forest. In the months of May and June it often happens that great fires sweep through the woods, burning up all the fallen trees and dry branches strewn over the ground, and so scorching the living pines that most of them wither at the top and die during the season. Trees thus injured are soon attacked by both *M. Confusor* and *M. Scutellatus*, and within one year are so greatly bored that they are unfit for the manufacture of timber. Those experienced in the business, however, well understand the habits of the insects in this respect, and hasten to make the timber before it is destroyed. Pines scorched by the spring fires must be cut down and made into lumber the next autumn. After one of these fires it generally happens that there is a regular race between the lumberers and the beetles, the prize being a grove of white or red pine. I was told that Messrs. Egan & Co., lost £40,000 worth of timber by some unavoidable delay of a few months. Pine trees, when scorched, would be sound enough for timber five years afterwards, if it were not for the attacks of these formidable destroyers.

"When there are only a few pines, as in the neighbourhood of Montreal, it is rare to meet with more than one or two of these beetles together. But in the great forests of the Ottawa it is not unusual to find fifteen or twenty on a single tree. On one occasion I saw an extraordinary number, and entered an account of the circumstance in my note-book on the spot. It was on the 11th of September, 1857. I was at that time making some geological observations in the neighbourhood of Lake Clear, in the County of Renfrew. Following on the lumber road through the woods, I came to a place which had been burned over some time during the preceding spring. There was one large white pine standing on the sunny side of a small gently sloping hill. The height of this tree was about 120 feet, and its diameter nearly 3 feet. About 30 feet at the base was scorched; it was 60 feet to the lowest branch, and as nearly as I could judge, the foliage for 20 feet at the very top had turned yellow. The remainder was green, and apparently healthy. This tree was swarming with *M. Confusor*. and many of the females were occupied in laying their eggs. I think there were at least 300 of both sexes, and I saw several flying from other trees thirty or forty yards distant. In flying, the body is not horizontal, but inclined at an angle of only fifteen or twenty degrees from the perpendicular. The insects were on all parts of the tree, and they did not appear to take a firm hold of the bark, for a heavy blow with a hammer, at the base, would bring down a dozen at a time, some of them falling from near the top. While falling, they did not attempt to fly. I had fifty or sixty crawling around me at once, and had a fine opportunity to observe the very considerable variation in the size of the individuals, and the length of the antennæ. When two of them. going in opposite directions, met face to face, a clumsy kind of fight took place, in which they reared up and pushed against each other, until one or other fell over backwards. They bit each other with their mandibles, but with no effect that I could perceive. The females fought with each other, or with the males, indifferently. There can be little doubt but that this tree was, during the next twelve months, totally destroyed. If there were 150 females, and each laid 200 eggs, and half of these produced a healthy larva, then in one year this tree must have been perforated by 15,000 galleries. I examined other trees in the neighbourhood, and on a few only did I see any of the beetles, usually from one to four or five on each. I can only account for the preference given to this particular tree, by supposing that it was in a better condition for the nourishment of the larvæ than the others, and that the instinct of the females directed them to it. It is probable that nearly all the females for a considerable distance around were thus brought together on one tree, and were followed by the males.

"I cannot say whether or not these insects ever attack a perfectly healthy and sound tree. I think they do not, and yet their ravages are certainly injurious to the commerce of this country, as they destroy a vast deal of fallen or scorched timber which otherwise might be brought to market at any time during several years after the trees have received a death blow by fire or storm. I think also that thousands of trees, only sufficiently injured by fire to throw them for a while into a weakly or unhealthy condition, would recover were it not for the attacks of these formidable creatures."

The only means of warding off the attacks of these destructive insects is to manufacture, without delay, all scorched or fallen timber, and to strip the bark off all saw-logs that are left over a summer before being cut up in a mill. When the bark is removed the female has no convenient and safe place in which to deposit her eggs, and thus the timber escapes her attacks.

VIII. Oberea tripunctata, Fab.—The Raspberry Twig-Girdler

We now come to the last insect on our plate; the figure is a good deal exaggerated in size, the length of the beetle being under half an inch, and its width one-tenth of an inch.

Its colour is deep black, with the exception of the thorax above and the front part of the breast beneath, which are rusty yellow ; on the thorax there are three small elevated black dots, arranged in a triangle (not two only, as in the figure), whence is derived the specific name of the insect. The antennæ are nearly, if not quite, as long as the body. The beetles are usually found in July and the beginning of August; they attack all the varieties of raspberry, and come into gardens from the fields and clearings, where we have often taken specimens and observed their work. The mode of attack is peculiar; the first appearance of injury is usually manifested by the withering and drooping of the ends of the young shoots. On inspection, it is found that at the base of the affected part there are two rows of punctures, half an inch apart, running completely round the canes, and so girdling them that the supply of sap is stopped and the tops necessarily soon wither and break off. The parent insect begins by cutting with its jaws a series of small punctures side by side around the cane, six or seven inches from the top. As soon as the first row is completed, it turns round, and facing the other way, cuts a second row, measuring the length of its own body. These two girdles being completed, it makes a small hole a little way above the lower girdle, and deposits in it its small yellow egg. The whole operation occupies an hour or more. From this egg there hatches out in a few days a small, yellow, footless grub, which proceeds to burrow downwards, eating the pith of the cane and eventually causing its destruction.

In our Entomological Report for 1873, Mr. Saunders gives a full, scientific description of the larva of this insect and many other interesting particulars to which we beg to refer the reader. Though certain that the girdling of the raspberry canes was caused by this insect, he states that he had "not yet seen the beetle in the act of depositing their eggs" and making the girdles. We are glad to be able to complete the life history of the insect by the account we have given above, which is taken from repeated observations that we made ourselves several years ago at Cobourg, the substance of which we embodied in an article in the *Canada Farmer* of 1869 (page 358). The object of this singular girdling operation is, in all probability, to check the growth of the cane, and so prevent the crushing and destruction of the egg or larva by the rapid increase of cells and tissues in the plant.

An obvious remedy for the injuries inflicted by this insect is to break off *at the lower girdle* and burn the affected twigs, as soon as possible after they are observed to wither; the egg or newly-hatched larva will thus be destroyed and the increase of the species checked.

In the foregoing description of the wood-boring beetles figured on our plate, our aim has been, not to write an original dissertation upon the insects, but to gather together from various sources, as well as from our own observations, all the information respecting them that we have thought would be of interest or value to the readers of these Reports. We hope that the beauty and graceful forms of the insects will lead many of our country friends to collect for themselves, and then study the life history of these wonderful denizens of our groves and forests.

THE APHIDES OR PLANT LICE.

By W. Saunders, London, Ont.

Under the common term aphis or plant louse is embraced a number of distinct species belonging sometimes to different genera, but all resembling each other so closely in appearance or habits as to lead to their being grouped under one common name. So closely do many of the species resemble each other, that their distinguishing features cannot be made out without the use of a magnifying lens. There are very few plants, shrubs, ornamental or fruit trees, but are more or less affected by these insects, and on many of them they luxuriate and thrive to such an extent as sometimes to threaten their destruction. These plant lice are not restricted to any part of a plant; often they are found on the leaves, but sometimes on the stems, or again on the roots of plants, while other species roll up the leaves, or form gall-like swellings on them. This troublesome tribe of insects holds a position in regard to the vegetable world, somewhat analagous to that of some well-known parasites on animals; hence the popular name plant lice. They belong also to the same great order of insects, *Hemiptera*, all of whom obtain their livelihood in a similar manner, viz: by suction. They are all furnished with a beak-like mouth, sometimes hard and solid, which is thrust into the plant or animal they are feeding on, and used to extract its fluids.

Plant lice are remarkable for their fecundity. People are often puzzled at finding their plants or trees swarming with plant lice, where a week or two before there was scarcely one to be found. As a general rule an aphis, during the summer season, reaches maturity in ten or twelve days from birth, after which it produces every day two young ones, which, contrary to the general rule with insects, are born alive. This rate of increase is maintained for a considerable period, from fifteen to twenty days or more; the young begin to produce in like manner in from eight to ten days, and so on through the third, fourth and sometimes up to the twentieth generation in one season. Some idea may be formed of the numbers which in a short time this rate of increase would produce, from a calculation of Curtis, a celebrated English Entomologist, who has computed that, from one egg only, there would be produced in seven generations, taking thirty as the average of each brood, the enormous number of seven hundred and twenty-nine millions, so that were they all permitted to live, everything on the face of the earth would in a short time be covered with them. Indeed, sometimes the possible rate of increase is even greater than this. Dr. Fitch, late State Entomologist of New York, has ascertained by actual experiment that in the case of the grain aphis, the wingless females become mothers at three days old, and thereafter produce four little ones every day, so that even in the short space of twenty days the progeny of one specimen, if all were preserved from destruction, would number upwards of two millions.

It may be urged in objection to these calculations, that no allowance is made for a certain percentage being males, but strange to say all through the summer there are no males born, but all are fertile individuals, giving birth to others, and these to others still, independent of any influence from the opposite. With many species, some individuals of each brood acquire wings, while others are wingless; the wingless ones remain, of course upon the plant upon which they were produced, while the winged specimens fly to other plants, where they establish new colonies. About the middle of September, the last generation for the year is produced, which consists of males and females, the males generally becoming winged. On reaching maturity, the sexes pair, when the females no longer bring forth young, but lay eggs, which are able to resist the severe cold of winter, and these hatching in the following spring, produce mothers which bring forth their young alive. The individuals composing the late brood having provided for the continuation of their race, generally die on the approach of winter.

It appears that there are, however, exceptions to this general rule. In the case of the grain aphis, Dr. Fitch says that he has watched it the year round so closely that he is perfectly assured that no eggs were laid and no males produced, and he further states that in the autumn the mature lice continued to produce their young ones until they and their young became congealed upon the leaves of the young grain by the advancing cold of the season, and in this state they were buried beneath the snows of winter and with the warmth of the ensuing spring they were thawed and returned to life again Professor Cyrus Thomas also found living lice upon young fall wheat in South Illinois in the middle of winter, and after much sleet and rain had fallen. Even so far north as Connecticut, Prof. Verral found numbers of wholly plant lice of all sizes on the branch of an apple tree so late in the year as December 11th, and this after two snow-storms and many cold rains and freezing nights. Indeed those who cultivate plants in their houses or otherwise under glass during the winter, will ot require much further evidence than their own experience to convince them that plant-lice, tiny, tender looking, and juicy as they are, are endued with such perennial vitality and hardihood as to require great watchfulness and frequent use of remedies for their destruction in order to keep them within due limits.

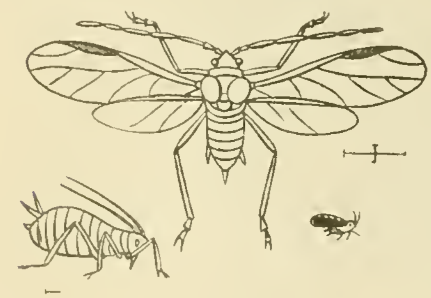


Fig. 4.

In figure 4 we give a highly magnified view of the apple aphis, *aphis mali*, both in the winged and wingless forms ; the hair lines along side of the figures show the natural size of the insects. At the tip of the abdomen is seen a little projection ; this is the ovipositer or egg-laying instrument, and on each side of this is another little horn-like projection. These latter are called the honey-tubes, and through them a sweet liquid is produced which is sometimes discharged upon the leaves of the infested plant, which drying up, forms a sweet glutinous substance known under the name of honey dew. In olden times the origin of this honey dew was shrouded in mystery, and many theories were advanced by sage philosophers to account for the strange phenomenon. Pliny, the great Roman naturalist, hesitates whether to call this honey dew, the sweat of the heavens, the saliva of the stars, or a liquid produced by the purgation of the air. Thanks to the careful observations of entomologists, philosopners have no longer any reason to puzzle themselves as to its origin.

In this connection another strange feature deserves explanation. Most attentive observers will have noticed that where trees or plants in the open ground are infested by plant lice, they are also much frequented by ants who are busy running up and down the trunk or stem the whole day long. This association of the insects has led some to suppose that the aphides are in some way produced from the ants, and we have heard of various ingenious devices being resorted to, to prevent the ants from ascending the trees, under the idea that in this manner the aphis might be in some measure got rid of. A slight examination will suffice to show the fallacy of this view, and reveal the real objects the ants have in their visits. It is a well established fact, as most housewives know to their cost, that ants are very fond of sweet things. Examine closely one of the groups of plant lice which are being visited by the ants and you will see one or more ants walking about among them ; applying a magnifying lense to the group, and you will presently perceive an ant drumming gently on the back of a plant louse with its flail-like antennæ until it coaxes the aphis to emit from its honey tubes a drop of the sugary liquid. This the ant absorbs and passes on to another, which is subjected to similar treatment, and so on until having filled itself, it descends to the earth and having regained its nest, discharges the sweet fluid into the mouths of the helpless maggots, the larvæ of the future ants, which are entirely dependent for their sustenance on these industrious, working ants. Linneus, one of the earliest entomologists, and a most careful investigator, truly observes, "the ant ascends the tree that it may milk its cows, the plant lice." These honey tubes are shown more prominently in fig. 5, which represents a wingless aphis.


Fig. 5.

That the ants value their useful cattle, and carefully watch over them, there is abundant evidence ; they regularly visit them for the purpose of milking them, and, according to Dr. Fitch, " some of the ants remain constantly by them night and day to protect these small, weak creatures from being molested by their insect or other enemies. Thus, before we are able to inspect a colony of plant lice, we are first obliged to brush off or destroy the ants which are guarding them." The late Dr. Walsh says, " It is certainly true that the ants, if they can help it, will not allow any winged fly to visit their milch kine, being probably afraid that such flies come to rob them of the sugary fluid in which they take such delight. Thus, unconscious of what they are really doing, they often drive off Ichneumon flies, that would otherwise deposit their eggs in the bodies of the plant lice, and thereby cause their death, and *Syrphus* flies that would otherwise lay their eggs among the plant lice. But I have repeatedly seen them gathering in crowds round one of the fat fleshy aphis-devouring larvæ of the *Syrphus* flies, pulling him about in every direction, as if to ascertain whether he had got any honey in his body, like their friends the plant lice, and then, having apparently satisfied themselves that the fat gentleman was not in the grocery business, and not knowing that he butchered daily hundreds of their honey-producing friends, turn away in despair, and leave him, unharmed and unwounded, to his own devices, as a hard case that nobody could make anything of. It is apparently for the same reason, namely, to prevent sugar-loving flies from robbing them of their own private and peculiar honey dew, that ants occasionally construct a kind of tent round a little flock of their plant lice, but only where those plant lice are located on a twig, and never, so far as I have observed, where they are located on a leaf."

Notwithstanding all the care the ants may take to repel intruders, thousands of flies share in the sweets produced by the plant lice, and often the location of a colony of these insects, which would perhaps otherwise escape observation, may be detected by the loud buzz occasioned by the disturbance of the attending flies.

But there is seldom a rule without its exception, and while the details given above apply correctly to hundred of different species of plant lice, yet in the case of the grain plant louse, *Aphis avenae*, although the honey tubes are well developed, yet they emit no honey, and in consequence of this, as has been remarked by Dr. Fitch, this species is not attended by ants. To use the words of the late Dr. Walsh, " as this peculiar breed of cows gives no milk, the milk maids do not think it worth while to visit them.

Having now given our readers same idea of the general habits and immense fecundity of these interesting insects, we shall refer in some detail to a few of the most troublesome and destructive species reserving what we have to say in regard to the remedies which nature has provided or man invented for their destruction until we have completed the enumeration.

The Apple-plant Louse (*Aphis mali*).

This insect which is represented in fig. 4 is the same as that which similarly infests the orchards in Europe and has doubtless been introduced on the trees imported into this country from across the Atlantic. The insects of this species of the previous year deposit in the fall in the cracks and crevices of the bark of the apple tree large numbers of their small oval black shining eggs. A large proportion of these are dislodged by the cold, driving rains and snows of winter, and destroyed ; doubtless also, multitudes are devoured by the smaller insectiverous birds. The survivors hatch quite early in spring before the buds are fully expanded, when the young lice locate themselves on the small, tender leaves displayed by the bursting bud, and there inserting their sharp leaks into the tissues of the leaves, pump out their juices. The wingless specimens are of a pale, yellowish, green colour with a yellow head and black eyes and are less than the tenth of an inch in length. The winged specimens have the head antennæ and thorax black, and the body green.

The Apple-root Plant Louse (*Eriosoma pyri*).

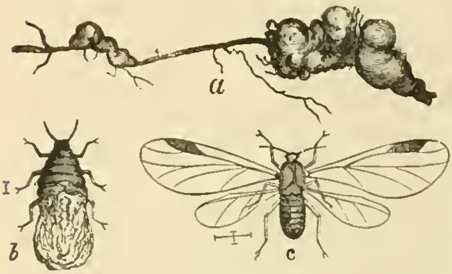


Fig. 6.

This species is a woolly louse which works under ground and produces upon the roots of the apple tree swellings or excresences (see fig. 6, a) of varying shapes and sizes; diseased growths which interfere seriously with the free circulation of the sap, an interference which often results in the death of the parts involved, and sometimes when these insects are very numerous their united efforts will occasion the death of the tree. In the more northerly parts of the Northern States this pest is very abundant and with us it is rare to receive a lot of young apple trees either from our own nurserymen or from those of the United States without finding some of them thus affected.

The mature louse (fig. 6, b) is about the tenth of an inch long including the closed wings of a dull colour with transparent wings and black legs, and with a peculiar downy or frosted look produced by the exudation from its body of a bluish white, cottony matter by which character it can often be readily recognised. When the wings are expanded the insect measures nearly $\frac{3}{16}$ths of an inch, (fig. 6, c).

As this species, situated as it is under ground requires diffierent methods of attack from those which infest the leaves of plants and trees we will refer to them here. The only artificial remedy yet suggested for the destruction of this pest is hot water used plentifully so as to scald the roots, or, at least, the larger ones over their entire area. To accomplish this successfully, it will be necessary to carefully remove the earth from about the surface of the roots so as to lay them bare. No danger need be apprehended from using the water scalding hot as the application has often been made without injury. This remedy is not so applicable to large trees as it is to young trees in the nursery row or those lately planted. As a preparatory measure, mulching the tree has been recommended, which brings the insects nearer to the surface where they can more readily be reached by the hot water.

Nature's remedies are, however, in this instance, probably more effectual than any which man can devise. In the first place, these lice are subject to the attacks of a very minute parasitic fly; and secondly, they are destroyed by the larva of the "Root-louse Syrphus Fly," *Pipiza radicans*, fig. 7 (after Riley). This latter friend is a fat, footless grub, fig. 7*a*, which lives underground among the lice and devours large numbers of them; in the fall it changes to a chrysalis, fig. 7*b*, and appears in the perfect form as a fly, fig. 7*c*, in the following spring.

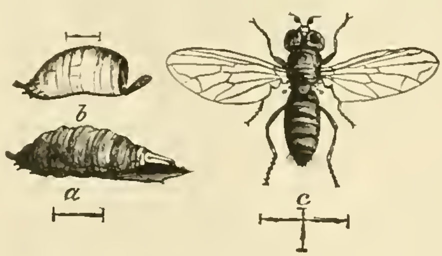


Fig. 7.

The Cherry-plant Louse, *Aphis cerasi*.

Probably no species of tree is so regularly infested by aphides as the cherry, and no species included in this large family of pests is more disgusting in appearance than this cherry-plant louse, for, while most others are of a more or less lively green colour, this is nearly black.

These insects begin to appear soon after the leaves have expanded, hatching from eggs deposited the previous year. They multiply with amazing rapidity, the young ones hud dling around their parents so closely as to entirely cover the twig, leaf-stem, or portion of the leaf on which they are feeding; indeed it is not uncommon to find them two deep, a portion of the crowded host standing upon the backs of others, all intent on the one business namely, that of absorbing the juice of the tree, which they do by inserting their beaks into the succulent portions. They seem never to suffer from over-crowding. Dr. Fitch estimates—his calculation being based on actual count—that the two surfaces of a small leaf, but an inch long, would furnish ample space to accommodate a thousand of these insects.

When we consider the rapid rate of increase which prevails among the aphides, some details of which we have already given, it is not astonishing that the leaves, leaf-stalks, tender twigs, and even the fruit-stems are so soon found to be swarming with these pests, their black bodies literally covering every succulent portion, while all around flies, wasps, and other insects are swarming, keeping up a constant buz and hum abont the infested tree, to which they are attracted by the sweet liquid which exudes from the bodies of these aphides. By the end of June they have usually attained their maximum numbers, for by this time their numerous enemies, which we shall hereafter refer to more in detail, have become so multiplied as to begin to get the better of them, and when once the scale is turned against them they are sometimes destroyed so rapidly and entirely that in a few days not a living specimen can be found, the empty skins of the slain being the only remaining relics of the vast hordes but recently seen. Dr. Fitch well remarks, " It is by looking at the works of nature in a definite manner, and tracing out her operations specifically and in their minute details that we arrive at some faint conceptions of their magnitude and grandeur, and become vividly impressed with the truth that no other agency than that of a Creator infinite in wisdom and power could have peopled the world which we inhabit with such countless numbers, and such an endless variety of objects animate and inanimate, each occupying its appropriate sphere, and all so arranged as to fulfil the objects for which they were called into existence. Has the reader as he has passed a forest ever attempted to conjecture the number of trees which it contained? and has his mind passed onward to a surmise of the probable number of leaves growing upon each tree, and onwards still to the number of insects which may be drawing their sustenance from each one of these leaves; and still further to the number of miuute and infinitesimal parasites which may be subsisting upon these insects?" Such reflections could scarcely fail to lead the thoughtful observer " from nature up to nature's God."

During July the cherry tree generally enjoys some respite from the attacks of these tiny foes, but early in Angust they usually appear again to increase and multiply until being again overtaken by their enemies they are a second time overcome, this later brood is seldom as numerous as the first one. This black aphis seems to be restricted to the cultivated cherry, for we never find them invading any of our native or wild cherry trees, and these in turn seem each to have a species of plant louse peculiar to them, which seldom if ever attach themselves to the foliage of other kinds. Dr. Fitch has described in his first report on the noxious insects of New York, a green species *Aphis cerasifoliæ* which affects the undersides of the young and tender leaves of the choke cherry, and refers to another which infests the wild black cherry.

Thus we might go on enumerating and describing species after species to the exhaustion of the patience of our readers, for there is scarcely a tree, shrub, or plant, which is not at some period or other in the year infested with them. We would, however, particularly mention the currant plant louse *Aphis ribis*, which swarms on our currant bushes, and which has probably been imported into this country from Europe; the Cabbage-plant louse *Aphis brassicæ*, also introduced from Europe; the Hop-plant louse *Aphis humuli*, and the Grain-plant louse *Aphis avenæ*, since these from their great abundance frequently attract general attention.

We now propose to refer to the remedies which nature has provided, and man has devised for the destruction of these tiny foes, and beginning with the more important and most effective, we shall first advert to the natural enemies of the plant lice. It has been truly said, " the plant louse has but one friend—the ant, but its enemies are legion; and wisely is it so arranged, for were they permitted to increase and multiply at their natural rae without material check, ere a few months had elapsed every green thing on the face ofthe earth would be so covered with them as to cause general destruction.

Foremost in the list of enemies we must place the lady-birds which feed on little else than aphis either in the larval or perfect states. Probably the commonest species is that known as the nine spotted lady-bird *Coccinella 9 notata* fig. 8, a nearly round insect, of a brick red colour, with nine black spots, fig. 9, shows the same in the larval condition. Another common species is the two spotted lady-bird *Coccinella bipunctata*very similar in form and colour to the previous species, but smaller and with two black spots instead of nine.

Fig. 8.

Fig. 9.

The spotted lady-bird *Hippodamia maculata* fig. 10, is also frequently met with, and being found both in Europe and America has probably been imported from one country to the other. The colour of this is pink withlarge black spots. The thirteen spotted lady-bird *Hippodamia 13 punctata* fig. 11, is rather larger than either of the preceding species and has thirteen black spots on a brick red ground.

Fig. 10.

Fig. 11.

The trim lady-bird *Coccinella munda*, Fig. 12, may be readily distinguished from most of the other species by its having no black spots on its red wing cases. The convergent lady-bird *Hippodamia convergens*, Fig. 13, is of a deep orange red colour, marked with black and white. Its larva *a*, is blue, orange and black in colour, *b*, shows the pupa or chrysalis suspendep by the tail, and *c*, the perfect beetle. This insect is also very useful in destroying the eggs and young larvæ of the Colorado potato beetle.

Fig. 12.

A B C

Fig. 13.

The fifteen spotted Mysia, *Mysia* 15 punctata, Fig. 14, is one of the largest species. The perfect insect varies much in colour from a light grey to a deep chestnut brown. An ordinary observer might readily conclude that the different forms belonged to those of distinct species, the more prominent of these variations are shown at *d*, *e*, *f*, *g*, in the figure. This predacious species also devours the young of the Colorado beetle, at *a*, the larva of thislady-bird is represented in the act of devouring one of these young enemies. In addition to those we have enumerated, there are a number of other less common species, in colour mostly yellowish or reddish with black spots or bands. In the larval state they all resemble each other very much, being elongated in form and active in habit, usually of a dull colour withmore or less yellowish or bluish markings. Fig. 9 may be referred to as a type of the whole.

Fig. 14.

There is still another species, belonging to another genus of lady-birds, which, from its abundance and great usefulness deserves mention, we refer to the twice-stabbed lady-bird *Chilochorus bivulnerus*, Fig. 15, a highly polished black insect with two red spots, and which in form much resembles the half of a split pea. This species preys more particularly upon bark lice, and hence is most commonly found on the trunks and branches of trees. The larva, Fig. 16, is a verycurious, prickly looking creature, extremely active and voracious in its habits. Its chrysalis may often be seen on thetrunk of trees partly covered by the prickly larva skin.

Fig. 15.

Fig. 16.

Prominent also among the insects which subsist upon plant lice, are the aphis lions, the larvae of the golden-eyed and lace-winged flies. The perfect insects are very pretty and delicate-looking creatures, with prominent fiery eyes, slender bodies, and two pairs of large, beautifully netted, pale green wings Many of them, however, when handled, impart an intensely disagreeable odour to the fingers, and one of a remarkably permanent character, Fig. 17 represents this insect in theperfect state.

Fig. 17.

The eggs of this insect are curiously placed upon stalks as shown in Fig. 18. Dr. Fitch says, "Nature has furnished these insects with a fluid analagous to that with which spiders are provided for spinning their webs, which possesses the remarkable property of hardening immediately on being exposed tothe air. When ready to drop an egg, the female touches the end of her body the surface of the leaf, and then elevating her body, draws out a slender and cob-web-like thread half an inch long or less, and places a little oval egg at its summit. Thus a small round spot resembling mildew is formed upon the surface of the leaf from the middle of w hich arises a very slender glossy white thread, which is sometimes split at its base, thus giving it a more secure attachment than it would have if single. The egg at its summit is of a pale green colour when newly deposited, but before it hatches it becomes whitish and shows two or three faint dusky transverse bands. The larva leaves it commonly I think in less than a week from the time it is deposited, through an opening which it gnaws in the summit, and the shell remains empty supported on its stalk, somewhat shrivelled and of a white colour.

Fig. 18.

The young larva begins at once to seek its food, and if it finds itself in the midst of a colony of plant lice, many of these speedily fall victims to its enormous appetite, but if not so favourably situated, a vigorous search is generally rewarded by the finding of a cluster of insects' eggs or some newly hatched catterpillars, either of which will furnish our young traveller with a dainty meal. The larvæ of the different species vary somewhat in colour and ornamentation, but in most instances the ground colour is of a dull reddish brown, and there are whitish markings along the sides, and a dark central stripe. They all have long, narrow bodies, and are furnished with six rather long legs, and two long and slender, but powerful jaws curved like a sickle, and down each side of the body is a row of tubercles, each tubercle being tipped with a cluster of spreading hairs or spines. Fig. 18 will give a good idea of their general appearance. In some species the bristly clusters of hairs are so multiplied as to almost cover the surface. Dr. Fitch mentions a novel use to which these hairs are put, he says that these voracious creatures often conceal themselves from view by placing the empty skins of the victims they have devoured, between their radiating bristles so that they adhere and thus completely hide the insect from view. It is the skins of the woolly plant lice that they mostly employ for this purpose, and thus covered they resemble a little mass of white down adhering to the bark of the tree, presenting just such an appearance as does a little colony of woolly plant lice. By this device they are enabled to approach their victims without exciting their alarm and to quietly devour them one by one.

After acquiring full growth the ant-lion having made a hearty meal, remains for a time torpid, and then begins to spin its cocoon, which is formed from a glutinous fluid supplied and distributed by the hinder extremity of the body, a fluid which hardens as it is spun into threads. In a few hours the insect spins enough of its cocoon to hide itself from view, and when completed the threads composing the cocoon are so closely compacted as to give the surface a papery look. During the operation the larva contracts much in size and bandages itself so tightly within its enclosure that the cocoon appears very small in comparison with the size of the larva constructing it. Here the insect changes to a chrysalis of a pale green colour and remains in this condition in summer a fortnight, but if the insect belongs to the later brood, it remains in the chrysalis state all winter, appearing as a perfect fly the following spring.

Other enemies to the plant lice are to be found among the larvæ of the various species of Syrphus flies. These flies vary in size, some being smaller, others larger than the common house fly, and usually more slender in form, they are also handsomer, their bodies being of a bright yellow colour, banded and spotted with black. Fig. 19 represents one of the species. They are very swift of flight, darting about with great rapidity, again hovering with poised wing in the bright sunshine, or alighting upon flowers These flies place their eggs singly, fastening them to a leaf or twig infested by plant lice, usually placing them in the midst of a colony where the young larvæ may not have long to search for appropriate food. One cannot go far in summer in the careful examination of groups of plant lice without meeting with those small white oval eggs. The young larva when hatched

Fig. 19.

is not unlike a leech, both in appearance and movements. Having no eyes, it appears to be placed at a great disadvantage in the search for food, but fixing the hinder extremity of its body to the surface on which it is placed, it reaches as far as it is able to stretch first on one side, then on the other. If no food is reached, it moves a little further, and then repeats the same motions, and so on until it reaches a plant-louse, when at once it seizes its prey, holding it up in the air, as shown in fig. 20, until having sucked it empty, nothing remains of the louse but a shrivelled skin, and all this occupies scarcely more than a moments time; indeed it has been asserted that a medium sized larva will thus consume a hundred plant lice in an hour. These larvæ are semi-transparent, so much so that the movements of some of the internal organs are plainly discernible through the skin in one of the larger specimens. Their usual colour is whitish or greenish, with white, yellow or dull reddish markings, or with a combination of these down the centre of the back. When they have completed their growth, they fix themselves to the surface of a leaf or a piece of bark and contract themselves to an oval form, which gradually becomes hard and horny, and of a blackish colour, and within this shell the change to a chrysalis takes place, and in due time, from it the perfect fly escapes.


Fig. 20.

But the aphis has foes which attack it from within, as well as from without. Almost all insects are infested more or less by parasites, and the aphides are no exception to this general rule. There are several genera of tiny parasites which thus befriend man, all of which are included in one group named *Aphidiides*. Dr. Fitch's remarks on this interesting group are so much to the purpose that we quote them entire. He says: "These are all exceedingly small insects, little exceeding the twentieth of an inch in length, and mostly with black bodies, variously adorned with bright tawny yellow, and pale sulphur yellow bands and other marks. One of these small Ichneumon flies, resembling a winged ant in appearance, may occasionally be discovered busily at work among a colony of aphides. With her long thread-like antennæ stretched out in front of her, and rapidly vibrating, she approaches an aphis and touches it gently, much like an ant when nursing these creatures. By this slight touch, she at once ascertains whether the aphis has been previously visited. If it has not, she curves the tip of her abdomen forwards under her, puncturing the body of the aphis and inserting an egg therein. She then passes to another and another. From this egg hatches a minute worm, which resides within the aphis, subsisting upon the juices which the latter extracts from the plant. Thus it grows with the growth of the aphis, which furnishes the exact amount of sustenance which the worm requires for bringing it to maturity. It is singular that the parent Ichneumon fly knows if two eggs were deposited in the aphis the worms from them would die for want of a due supply of food, and that by a mere touch with her horns, she is able to ascertain which individuals have already been impregnated. Some of the species of Aphidius are larger than others, and their offspring consequently require a larger quantity of food; but each parent has the instinct to select an aphis of such size as will yield the amount of sustenance which its young requires.

"By the time the worm has attained its growth, the aphis becomes so exhausted that it dies. If it should now drop from the leaf to the ground, it would be liable to be found and devoured by centipedes and other insects which feed upon the carcases of animals of this class, and thus the worm within it would be destroyed. Nature has, therefore, so constituted the aphis that in these circumstances it dies without a struggle or a spasm, with its beak inserted, and its claws clinging to the surface of the leaf, standing with its antennæ turned backwards, and its whole aspect so life like that in the infancy of my studies, I supposed these were one of the varieties natural to the species with which they occurred. Their bodies are remarkably plump and smooth, commonly clay-coloured, or the hue of brown paper, and the aphis lions and other insects, which destroy the aphides, appear to pass by those which have these parasites within them. Hence, where a leaf or twig has recently been cleared of plant lice by their enemies. several of these ichneumonized individuals may frequently be found remaining upon it, dead and unmolested. In other instances, the whole colony of aphides appears to be exterminated by these parasites alone, the dead swollen bodies of their victims covering the surface of the leaves or twigs as closely as they can stand. The worm remains within the body of the dead aphis during its pupa state. It then cuts a circular hole through the dry hard skin, and comes out in its winged and perfect form."

"These parasitic insects, which feed internally upon the aphides, are as efficient in destroying them as the aphis-lions or any other class of their enemies. And it is truly wonderful, that whilst every kind of tree and plant appears to have one or more species of aphis infesting and blighting it, each species of aphis seems to have a particular parasite preying upon and devouring it ; for each kind of aphis, from which I have reared these insects, has furnished a species differing from all the others, and, in some instances, two species have been obtained from one kind of aphis."

How complicated and how wonderful are the marvels of Nature. There seems a providence in all these arrangements. Kirby has well said that it is strange that among the innumerable species of insects, many of them extremely fragile and exposed to dangers and enemies without end, no link should be lost from the chain, but all be maintained in those relative proportions necessary for the general good of the system ; that if one species for a while preponderate and instead of preserving seem to destroy, yet counter-checks should at the same time be provided to reduce it within its due limits ; and further, that the operations of insects should be so directed and overruled as to effect the purposes for which they were created, and never exceed their commission ; nothing can furnish a stronger proof than this, that an unseen hand holds the reins, now permitting one to prevail and now another, as shall best promote certain wise ends, and saying to each " Hitherto shalt thou come and no further."

A few words will suffice to indicate the remedies which man has devised to lessen the numbers of these destroyers of vegetation. It is universally conceded, that where the remedy can be conveniently applied there is nothing more effectual than tobacco smoke. To exterminate them in green-houses, smoking – by strewing a few leaves of tobacco on hot coals—is regularly resorted to, and, if thoroughly done, is very effectual. A few favourite plants may be similarly treated by enclosing them in a light paper-covered frame and smoking under it, or by placing them under an inverted barrel or box ; after such treatment the plants should be immediately washed with luke-warm water from a syringe or watering-pot. Where this remedy cannot be applied, drenching with tobacco-water has been recommended, also the application of strong soap-suds, or weak lye, sprinkling it freely on the plant, and even dipping the succulent ends, where the aphides cluster, into the liquid.

Hot water has also been recommended, but this, if not cautiously applied, is very apt to injure the plant. Some species will bear an application of water heated to 130° Fahrenheit; indeed, some few will bear a higher temperature than this without injury, but others are more susceptible in this respect, hence the remedy requires careful handling.

REPORT

ON

SOME OF OUR FRUIT INSECT ENEMIES,

FOR 1877.

BY B. GOTT, ARKONA, ONT.

It was with much pleasure and satisfaction that I was able to be present for the first time at our Society's annual meeting, last September, in London, Ont., I then and there imbibed deeper and wider ideas of the extent and importance of the work in which our entomologists are so ardently and devotedly engaged, I also had an opportunity of personal acquaintance with the characters and qualifications of the men who are the foundation and the noble pillars of the Society. The men then present were practical and intelligent, and the earnest sympathy they showed in the work and objects of the Society, could not be otherwise than encouraging to those engaged in this interesting and serviceable study. It is not easy to conceive how any people possessing and supporting such a Society, whose work and results are so palpable to the masses, can be otherwise than progressive; and as far as their productive results are concerned, every way prosperous. Should we not desire that the effective membership of the Society may largely increase, and that thus the educating and elevating influences of the study may be extended, and felt to be not only an assistance but a powerful helper of the people through the length and breadth of the land. In my own individual case I find my interest in the subject of entomology annually deepening and widening in proportion to the extent in which my attention is directed to it. Since being engaged to some extent as I have been for the last few years in the critical but interesting production and cultivation of fruit in this western part of Ontario; I found from the very start that something more was necessary to success than a mere knowledge of the theory of production. I found insect enemies to contend with, for which, in my ignorance, I had made but little or no provision. My combativeness was at once aroused; but finding progress in a hand to hand fight very slow, and not very encouraging or satisfactory, I began to reflect that prudence was the better part of valour, and I at once set myself bravely to the task of arriving at some knowledge of their differences, their habits, their possible numbers, and their possible use; with also some data for successful competition. I have not advanced far, but I soon found that my opportunities, my samples and specimens were not scarce, especially in our summer and growing season, and that their differences and peculiarities were very interesting, and their numerical forces sometimes appalling. Some were feeding voraciously on a specific plant, shrub, or tree, or on a class of these; and others were feeding as voraciously on their opposites. Some were most injurious and destructive in their immature state, and others needed the complete forces of maturity to do the same amount of effective execution; some were most active in their destructive work on the roots in the ground, some were content with the leaves, and yet others were satisfied with nothing of less value than the fruit. So I concluded that insect depredators were not wanting more or less for everything that grows. It would almost appear too, that we have peculiar local insect troubles, as though special and individual classes of insects were localized and restricted to sectional divisions; but by further acquaintance with the subject, I must suppose this can hardly be. However, it is beyond dispute, and capable of most positive and convincing proof, that in this department of natural research there is much to be studied and much to be learned; there is ample and profitable room for the intellect, and investigation of the most vigilant and the most penetrating.

Moreover, what abundant cause have we for gratitude and thankfulness to those patient, honoured, and great names whose owners have worked hard and long, and spent their valuable and industrious lives in this interesting field of inquiry, and have freely left us, as a legacy, the cherished results of their labours—" their works do follow them,"—and we are thereby assisted in those difficult and puzzling problems of insect life and insect differences and relationships; and although there is yet much to be done, much has already been accomplished and vividly portrayed before our vision. The field has already been surveyed and mapped, and it only remains for us to follow those lines to arrive at rich and desired results. I propose, therefore, in the following pages, to give as short and concise an account as possible of some of the most palpable insect enemies of our fruit, &c., for the past season. And this I do, not with the intention to supplant the able and graphic report of insect enemies by the President of the Fruit Growers' Association, in his address before that body last September; or of that of the President of the Entomological Society, at about the same time, but rather as an adjunct additional testimony in the same direction. I further may be allowed to state that I make no pretentions to scientific accuracy, but shall simply state my observations as they occur to me in my own untutored way. With these preliminaries I come at once to the subject in hand, viz :—

The insect enemies of our Fruits, &c., for 1877.

By this caption I do not mean that I shall confine myself exclusively to those insects merely which feed alone on our fruits, but shall include also those injurious to the leaves and even the roots and branches of our fruit trees and shrubs, as equally noxious to our fruit products and prospects. And first, I may mention the

American Lackey Worm, or Tent Caterpillar (*Clisiocampa Americana*)

Of Harris. For larvæ and eggs see fig. 21; the male moth is shown in fig 22, the female in fig. 23. This insect, by its appalling and unprecedented numbers, and by its voracious and devastating habits,at least in this section, for the last few seasons, has filled us with the most serious apprehensions for the safety of not alone our fruits, but also for the very life of the trees. So serious was this damage during the past season that the aid of legislation was talked of, to compel people to do what they could for the suppression of this insect grievance; because not only the orchards of the negligent and careless were thus blighted, but those also of the industrious and careful were besieged and destroyed by the very enemies his careless neighbour was rearing and helping to propagate. People began to ask of one another, " What is the use of planting and cultivating orchards, they will only be devoured and ruined by the caterpillars ?" Aided also by *C. Sylvatica*, the larva of which is shown in fig. 24, those orchards standing in the neighbourhood of forests have suffered very severely; and although persistent and industrious, our efforts seem feeble and almost totally unavailing to save our orchards and our gardens. This latter insect is very active, and is on constant parade over trees and shrubs, over fields, orchards, and gardens, where anything can be found to gratify its devouring appetite; and then, it is recruited so plentifully and so frequently that we fairly sicken of the fight, and despair of the prospect of victory. But there is to this dark picture

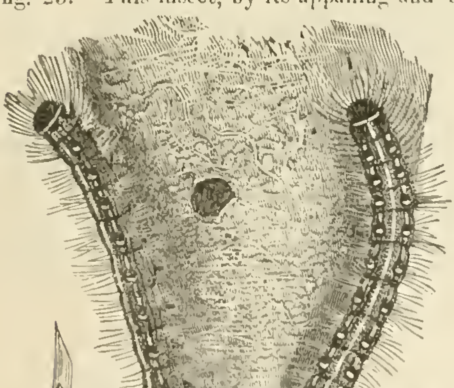


Fig. 21.


Fig. 22.

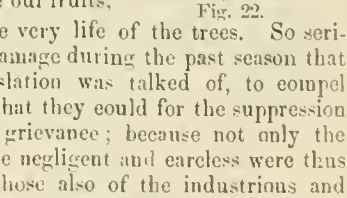


Fig. 23.

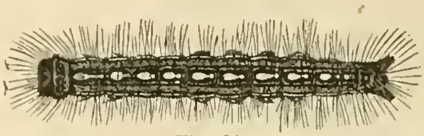


Fig. 24.

a cheering ray, a bright prospect of assistance, from a small ichneumon fly. On examining a number of the cocoons of *clisiocampa*, as they were safely nestled in the folded fragments of leaves left on the trees, we found a large proportion infested with maggots or small white grubs. These we found were of two or three distinct sorts; one was a largish white grub, and existed in the body of the caterpillar, sometimes solitary and sometimes in pairs, and entirely devoured the internal portions; and in other cases they were smaller and closely huddled together, but in each and every case the destruction of the caterpiller and of the future egg-laying moth was most complete.

Our methods for suppressing this grievance and lessening their numbers were not very effectual, but consisted in entrapping the moths by means of light, and in taking their egg clusters from the branches of the trees and destroying them. As soon as the young larvæ were hatched in the spring our practice was, as early as possible in the day, while they were yet very young and closely compacted, to collect them in masses and destroy them. In this way millions were easily and effectually captured and destroyed, but there are always some careless neighbours who would do nothing, and declare it was of no use fighting them as they would eat up the trees anyway, and so by swarming in from the forests, and those neglected orchards, the trouble was annoyingly kept up.

MEASURING WORMS (*Geometers*) AND LEAF ROLLERS, (*Tortrices*)

were this year, as usual, very abundant on all our fruit and ornamental trees, shrubs and plants, but the diligent overseer, by his watchfulness and skill can, with comparative ease, so reduce these troublers that their work on the mass of foliage is scarcely perceptble. The only way they seem to us damage, and in which we feel them to be a burden is as assistants combined with the already multitudinous forces in the same field of destruction, we feel that we could readily do without their services.

THE CURRANT BUSH BORER (*supposed to be the European Aegeria Tipuliformis*, See fig. 25.)

Fig. 25.

is doing us considerable damage in our currant plantations, and here, too, this evil is permitted by the careless and indolent cultivators to increase upon us, so that eventually, currant growing in this country will become very uncertain and very troublesome. These insects eat out the heart of the young stem and so weaken it that it is incapable of ripening its fruit and shortly dies or breaks off. Of far more serious moment at present, however, is

THE CURRANT OR GOOSEBERRY WORM (*Nematus Ventricosus*).

Fig. 26.

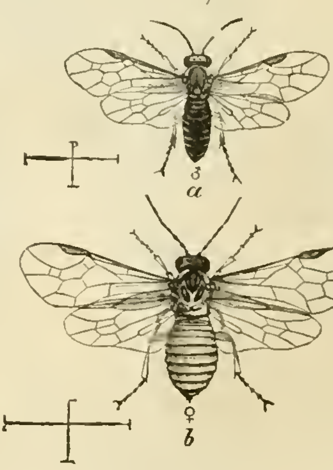


Fig. 27.

The larva of this pest is seen in fig. 26. The perfect fly, male and female, fig. 27; and the eggs as laid on the leaves in fig. 28. This abundant and voracious insect feeds readily in the larval state either on the leaves of the currant or those of the gooseberry, but I prefer to call it by way of distinction, the *Currant Worm*, and the insect that feeds on the fruit of the goose

Fig. 28.

berry and currant, the *Gooseberry Worm.* This insect is very common and very injurious and has been for many years past, and in all parts of the country, so that a description is needless as all are thoroughly familiar with its appearance and its work. It is felt to be such a severe scourge, however, and so discouraging in its effects upon us that it has very sensibly, suddenly and effectually checked the production of this refreshing summer fruit. We seem to be helpless in the matter and have little or no respite for the incessant attacks upon us of several broods in one season, will effectually, baffle the most determined and the most industrious. Our readiest and best remedy is applying powdered *White Hellebore* to the surface of the leaves which is a temporary relief as it does not agree with the best functional interests of their insect constitution. But the thought of poison among our summer fruits is rather appalling, and not of the most relishable or attractive character.

THE GOOSEBERRY FRUIT WORM (*Pempelia Grossularia*).

Fig. 29.

For a representation of the moth and cocoon of this species, (See fig. 29). This is, perhaps, the most insidious and annoying enemy of the gooseberry and the currant. It winters as a chrysalid near the surface of the ground just under the bush where it was last feeding. In the early spring as soon as the sun has warmed the soil the active and vigilant moths appear, and after copulation, commence at once their work of egg depositing in the young fruit almost before the full and proper expansion of the blossoms. These eggs quickly give rise to little white, insidious worms that make their way into the very heart of the berry and grow and thrive upon its internals. As soon as this berry is consumed and unable, longer, to serve the worm any good and substantial purpose, it leaves and immediately attaches itself to another by means of its silken cords or web-like productions, and thus secures itself safely against all danger and loss. In this way it has attacked and destroyed a dozen or more berries to satisfiy its cravings before it has reached the period of maturity or the season for change. When this period arrives it falls to the ground by means of its silken threads, buries itself in the earth and changes to a chrysalis. The remedies are hand-picking, and the application of noxious substances to the bushes in early spring, but these are troublesome and partly ineffectual and hence not very satisfactory.

THE MAY BEETLE (*Phyllophaga Quercina.*—See Fig. 30).

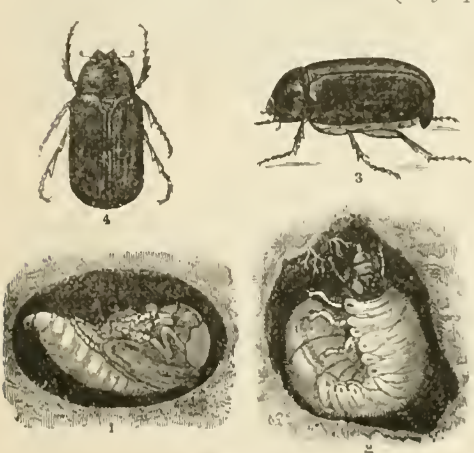


FIG. 30.

2 represents the larva, 1 the chrysalis, and 3 and 4 the perfect beetle. The larva of this active summer evening buzzing beetle stands charged with many and grievious offences against the farmer and the fruit grower. A neighbour of mine said to me the other day "My corn was only half a crop—those cussed white grubs eat it so; it wilted to the ground;" but I suppose that in his case, perhaps, something else did it. However, although our soil is peculiarly suited to their purposes, and is liberally supplied with the larva in all stages of growth. I have but one or two heavy grievances to lay to their charge, one of which I feel pretty deeply and severely. I had long noticed, after planting out young evergreens in nursery rows in the spring, particularly seedlings of spruce, hemlock, and fir, that occasionally several of them just after commencing

their growth would suddenly wilt and at once give up ; and this Spring this occurred more extensively than ever. I was in difficulty and could not decipher the cause, as my land I knew was good and well adapted to their successful growth. Upon pulling them up, however, I found that every particle of fibrous root was entirely gnawed off; and besides this, the bark was taken off almost up to the collar, and the tough naked woody branches of the roots only left. This last season I lost whole rows in this way, and, on closely investigating the case, I am pretty well satisfied that the larvæ of the May Beetle are chargeable with the whole trouble ; and worse, I know of no remedy! The other charges are, eating the roots entirely off from several of our strawberry plants, and also eating large and injurious holes in our potatoes, &c., &c.

The Hawk Moth, or *Sphinges*

are growing annually more numerous, but we have no very grievous complaints to make against the fine and handsome larvae of these beautiful moths. Occasionally, however, the foliage suddenly disappears from some branch of our apple trees or our cherry trees, or it may be from our grapes or our potatoes, or perhaps from the tomato vines, and we know from the character and the abundance of the surrounding droppings that one or more of these diligent creatures has been at work. These ravages, however, are not burdensome, and then we readily bear with much from them solely on account of the magnificence and grandeur of their characteristic appearance. About the second and third weeks in October last there were a number of fine larvæ discovered among the grass and late growing green plants in this place. They were about two and a half or three inches in length, fine green colour, mixed and striped with yellow ; had the characteristic horn on the last segment, and would curl up as a crescent on being disturbed. I could not determine it, but I have reason to believe it was one of the sphinges.

Cut Worms.

With these I sometimes conclude that the very earth is infested, so great are their numbers and so active their operations. There are evidently many species of them, but the worst and by far the most dreaded is the sneaking thief that cuts our cabbage and tomato plants after they have commenced to grow so finely.

Agrostis Devastator

of Harris, and very correctly labelled. These are the most insidious in their attacks, and the most annoying in their devastations, apparently, of any of our garden enemies, and we seem powerless in our defences. They are the most industrious while we are asleep, and like many another dastardly thief hide as soon as the light appears. Our remedies are, vigilant searching for them and destroying them by hand.

The Potato Beetle *(Doryphora decemlineata)*.

No longer maintains the destructive character which it brought with it at the first, nor are our people so alarmed and troubled by its presence ; it has become now a familiar matter-of-course arrangement. Although yet pretty numerous, it affects only the careless and the indolent ; the industrious and the ingenious not only baffle their efforts, but to a very large extent render them harmless. It is now well ascertained by our potato raisers that the first broods are comparatively light, and that the insects best efforts are not made until mid-summer and after, so by planting largely or altogether early maturing varieties, and these placed in the ground as early as possible to get their tops and their tubers ripe before the second brood appears, all danger is out of the way. The beetle is perfectly baffled by this arrangement, and it goes wandering about over the fences and on the streets and roads seeking green fields where to pasture, and to deposit its myriads of eggs. This season the crop of potatoes, at least in this section, has been most abundant and of great excellence, the variety mostly *Early Rose*, the best potato that was ever given to the American people. Our remedies for the beetle were hand picking ; and occasionally a dose of Paris Green applied as a liquid.

THE GRAPE VINE BEETLE (*Pelidnota Punctata*, see fig. 31.)

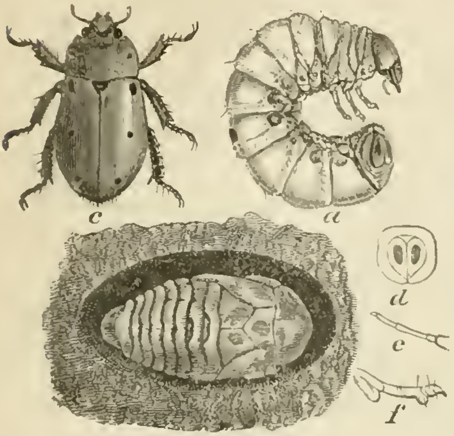


Fig. 31.

Seems very fond of harboring about our grape vines, and has this season been pretty plentiful, but we fail to observe that its presence is an alarming evil or that its injuries are very distinctly marked. It rather appears a sort of harmless case, a pretty creature, whose only office is to vary and beautify nature. But these remarks are not in the least applicable to THE GRAPE VINE FLEA BEETLE, Fig. 32 larva; Fig. 33 the perfect beetle (*Haltica Chalybea*), whose numbers in the spring are rather alarming. This insidious, heartless little arch rogue attempts to baffle and frustrate our plans in the very start. This it does by boring into the swelling bud and totally destroying its promising contents, and thus by one effort he flattens our sanguine hopes by taking the entire product of the bud, leaf, cane, fruit and all. We this year hired our children to capture them on the vines as they were at work, which they readily, cheerfully and effectually did. In this way their efforts were greatly lessened. It is becoming more and more evident that we also in this country may yet have trouble from THE GRAPE VINE PHYLLOXERA (*Phylloxera Vastatrix*). I have already seen specimens of it, and it is my most decided opinion that unless some effectual remedy is found, our grape vines will be found to suffer much from the injurious effects of this tiny insects, upon their leaves and especially their roots. Grape growers should seriously study this subject at once ; for should the evil become established upon their vines, it would at length be very difficult to eradicate. For description and very full particulars, see Rev. Mr. Bethune's very able and instructive article on the subject in the Society's Report for the year 1874.


Fig. 33, the perfect beetle.

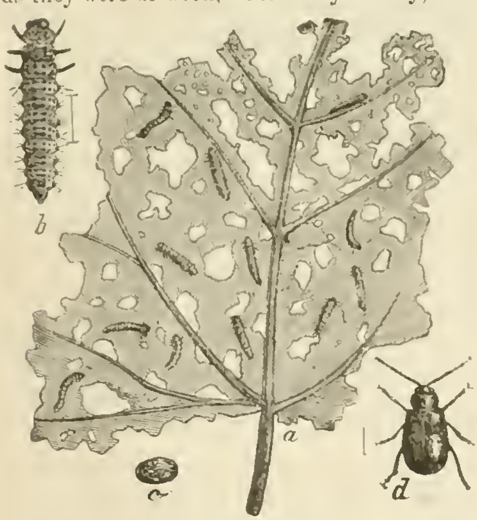


Fig. 32, larva.

PLANT LICE (*Aphididae, Fam. Eriosoma*), particularly. Although aphidians in great numbers and different species feed very heavily upon the leaves of our Cherry, Pear, Apple and other trees, yet this white woolly aphis feeding in immense numbers on the stems and shoots of our young apple trees seem to be the most injurious, and should be looked after most vigilantly. They differ from most insects in one particular, viz.: they attach themselves to a certain spot or spots on the trees, and without locomotion attract their food to them! An opening is made in the bark of the tree which bleeds freely for their support. And the accumulation of unused or unsuited matter forms excrescences about the place. It seems to me they pump very heavily on the vitality of the tree, especially in its young and tender years ; and should be kept off by means of oil applications, or destroyed by the hand rubbing them from the spot and crushing them.

THE APPLE FRUIT MOTH.—(*Carpocapsa pomonella*).

commonly called codling moth. (See Fig. 34). As usual, has been very dilligent this season, and wherever there was fruit upon which to feed, it has shown that this fruit was not overlooked. An account of the general and almost unparalleled scarcity of the fruit, however, this season, it is confidently hoped that they have not propagated to any great extent, and that a comparative immunity from their ravages may be expected in the future. The apple-grower must ever be industrious, and at all times on the watch, never forgetting that "*eternal vigilance is the price of fruit.*" This advice also holds good in the case of plums, for THE PLUM CURCULIO (*Conotrachelus Nenuphar*, see Fig. 35), has had much better accommodation for rapid propagation than that of the apple moth. The plum crop in some sections was very abundant and good; but in others it was totally destroyed by the workings of this industrious and active beetle. I noticed also that the little Turk, as it has appropriately been called, would not scruple to attack our peaches, in case a scarcity of plums occurred, and that in this way the the peach crop this season suffered very severely.

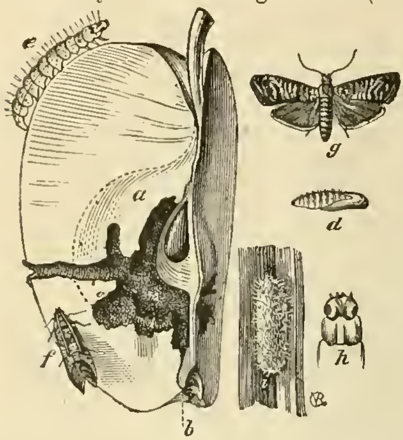


Fig. 34.

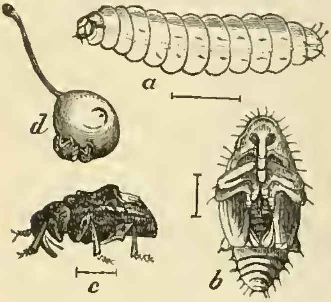


Fig. 35.

THE CABBAGE WORM (*Pieris rapae*), has this season been at work in full force, and has been very generally and extensively disastrous to our cabbages. They are very troublesome, especially to market gardeners, and where remedies were not used, the cabbages were totally destroyed. The parent of this larva seems to have no definite conception of the nature and severity of the changes of our climate, and in this respect it shows its foreign origin, as in any fine day in October she may be seen busily flitting about over the cabbages, &c., apparently eager in the business of depositing her eggs; and the young larva may be seen thus late in the season in all stages of development, regardless of the severe and destructive changes that are at hand. A sharp Canadian frost comes as it did this year, Nov. 9, and lays the whole brood motionless on the ground. Nevertheless there may be some danger of protecting these late worms in our ellars and cabbage pits, where the crop has been early stored away; and so the conditions for future broods may thus be secured. But perhaps there is little need of concern on this point, as insect nature has usually been found to carefully and effectually provide for itself.

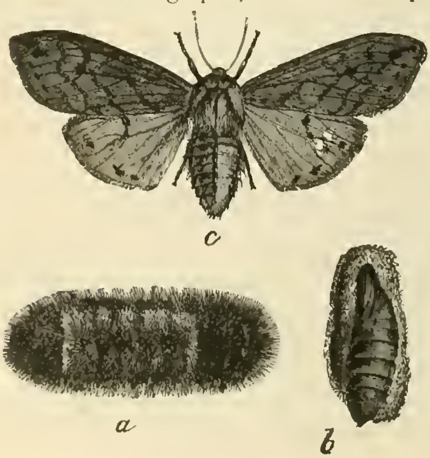


Fig. 36.

☞ THE ISABELLA TIGER MOTH.—(*Arctia Isabella*. See Fig. 36 for representation of this insect in its various stages).—As usual, has an abundance of her hairy larva abroad this fall. But as these hairy caterpillars are not known to be very seriously injurious to vegetation, and so scarcely come under our caption. I therefore pass them gently by. I have thus hastily glanced at some of the most common and prominently destructive insects that have come forcibly before my notice this season. I regret, however, my utter inability to treat the subject more thoroughly, and to better advantage.

The following details were got up for one of our weekly newspapers this summer, and entitled,

AN INSECT REGISTER FOR 1877.

May 10th.—Tent caterpillars first hatched out.
May 25th.—Gooseberry worms began actively to work into the young fruit.
May 30th.—Forest tent caterpillars began to leave the woods in great numbers.
June 1st.—The currant worms began to work on the leaves, but apparently were not so numerous as formerly.
June 18th.—Potato beetle larvae began to hatch out, but not so numerous as in former years.
June 20th.—Gooseberry worms leave the bushes, and retire into the ground to change. Also cut worms are not so numerous or destructive as in former years.
June 21st.—Tent caterpillars began to spin cocoons and retire to change.
June 25th.—The plum weevils very numerous, and have destroyed many of our plums and peaches. Also the apple fruit worm, or codling moth, larva not much to do this season—*no apples.*
" —Canker worms, measuring worms, and other larvae of various insects are very plentiful this season, and we are suffering much from their depredations.
June 27th.—Not many tent caterpillars now abroad.
June 28th.—First swarm of bees this season.
June 30th.—First newly-made tent caterpilllar's cluster of eggs. Moths perfected.
" —The currant worm moth still propagating, and young hatching out.
July 2nd.—Pea beetle began to deposit eggs in young peas.
Oct. 12th.—The cabbage worm butterfly still depositing her eggs, and the young larva still hatching out.
Nov. 9th.—Hard frost, completely stopped the cabbage worm from further increase.
Nov. 12th.—Canker worm moths very thickly on the wing, their females clustering on the branches of the trees.
Nov. 29th.—Musquitoes, black flies, and most of the insect world silently nested away for this season.

Arkona Nurseries, November, 20th, 1877.

ON GRAPE VINE GALLS.

COMPILED BY JOSEPH WILLIAMS, LONDON, ONTARIO.

THE GRAPE-VINE APPLE GALL. (*Vitis pomum*) WALSH & RILEY, ORDER, *Diptera* FAMILY, *Cecidomyidæ*.

The following discriptions have been compiled from the valuable reports of Prof. C. V. Riley, St. Louis, Mo.

Besides the leaf-gall caused by the Grape Phylloxera, the Grape Vine is subject to various other gall-growths or excrescences, the nature of which often puzzles the vine grower. I shall give an account of four of the most conspicuous which are found in Missouri. They are all caused by Gall gnats (*Ceoidomyidæ*), the larvæ of which are distinguished by being of an orange-colour ; but more especially by having on the upper surface, near the head, a horny process known as a breast-bone.* This process is variable in shape, but more often clove-shaped, Y-shaped, or oar-shaped. It always has a stem, which is mostly hidden, and terminates in two projections or prongs (sometimes three in those which are oar-shaped), which are armed with sharp points. It is retractile, and the prongs may be exerted at will, and are doubtless intended to assist in abrading the tissues of plants, so as to cause an abnormal flow of sap, which serves as food for the larvæ. That they have little, if anything, to do in causing the gall growth, we may infer from analogy, and from the fact that many Cecidomyidous galls are formed before the larvæ hatches, and depend on something deposited with the egg. The perfect flies are of a dull black colour, like that represented at figure 37, (*a* female, *b*, antennæ of male), and many species so closely resemble each other, that it is next to impossible to distinguish them when dry. Those which produce the galls here mentioned, are difficult to rear, and with one exception not yet known.

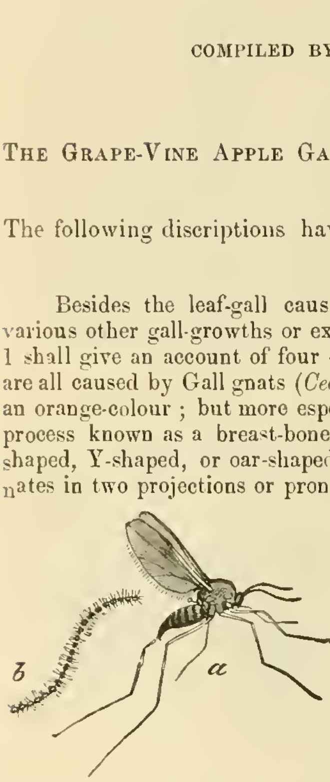


Fig. 37.

The Grape-Vine Apple-gall has been a fruitful source of speculation, and has given rise to some curious botanical theories, as the following extract will attest :

AN APPLE GROWING ON A GRAPE-VINE.

A Vegetable Phenomenon.—In the garden of Capt. David E. Moore, Lexington, Va., there is growing on a grape vine, a fully developed apple. On one side of the apple is an appearance of what might have been a grape-bloom. This interesting *lusus naturæ* is, as far as we know, without precedent, and of course has attracted marked attention, and caused no little speculation in the circle learned in such matters about Lexington. The prevailing opinion, we learn, is that an apple-bloom falling accidently upon a grape-bloom, became incorporated with it and produced the result ; but, if so, is it not singular that such an accident has never occurred before ? And, if so, again, does it not teach that the grape and apple may be grafted on each other ? We hope the pomologists of Lexington will note very

* This process is said by all authors with whom I am acquainted, including Baron Osten Sacken, to be neutral, for which reason I suppose, it has been called the "breast-bone." I believe myself that it is dorsal. As, however, it sometimes has a good deal the form of the breast-bone, or "wish-bone" of a fowl, the term may be retained, though conveying a wrong idea. The larvæ are also said to differ from all other insect larvæ in having fourteen joints. I have examined a great number of Cecidomyidous larvæ without being able to make out any such abnormal number, whilo in many species it is difficult to detect more than twelve and a subjoint. Usually, I have been able to clearly make out thirteen joints and a subjoint, which is,the normal number iu insects. (*Rules.*)

carefully all the phenomena of this freak of nature, and that they will have the apple photographed, with a portion of the vine, before its removal, for engraving and publication in Horticultural journals.—*Richmond Whig.*

When growing on vines in the vicinity of hickory trees, it has ridiculously been considered a hybrid fruit between these two very widely separated plants.

The form of the gall is variable—sometimes being quite flattened or depressed, but more often spherical, or flattened at base and more pointed at tip. When young it is downy on the outside, and succulent, with a pleasant acidulous flavour. When mature, it usually has eight or nine longitudinal lobes, as in a musk-melon, and is smoother (Fig. 38 *a*). A transverse section (*b*) shows it to consist of a fleshy outside covering, like the hull of a walnut, and of a much harder, woody interior, with numerous longitudinal two-tiered cells or cavities, the upper tier twice as long and more regularly separated by harder fibre than the lower. The yellow larvæ are found in these cavities, and they have a brown clove-shaped breast bone. This gall which bears so great a semblance to a fruit, doubtless carries the semblance still further by falling to the ground. And, as the seed is released upon the death of the fruit which surrounded it, and consigned to the bosom of the great mother earth for development, so the larvæ escape from the decomposing and softening gall to consign themselves likewise to the same great nursery, which seems to be absolutely necessary for their well-being and growth, as I have kept the galls for over a year out of earth and away from her fecund influences without getting the perfect gnats.

Fig. 38

This gall was first described in the *American Entomologist*, (vol. 1, p. 106.)

THE GRAPE-VINE FILBERT-GALL, (*Vitis coryloides*) W. & R.

(Order, *Diptera*; Family, *Cecidomyidae.*)

This gall (Fig. 39 *b*), as its name implies, bears some resemblance to a large bunch of filberts or hazel-nuts. It is found more frequently than the other, and especially on the River Bank grape (*Riparia*), in the month of July. It is an assemblage of separate galls, more or less coalescent, varying in number from ten to forty or more, and of different shapes, being either round, irregularly oval, fusiform or pyriform, but generally narrowing at the tip. When young, these galls are densely pubescent or woolly on the outside, but less so when mature. The interior is fleshy, juicy, sub-acid, and a tranverse section shews a single longitudinal cell in each (Fig. 39 *c*). The gall is evidently a deformation of a bud, as it springs from a single point where a bud would be, and often has quite a stem to it. A stunted deformed leaf is also sometimes found upon it, as given in the figure.

The larva is orange-yellow, partly transparent, partly opaque, and has the breast-bone clove-shaped, as in the preceding (Fig. 39 *a*), first described in *Am. Entomologist*, (I. p. 107).

Fig 39.

THE GRAPEVINE TOMATO-GALL, (*Vitis tomatos.*)

(*Made by Lasioptera vibis O. S.*)

(Order, *Diptera*, Family, *Cecidomyidae.*)

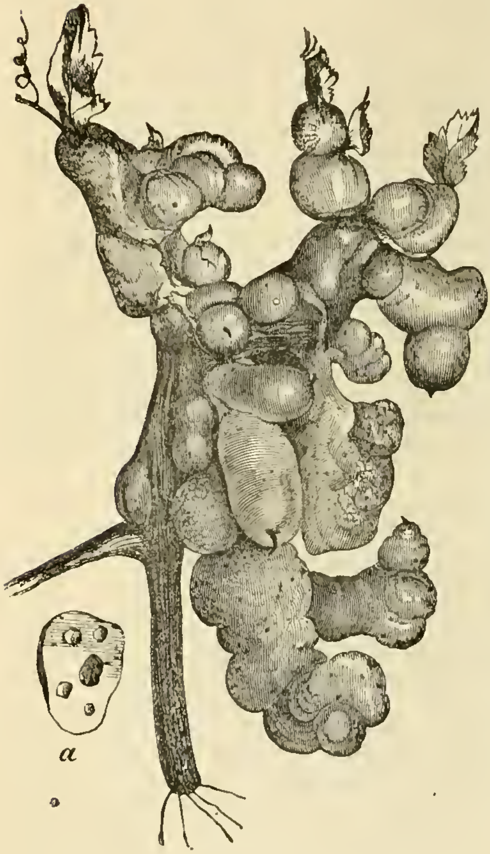


Fig. 40.

The following clipping will show that this gall, which is quite common on the River Bank grape and its cultivated varieties, has not remained unnoticed by the curious, and that it has, like the others, its fruit resemblances.

Freak in a Vineyard.— In gathering grapes to-day we found one of the clusters in shape a *perfect tomato.* It is of quite large size, and on the outside is divided into eight segments or lobes, having a seed to correspond with each segment or lobe. It was found on a cluster of one of Rogers' Hybrids, and a peculiarity is, that the grape is *blue*, while this is *red.* In flesh and seeds and all else it is a perfect grape. President Wilder's Trophy tomato stands about three rods from the vine. I call upon President Wilder to explain with what sort of propagating qualities he has invested his Trophy tomato, to know, if we continue the cultivation of that fruit, whether our apples, plums, cherries, etc., will or will not turn into Trophy tomatoes. I have saved the eight seeds for the further solution of the problem. If President Wilder declines an explanation for *fear of the consequences,* I call upon all the horticulturists of America to commence at once an investigation and I will furnish them with the *hide,* which I have carefully preserved as a testimony against him.—*Rural New Yorker.*

R. L. DORR.

Dansville, Livigston County, N.Y. Oct. 6th, 1872.

It is the most variable gall with which I am acquainted, as it may be found of all sorts of fantastic shapes, from the single, round cranberry like swelling on a tendril to the large collection of irregular bulbous swellings on the stem or leaf-stalk; sometimes looking not unlike a bunch of currants or a bunch of grapes, but more often like a bunch of diminutive tomatoes, such as the Cluster Tomato, grown by Mr. J. C. Ingham, of St. Joseph, Michigan. It was first briefly described together with the fly which produces it, by Baron Osten Sacken (Diptera of N. A., part I. pp. 201–2). The substance of the gall is soft, juicy and translucent, the flavour pleasantly acid, and the colour yellowish-green, with rosy cheeks, or else entirely red. Each swelling has several cells (Fig 40*a*) in each of which is nursed an orange-yellow larva, which, upon the dissolution of the gall, enters the ground to transform, and emerge a pale reddish gnat with a black head and antennæ and gray wings.

This gall-maker is subject to the attacks of at least two different enemies—one a species of *Thrips*, which invades the cell and destroys its inmate, and one a true Hymenopterous parasite, [1]belonging [apparently to the family *Proctotrupidæ*, and which after killing the gall-maker, spins a cocoon within the cell.

THE GRAPE LEAF TRUMPET-GALL—(*Vitis viticola O. S.*)—*Order Diptera. Family Cecidomyidæ.*

This is another, more regular gall, made by a gall-gnat which has not yet been described. is elongate, conical, and grows more or less numerously from the surface of the leaf, looking something like a small trumpet. (Fig. 41) I have found it on both wild *Cordifolia* and *Riparia*, and it doubtless occurs on their cultivated varieties. It is also found on *Labrusca* and *Vulpina*. (See A. E., II. p. 28.) The usual colour is a bright crimson, but it sometimes inclines to green; especially when young or on the under side of the leaf; for though it is more often found on the upper side, I have met with it antiposed. Upon cutting into these galls, we shall find them to be hollow, and each to contain a pale orange larva, which probably resembles those already mentioned in transforming under ground. The gall was at first briefly described by Baron Osten Sacken (Diptera of N. A., part I., p. 202). Similar but distinct galls grow on the leaves of Hickory and Hackberry, but are always green.

Fig. 41.

DRAGON FLIES.

By Joseph Williams, London, Ontario.

In the months of July and August there are few insects more abundant than the Dragon flies, and none which attract more attention from even the most indifferent observer, and a description of the more common kinds and some account of their habits may not be uninteresting. For the following account we are largely indebted to the graphic description of A. S. Packard, Jun., in our "Common Insects."

In various countries these insects have received various popular names—the French call them Demoiselles; the Germans, Florfliegen or Gauze-flies, or Wasserjungfern or Virgins of of the Water; while the English style the Dragon flies, Horse-stingers, or Devil's Darning-needles. The English terms, although less poetical than those of our European friends, are, we believe, more appropriate to the private character of these insects.

The accompanying illustration of one of our most common species (*Libellula trimaculata*), Fig. 42, will give an idea of the appearance of these insects. Of the general character of the group Packard says:—"Were we to select from among the insects a type of all that is savage, relentless, and blood-thirsty, the Dragon fly would be our choice. From the moment of its birth until its death, usually a twelvemonth, it riots in bloodshed and carnage. Living beneath the waters, perhaps eleven months of its life, in the larva and pupa states, it is literally a walking pitfall for luckless aquatic insects; but when transformed into a fly, ever on the wing in pursuit of its prey, it throws off all concealment, and reveals the more unblushingly its rapacious character.

Fig. 42.

"Not only does its horrid visage and ferocious bearing frighten children, who call it the 'Devil's Darning-needle,' but it even distresses older persons, so that its name has become a by-word. Could we understand the language of insects, what tales of horror would be revealed! What traditions, sagas, fables, and myths must adorn the annals of animal life regarding this dragon among insects!

"To man, however, aside from its bad name and its repulsive aspect, which its gay trappings do not conceal, its whole life is beneficent. It is a scavenger, being like that class ugly and repulsive, and holding literally, among insects, the lowest rank in society. In the waters it preys upon young mosquitoes and the larva of other noxious insects. It thus aids in maintaining the balance of life, and cleanses the swamps of miasmata, thus purifying the air we breathe. During its existence of three or four weeks above the waters, its whole life is a continued good to man. It hawks over pools and fields aud through gardens, decimating swarms of mosquitoes, flies, gnats, and other baneful insects. It is a true Malthus' delight, and following that sanguinary philosopher, we may believe that our Dragon fly is an entomological Tamerlane or Napoleon sent into the world by a kind Providence to prevent too close a jostling among the myriads of insect life.

"We will then conquer our repugnance to its ugly looks and savage mien, and contemplate the hideous monstrosity—as it is useless to deny that it combines the graces of the Hunchback of Notre Dame and Dickens' Quilp, with certain features of its own—for the good it does in Nature.

"Even among insects, a class replete with forms the very incarnation of ugliness and the perfection of all that is hideous in nature, our Dragon fly is most conspicuous. Look at its enormous head, with its beetling brows, retreating face, and heavy under-jaws—all eyes and teeth—and hung so loosely on its short weak neck, sunk beneath its enormous hunchback—for it is wofully round-shouldered—while its long, thin legs, shrunken as if from disease, are drawn up beneath its breast, and what a hobgoblin it is !

"Its gleaming wings are, however, beautiful objects. They form a broad expanse of delicate parchment-like membrane drawn over an intricate network of veins. Though the body is bulky, it is light, and easily sustained by the wings. The long-tail undoubtedly acts as a rudder to steady its flight."

While we do not hold the Dragon fly to be the "very incarnation of ugliness and the perfection of all that is hideous," as does the author above-named we do not believe its benefits to man have been exaggerated. The rapid flight and enormous range of vision of these creatures enable them to capture other insects with ease ; while, their taste not being limited, they destroy moths, butterflies, and other insects without compunction, and they have been known to destroy and eat each other as well as very small fishes. However, it is this ravenous propensity which makes this insect so valuable to man, as they destroy immense numbers of other insects which are injurious to vegetable and other products, while they do not injure these substances themselves. A few of them shut in a house will soon rid it of flies, bugs, and mosquitoes, and therefore their presence should be welcomed. The popular opinion that they are dangerous to man is without foundation, as they can neither bite, sting or poison him.

We may now consider the development of *Libellula trimaculata*, previously figured, as it furnishes some curious and interesting information, and may bo taken as representing that of the group.

When the female is about to deposit her eggs, she attaches herself to some plant growing out of the water, and pushing her abdomen beneath the surface, glues a bunch of eggs to the submerged stem or leaf (Uhler). These eggs produce larvæ which have a distant and ugly resemblance to the perfect insect. The larva is active and passes its existence in the water, feeding on numerous weaker insects. It possesses a curious syringe-like apparatus situated in the end of the body, by which it discharges a stream of water for a distance of two or three inches behind it, thereby propelling the insect forward. The motion thus given is most irregular and appears to be beyond the control of the larva. This curious arrangement serves for respiration as well as locomotion.

The larva soon reaches the pupa state (corresponding to the chrysalis state of a butterfly), in which it is also active, crawling over the bottom of the stream preying on other insects. In this state it is longer than the larva and still more resembles the perfect insect. When about to become a perfect insect, the pupa climbs up some suitable plant near the surface of the water, and attaching itself firmly awaits the last great change. In a short time the skin opens down the back and the adult Dragon fly, by bending backwards and forwards for some time, emerges. It only requires to remain a few hours, until its wings attain their full size and hardness, when it starts off on a life-long expedition of plunder.


Fig. 43.

In Fig. 43 we have a representation of three stages in the life of a foreign *Libellula*. The figure on the left shows the larva using its *mask* to capture prey ; the figure on the right represents the perfect insect in the act of emerging from the pupa case.

The full-grown *Libellula* may be described as follows :—The body is much elongated and cylindrical, and attains a length of two inches, in average specimens. The head is large and bears two very large and prominent compound eyes. These eyes which consist of many thousand facettes each, are so large that they meet on the upper surface of the head. This great power of vision is still increased by three simple eyes, or ocelli, situated on the upper surface of the head. From the front part of the head project two short tapering antennæ. The mouth occupies the front surface of the head, and is a most formidable structure. The upper lip is broad and conceals very powerful toothed organs, called mandibles; the other organs of the mouth are also armed with strong teeth which enable the creature to satisfy its carnivorous desires. The most remarkable portion of the mouth, however, is the lower lip, a large, flat, lobed organ, closing the mouth from the under side, and which may be projected forward to a comparatively great distance when attacking other insects.

The thorax, or middle portion of the body, is three or four times as long as the head, and very much greater in diameter. It resembles the head in colour, being of a medium chocolate shade, and is sparsely clothed with very short hairs of the same hue.

The abdomen, or posterior part of *L. trimaculata* tapers very gradually to the end, and is much smaller than the thorax in diameter, but more than twice its length. The colour is slightly paler, and is relieved by a line of yellowish blotches along each side, which gradually becomes smaller in size toward the end of the body. The upper surface is arched, while the under is flattened.

The legs are six in number, and are attached three to each side of the lower surface of the thorax.

The wings, which are four in number, are attached two to each side of the upper part of the thorax, and are about one and a quarter inches long, and three-eighths to nearly half an inch in breadth; the front ones being slightly the narrowest. The substance of the wings is a very delicate network covered by a thin transparent membrane, having a shining surface. From the place of attachment of each wing, there proceeds a narrow elongated patch of a deep brown colour, while from about the middle of the wings there is a large irregular patch of the same colour, which extends completely across. The structure of the wings combines great strength with lightness, thereby enabling the insect to fly with very great rapidity. Their shining surface, transparency and brilliant colouring in this and other members of the same order, combine to give them a beautiful appearance when flying in the bright sunshine, and evidently suggested the popular names given to them by the French and Germans.

Fig. 44.

There are several other members of the same group which are more or less common in various parts of the country.

Libellula quadrimaculata, the four-spotted Dragon fly, (Fig. 44.) is seen on the wing in June, flying through dry pine woods far from any standing water.

Another very common Dragon-fly is the ruby Dragon-fly *Diplax rubicundula,* which is yellowish red.

Fig. 45.

Fig. 46.

Fig. 47.

Another common form is *Diplax berenice*, (Fig. 45, male; Fig. 46, female). The accompanying cut (Fig. 47.) represents the larva, probably of this species, according to Mr. Uhler. It is black, the head blue in front, spotted with yellow, while the thorax and abdomen are striped with yellow. There are fewer stripes on the body of the male, which has only four large yellow spots on each side of the abdomen.

Still another specimen is *Diplax Elisa*. It is black, with the head yellowish and with greenish yellow spots on the sides of the thorax and base of the abdomen. There are three dusky spots on the front edge of each wing, and a large cloud at the base of the hind pair towards the hind angles of the wing.

Fig. 48.

Rather a rare form, and of much smaller stature is the *Nannophya bella*, (Fig. 48.) It was first detected in Baltimore, and was afterwards found unfrequently by a pond in Maine. Its abdomen is unusually short, and the reticulations of the wings are large and simple. The female is black, while the male is frosted over with a whitish powder.

In the allied genus *Agrionina*, there are many interesting insects; we give an illustration in fig. 49. of one of the most common, *Agrion saucium*. This insect is smaller in size than those we have previously mentioned.

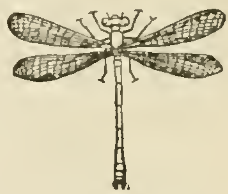


Fig. 49.

Although in this country we rarely see Dragon-flies gathered in large numbers at one time, yet it is known that in some countries they not unfrequently form immense swarms. In Kirby and Spence's Entomology we find the following:—" Meinecken tells us, that he once saw in a Village in Anhalt, on a clear day, about four in the afternoon, such a cloud of Dragon-flies (*Libellulina)* as almost concealed the sun, and not a little alarmed were the villagers, under the idea they were locusts; several instances are given by Rosel, of similar clouds of these insects having been seen in Silesia and other districts; and Mr. Woolnough, of Hollesley in Suffolk, a most attentive observer of nature, once witnessed such an army of the smaller dragon-flies, *(Agrion)* flying inland from the sea, as to cast a slight shadow over a field of four acres, as they passed.

A migration of Dragon-flies was witnessed at Weimar, in Germany, in 1816, and one far more considerable, perhaps the greatest on record, May 30th and 31st, 1839, when cloud-like swarms of these insects, chiefly (*Libellula depressa*) were seen at Weimar, Eisenach, Leipsig, Halle and Gottingen, and the intervening country, extending over a large district."

Although so well known in the adult or perfect state, comparatively little is known of the transformations of Dragon-flies. They may be easily kept in aquaria where their various changes may be watched, and any one who can spend the necessary time and patience in rearing them, so as to trace up the different stages from the larva to the adult fly, and describe and figure them accurately, will do good service to science (Packard).

The graceful appearance of these insects has not escaped the notice of poets, for Moore alludes to them as " the beautiful blue damsel flies," while Tennyson, in his poem of the " Two Voices," gives the following description :—

To-day I saw the Dragon-fly
Come from the wells where he did lie.
An inner impulse rent the veil
Of his old husk : from head to tail
Came out clear plates of sapphire mail.

He dried his wings : like gauze they grew ;
Through crofts and pastures wet with dew
A living flash of light he flew.

THE HESSIAN FLY.

(*Cecidomyia destructor Say.—Diptera : Tipulidæ.*

By the Rev. C. J. S. Bethune, M.A.

For many years this Province has happily been almost entirely free from the ravages of the Hessian Fly. During the present year (1877) however, this very destructive insect has again appeared in the wheat-fields, and is attracting much attention from farmers and others specially interested in the culture of this most important cereal. As far as we have been able to obtain information the Hessian fly has been recently observed in the counties of Grey, Simcoe, York and Ontario, and also in the County of Oxford. No doubt, if not checked, it will soon spread over a much wider area, and cause much loss and disappointment to our wheat-growers.

The subject being one of so great importance, it has been considered advisable to reproduce here our Report upon this insect, published six years ago (*Report of the Entomological Society of Ontario*, 1871, pages 392-5).

The Hessian fly, together with a number of other most destructive insects, has come to us from the other side of the Atlantic. European entomologists have repeatedly maintained that it must be a native of America, as no such insect was observed amongst their wheat-fields during a long series of years ; and Mr. Curtis has even gone so far as to call it "the *American* wheat-midge," in contradistinction to what he terms "the *British* wheat-midge" (*C. tritici*). It is now, however, generally admitted that it is of European origin, and it is almost certain that it was first brought to this continent in some straw used for the purpose of packing by the Hessian troops, under Sir William Howe, during the American War of Independence. These soldiers landed on Staten Island, and on the west end of Long Island, in the year 1776, and in this neighbourhood the fly was first observed; hence it obtained its popular name of "Hessian Fly." Having multiplied in these places—as Dr. Harris relates—"the insects gradually spread over the southern part of New York and Connecticut, and continued to proceed inland at the rate of fifteen or twenty miles a year. They reached Saratoga (two hundred miles from their original station) in 1789." Proceeding in this manner, the tiny pest gradually spread over the country, and has been found in almost every locality where wheat is grown. In the old world also, its depredations have been sufficiently great to attract notice in England, France, Germany, Austria, Switzerland, Italy, Russia,—in fact in almost every country where this grain is cultivated to any extent. Our own Dominion, though frightfully devastated in subsequent years, was not invaded by the pest till about the year 1816, when it became prevalent in Lower Canada. It appears to have been first noticed in this Province in the year 1846. (For a detailed history of its progress in this country and the neighbouring States down to the year 1854, see Prof. Hind's Essay, pp. 42–46.)

So much has been said and written respecting the Hessian fly, and so many descriptions of it have appeared in agricultural and scientific publications, that we feel disinclined to attempt any new account of it or repeat once more "an oft told tale." As we have no new light to throw upon the subject, and, with the exception of some specimens received from Ancaster during the past summer, have had no opportunity for some years of investigating its habits, we shall not hesitate to make free use of the writings of others, especially those which are not likely to be accessible to the majority of our readers. In every case we shall, of course, make due acknowledgement of the source from which information is derived.

The Hessian fly, though known for its destructive qualities for some time before, was first scientifically described by Mr. Say—one of the most eminent of the early American

Entomologists—under the name of the Destructive Midge (*Cecidomyia destructor*). "This insect—Dr. Fitch relates—as a general rule passes through two generations annually. The first of these occupy the autumn, winter and fore part of spring, and is reared at the roots of the young grain slightly under the ground. The second occupies the remainder of the spring and summer, and is nurtured in the lower joints of the straw. The time when its several changes occur, however, is not perfectly uniform, being varied by the climate, the state of the weather and perhaps other contingencies, and it is not improbable that individual specimens, placed in circumstances unfavourable to their developement, in some instances have their growth so much retarded as to require even a whole year to complete their metamorphoses. In the ordinary course of nature, therefore, our crops of winter wheat are liable to two attacks of the Hessian fly, one generation reared at its roots producing another which occupies the lower joints of the stalks. Thus the larvæ and pupæ are present in it almost continually, from the time the tender young blades appear above the ground in autumn till the grain ripens and is harvested the next summer. Our spring wheat, on the other hand, can rear but one brood of these insects; they consequently resort to it but little if at all. Nor can the Hessian fly sustain itself except in districts where winter wheat is cultivated, in which to nestle during the autumn and winter."

The eggs of the autumn generation are deposited by the female fly generally early in September, in the young fall wheat, in a crease of the leaf. Twenty or thirty eggs are laid on a single leaf, and these hatch out in about four days if the weather be warm. Mr. Tilghman, of Maryland, has published in *The Cultivator*, of May, 1841, the following minute and interesting account of the mode in which the eggs are laid: "By the second week of October, the first sown wheat being well up, and having generally put forth its second and third blades, I resorted to my field on a fine warm forenoon to endeavour to satisfy myself by ocular demonstration whether the fly did deposit the egg on the blades of the growing plant. Selecting a favourable spot to make my observation, I placed myself in a reclining position in a furrow, and had been on the watch, but a minute or two before I discovered a number of small, black flies alighting and sitting on the wheat plants around me, and presently one settled on the ridged surface of a blade of a plant, completely within my reach and distinct observation. She immediately began depositing her eggs in the longitudinal cavity between the little ridges of the blade. I could distinctly see the eggs ejected from a kind of tube or sting. After she had deposited eight or ten eggs, I easily caught her upon the blade and wrapped her up in a piece of paper. After that I continued my observations on the flies, caught several similarly occupied, and could see the eggs uniformly placed in the longitudinal cavities of the blades of the wheat, their appearance being that of minute reddish specks." These eggs are computed to be about one-fiftieth part of an inch in length.

When hatched from the egg, the next proceedings of the insect are thus related by Mr. Herrick:—"The little wrinkled maggot or larva creeps out of its delicate membraneous egg skin, crawls down the leaf, enters the sheath, and proceeds along the stalk, usually as far as the next joint below. Here it fastens lengthwise, and head downwards, to the tender stalk, and lives upon the sap. It does not gnaw the stalk, nor does it enter the central cavity thereof; but as the larva increases in size, it gradually becomes embedded in the substance of the stalk. After taking its station the larva moves no more, gradually loses its reddish colour and wrinkled appearance, becomes plump and torpid, is at first semi-translucent, and then more and more clouded, with internal white spots; and when near maturity the middle of the intestinal part is of a greenish colour. In five or six weeks (varying with the season) the larva begins to turn brown, and soon becomes of a bright chestnut colour, bearing some resemblance to a flax-seed." Two or three larvæ, thus embedded in a stalk, serves to weaken the plant and causes it to fall down, or to wither and die.

In this condition, the "flax-seed state," as it is usually termed, the insect remains all winter. Regarding the structure and formation of this peculiar appearance there has been much controversy, into which we need not enter here. Suffice it to say, that some have held the opinion that the larva spins its cocoon which bears this form; others, that it is the hardened outer integument of the worm, separated from the insect, which remains within; others again, and notably, the late Mr. Walsh, that the pupal cocoon is exuded from the larva. Whatever may be the process, in this condition it remains till the warm days of spring arrive, when the insect completes its pupal state, and finally comes forth as a tiny two-winged fly. (Fig. 50.)

Fig. 50.

"The head, antennæ, and thorax of this fly are black; the hind body is tawny, more or less widely marked with black on each wing, and clothed with fine greyish hairs. The egg-tube of the female is rose-coloured; the wings are blackish, except at the base, where they are tawny, and very narrow,—they are fringed with short hairs and are rounded at the tip; the legs are pale red or brownish, and the feet are black. The body measures about one-tenth of an inch in length, and the wings expand one-quarter of an inch or more. After death the hind body contracts and becomes almost entirely black." (Harris, *Injurious Insects*, p. 570.) The antennæ of the female are about half the length of the body; those of the male three-fourths. The former are composed of sixteen oval joints twice as long as thick, and clothed with a number of hairs; the latter have short, round joints, each with a chord of rather long hairs.

After these flies come forth from the pupa state in the spring they speedily, set to work to lay their eggs on the leaves of the spring wheat, now appearing above the surface of the ground, as well as upon that sown the autumn before. From this batch of eggs another brood is soon hatched, the work of destruction goes on, and late in summer the second generation of flies comes forth. The larvæ of the summer brood are found almost always under the sheath of the leaf just above the first joint; their suction of the juices at that point weakens the stalk so much that a high wind very soon bends it down, and even breaks it off when the straw approaches ripeness. Of course the size and value of the grain is also immensely lessened by the absorption of the sap, which ought to go to filling out the ear. The winter brood attack the young plant lower down, and injure it at the root, frequently killing it outright.

Having now traced the life of the insect from the laying of the eggs in one autumn to the same point in the following year, we may turn our consideration to the remedies for the foe, which, as in the case of the wheat midge above, may be classified as natural and artificial.

Natural Remedies.—Though we are, unhappily, so very deficient in natural checks to the spread of the wheat-midge on this side of the Atlantic, our case is very different as regards the Hessian fly. It is preyed upon and devoured by a number of parasitic insects, whose combined attacks are computed to destroy nine-tenths of every generation of this pernicious foe. Mr. Say described one of the most useful of these parasites under the name of *Ceraphron destructor*. It is a shining black four-winged fly, about one-tenth of an inch in length. "In the month of June, when the maggot of the Hessian fly has taken the form of a flax-seed, the *Ceraphron* pierces it through the sheath of the leaf, and lays an egg in the minute hole thus made. From this egg is hatched a little maggot, which devours the pupa of the Hessian fly, and then changes to a chrysalis within the shell of the latter, through which it finally eats its way, after being transformed to a fly. This last change takes place both in the autumn and in the following spring. Two more parasites, discovered by Mr. Herrick, also destroy the Hessian fly, while it is in the flax-seed or pupa state." (Harris.) A fourth has been found by the same observer to attack the eggs of the enemy. "This egg parasite is a species of *Platygaster*. It is very abundant in the autumn, when it lays its own eggs, four or five together in a single egg of the Hessian fly. This, it appears, does not prevent the latter from hatching, but the maggot of the Hessian fly is unable to go through its transformations and dies after taking the flax seed form. Meanwhile its intestine foes are hatched, come to their growth, spin themselves little brownish cocoons within the skin of their victims, and in due time are changed to winged insects, and eat their way out."—Harris.

It is owing almost entirely to these minute allies that our crops have been preserved to so great an extent, of late years, from the ravages of the Hessian fly. For a time the pest inflicted great damage, but its enemies soon increased and gathered strength, and have succeeded in keeping it within due bounds. Assuredly, we should feel deeply grateful to the merciful Creator, who has provided such effectual, though apparently insignificant, means to save the fruits of our fields from destruction.

Artificial Remedies.—These are often attempted, but seldom with entirely satisfactory results. The best precaution to take—where the insect has shown itself in numbers and where the wheat-midge is not apprehended—is to sow the next crop of fall wheat as late as can be done with safety in the autumn—about the middle or towards the end of September.

This course prevents the parent fly from obtaining any young wheat upon which to lay their eggs, and destroys the prospects of another generation. A fertile, thoroughly-cultivated, and well drained soil is as effectual a means of escaping loss from the attack of this insect as any, probably, that can be mentioned. Benefit may also be derived from the sowing only of an approved flinty-stemmed variety of wheat, which is thus more capable of resisting the fly's attacks upon it. But after all the chief reliance for immunity is to be placed upon the labours of the parasitic insects mentioned above.