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REPORT

OF THE

Entomological Society of Ontario,

FOR THE YEAR 1871.

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

BY

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

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

WILLIAM SAUNDERS,

Vice-President,

AND

EDMUND BAYNES REED,

Secretary-Treasurer.

Toronto :

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1872.

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1871-1894

General Meeting
Act of Incorporation
Annual Meeting
Treasurer's Report
President's Address
Catalogue of Members
Constitution
Introduction

INSECTS AFFECTING
The Orange
The Walnut
The Cotton

INSECTS INJURING
The Grape
Grape
Grape
Spilostoma
Large
Grape-
The Thistle
Grape-
Green
Agrotis

INSECTS AFFECTING
The Plum
The Lemon
The Peach
Grey D

INSECTS INJURING
The Immature
The Nectar
The Currant
The Spine
The Grape
The Black
The Peach
The Oblique
The Foot
The Immature
The American
The Good
The Good

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ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

1871,

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

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 1871, with the Constitution and By Laws, a detailed statement of receipts and expenditures, its proceedings during the year, and also a list of the office-bearers elected for the year 1872.

The annual meeting of the Society was held at the City of Kingston, at the same time as the Exhibition of the Agricultural and Arts Association, according to our Statute of Incorporation, and the various Reports were then presented and approved of.

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

The Society still continues the monthly publication of "THE CANADIAN ENTOMOLOGIST" which has now nearly reached the completion of its third volume, and I feel great pleasure in being able to inform you that our little periodical has elicited warm approval both in England and the United States, from Entomologists, whose position in the scientific world renders such approbation most grateful and encouraging to us. The Society has now some 250 members, and has branches established at London, Kingston and Quebec.

I have the honour to remain
 Your obedient servant,

EDMUND BAYNES REED,
Secretary-Treasurer of the Entomological Society of Ontario.

London, Ont., October 25th, 1871.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

A general meeting of the Entomological Society of Canada, was held in the rooms of the Canadian Institute, Toronto, on Thursday morning, March 2nd, 1871. E. Baynes Reed, Esq., (London), Vice-President, occupied the chair. A goodly number of members were present, including several from the London Branch of the Society.

The minutes of the last meeting, and the Report of the Committee on the Cabinet for the Agricultural and Arts Association, were read and adopted.

Letters were also read from Prof. Hincks, Messrs. Couper, Cowdry, and Websdale. The application of certain gentlemen at Kingston, Ontario, who desire to form a Branch of the Society there, was read, and on motion laid over to the afternoon meeting for consideration.

Mr. Reed read the correspondence with the Bureau of Agriculture of Ontario, and gave a statement of the proceedings that had taken place with reference to the incorporation of the Society. He also read the following "Act to amend the Agricultural and Arts Act," which had been passed at the recent session of the Legislature.

ACT OF INCORPORATION OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Extracted from the Agricultural and Arts Act, 34 Vic., 1870-71.

That the following new section and sub-section, read as and be section 33 of 31 Vic., cap. 29:—

"The Society now existing and known as the 'Entomological Society of Canada,' may organize and form themselves into a Society, comprising not less than twenty-five members, and paying an annual subscription of not less than one dollar each, to be known as 'The Entomological Society of Ontario,' and shall have power to adopt a Constitution, and make By Laws for the admission of members, and for its guidance and proper management, and the promotion of any objects consistent with the study of Entomology, and its practical bearing upon the Agricultural and Horticultural interests of the Province of Ontario, and not inconsistent with the laws of the Province; and on filing a copy of such Constitution and By-Laws with the Commissioner of Agriculture, such Society shall become a body corporate under this Act.

"(1). And such Society shall be entitled to receive, from unappropriated moneys in the hands of the Treasurer of Ontario, a sum not to exceed five hundred dollars in any one year.

"(2). The said Society shall hold an annual meeting at the place and during the same time, as the Exhibition of the Agricultural and Arts Association is being held, in each and every year; and shall, at such meeting present a full report of its proceedings, and a detailed statement of its receipts and expenditures for the previous year, and shall, at such meetings, elect a President, Vice-President, Secretary and Treasurer, (or a Secretary-Treasurer), and not fewer than three, nor more than five Directors; and they shall also elect two Auditors.

"(3). A copy of the Annual Report of its proceedings, and a list of the office-bearers elected, and also a Report of such information as the Society may have been able to obtain on the subject of insects beneficial or injurious to the farm and the garden, with such appropriate illustrations as the Society may have been able to obtain, shall be sent to the Commissioner of Agriculture within thirty days after the holding of such annual meeting.

By another section the President of the Entomological Society of Ontario, is made a member *ex-officio* of the Council of the Agricultural Society."

It was then moved by Mr. Wm. Saunders, seconded by the Rev. C. J. S. Bethune,—

That the Entomological Society of Canada, gladly avails itself of the benefits arising from the liberality of the Government of Ontario, as set forth in the amended Agricultural Act; and that the meeting do now proceed to comply with the requirements of the Act of Incorporation.—*Carried.*

Mr. Saunders then gave notice that at the next meeting of the Society, he would move that the Constitution be amended so as to bring it into accordance with the Act of Incorporation:

The meeting then adjourned.

AFTERNOON MEETING.

A second meeting of the Society was held, pursuant to notice, at 3 o'clock, P.M., on the same day as the preceding, and at the same place. The President, Prof. Croft, occupied the chair: The minutes of the previous meeting were read and adopted.

In accordance with the notice of motion given by Mr. Saunders at the former meeting, the Constitution of the Society was taken up for discussion, and amended in accordance with the provisions of the Act of Incorporation.

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The following gentlemen were then elected to hold office for the year 1871 :—
 PRESIDENT.—Rev. C. J. S. Bethune, M.A., Trinity College School, Port Hope.

VICE-PRESIDENT.—W. Saunders, Esq., London.

SECRETARY-TREASURER.—E. Baynes Reed, Esq., London

DIRECTORS.—Prof. Croft, University College, Toronto; J. M. Denton, Esq., London; and R. V. Rogers, Esq., jun., Kingston.

AUDITORS.—J. H. Griffith, Esq., and C. Chapman, Esq., London.

The following gentlemen were elected members of the Society :—

A. B. Bennett, Esq., Brantford, Ontario, and D. W. Beadle, Esq., St. Catharines, Ontario.

The application from Kingston, for the formation of a Branch of the Society there, laid over from the previous meeting, was received, and permission was granted to establish a branch, in accordance with the terms of the Constitution of the Society.

After some discussion it was resolved that the clause in the Constitution relating to the balloting of new members be held in abeyance until the next annual meeting of the Society, and that in the mean time, any person be admissible, as an ordinary associate member, on payment of one dollar. The annual subscription of members, entitling them to a copy of the *Canadian Entomologist* and all other publications of the Society free of charge, had been previously reduced in the amended Constitution to one dollar per annum. It was resolved to transfer the printing and publication of the *Canadian Entomologist* to London, to increase its size, and issue it in a much more attractive form, embellishing its pages with suitable illustrations. The Rev. C. J. S. Bethune, was unanimously requested to continue to act as Editor, and Messrs. Saunders, Reed, and Denton were appointed a Committee to assist him in the work. The sum of one hundred dollars per annum was also voted to be paid to the Editor from the Society's funds.

The following resolutions were adopted :—“ That the hearty thanks of this Society are tendered to the Rev. C. J. S. Bethune, for his untiring zeal and activity while holding the office of Secretary-Treasurer, during the last eight years.”

The meeting then adjourned.

On the 11th day of May 1871, the Secretary filed a copy of the Constitution and By Laws with the Commissioner of Agriculture, and the Society became thereby incorporated under the Statute; the head quarters being Toronto, and branches being established at London, Kingston, and Quebec.—(*Vide Constitution at the end of this Report*).

ANNUAL MEETING 1871.

The first general annual meeting of the Society was held on Wednesday evening, September 27th, 1871, at half-past seven o'clock, at the Lecture Room of Queen's College, Kingston, the use of which had been kindly granted for the occasion.

The Vice-President, W. Saunders, Esq., occupied the chair.

The minutes of the previous meeting were read and approved.

The chairman read a letter of apology from the President, Rev. C. J. S. Bethune, regretting his inability to attend the meeting, and stating that his address had been forwarded.

The Secretary-Treasurer presented his annual statement, for the year ending September 23rd, 1871, showing a balance in hand of \$233 73, and explaining that the whole of this sum would be exhausted during the current year, in printing the remaining six numbers of the *Entomologist*, and meeting current expenses.

The accounts and statements had been duly audited.

On motion duly carried.

The Treasurer's account was received and adopted.

The Secretary reported verbally on behalf of the Council, That, as the programme for 1871, had been fully discussed and laid down at the last meeting held in April, and no new matters had since arisen, it had not been considered expedient to call a Directors' meeting during the year. The Kingston Branch had been fairly started and now consisted of some ten members, with a fair prospect of increasing its numbers. The publishing of the *Entomo-*

logist had been transferred to London, where very satisfactory arrangements had been made for printing. Owing to the difficulty in procuring a suitable curator at Toronto, the Society's cabinets and collections had been transferred to the care of the London Branch. This arrangement, however, was only temporary. The Directors had also made provisions for the preparation of a special report on insects, to be presented on behalf of the Society to the Commissioner of Agriculture.

The election of officers for the ensuing year then took place with the following result:—

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

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

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

Council.—Prof. H. Croft, University College, Toronto; Prof. J. Macoun, Albert College, Belleville; R. V. Rogers, Esq., Kingston; J. M. Denton, Esq., London; J. Pettit, Esq., Grimsby.

Auditors.—J. H. Griffith, Esq., and C. Chapman, Esq., London.

A discussion then took place upon the subject of illustrating the *Entomologist*, and some information was given as to the relative expense of procuring electrotypes and lithographs. General satisfaction was expressed at the improved *status* and condition of the Society, and at the change which had been made in the publishing and appearance of the *Entomologist*.

The Secretary took occasion to reciprocate the kindly sentiments that the President of the Fruit Growers' Association had so courteously expressed in his Annual Address, the night previous, with regard to the Entomological Society of Ontario. It was sincerely to be hoped that the two Sister Societies, may long continue to work together in such harmony, and that the results of their respective labours may be felt and appreciated by the country at large.

The meeting then adjourned.

TREASURER'S REPORT, FOR THE YEAR ENDING SEPTEMBER 23RD, 1871.

Receipts.

Balance from 1870.....		\$ 34 97
Members' Fees—Arrears, Members	\$12 00	
“ “ “ Branches	10 00	
“ “ “ 1871, Members	75 00	
“ “ “ Branches	15 00	
Grant from Bureau of Agriculture.....		112 00
Sale of Cork, Pins, &c.		\$500 00
Sale of back Nos. of <i>Can. Ent.</i>		55 97
Donation		16 07
Various small amounts		1 00
		14 89

Expenditure.

Working Expense account	\$77 92
Engraving	27 25
<i>Canadian Entomologist</i> : Printing Nos. 10, 11, 12, Vol. II, and Nos. 1, 2, 3, 4, 5, 6, Vol. III.....	330 91
Pins.....	11 80
Library account	41 95
Various small accounts.....	11 34
Balance in Bank of Montreal (which will be absorbed this year in printing <i>Entomologist</i> , and current expenses).....	233 73

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We certify that the above is a correct statement of accounts, for the year ending September 23rd, 1871, as shewn by the Treasurer's Books, with vouchers for all disbursements.

JOHN H. GRIFFITH, } *Auditors.*
CHARLES CHAPMAN, }

London, Ont., September 23rd, 1871.

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ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF
ONTARIO, 1871.

To the Members of the Entomological Society of Ontario:

GENTLEMEN,—It is with no ordinary feelings of pleasure and satisfaction that I offer you my congratulations upon the continued success and prosperity of the Entomological Society of Ontario. We are now met together to hold our *first* Annual Meeting under our Act of Incorporation, and as a Public Society duly recognized by the Government of the Province, and closely associated with the Agricultural and Arts Association of Ontario, who are now holding their great Annual Exhibition in this city of Kingston. As we have now attained to a position so much superior to anything we anticipated a few years ago, it may not be amiss to give a brief account of the origin and progress of the Society, and of the work it has been able to accomplish.

The origination of the Society may be traced to the publication in the number of the *Canadian Naturalist and Geologist* for June, 1862, of a "List of Entomologists in Canada," prepared by Mr. Saunders of London, Ont., and myself. As this list contained the names of thirty-six persons interested in the collection and study of Insects, it was resolved to hold a meeting and endeavour to form a Society or Club of those engaged in this branch of Natural Science. In the following September, accordingly, ten gentlemen assembled at the residence of Professor Croft, in Toronto, and decided upon the formation of an Entomological Society, whose objects should be: 1st. The preparation of as complete a collection as possible of Canadian insects, to be kept in some central place for general information and reference. 2nd. The charge of a depository of duplicate specimens contributed by Entomologists for distribution amongst its members; and 3rd. The holding of meetings from time to time for mutual information and the advancement of the science throughout the country at large. As so few were present at this meeting, no definite organization was attempted at the time, but the matter was laid over until the following spring.

On the 16th of April, in the following year, 1863, the Society was at length duly organized under the Presidency of Prof. Croft, and with Mr. W. Saunders as Secretary-Treasurer, and the late Rev. Prof. Hubbert as Curator. The names of about twenty-five persons were enrolled as original members. During the year meetings were held from time to time, and several more names were added to the list of members.

The next year, 1864, was one of great progress, being signalized by the formation, in March, of a branch, with ten original members, at Quebec, Canada East; and of another in July, at London, Canada West, with thirteen original members. A preliminary list of Canadian Lepidoptera, embracing 144 species of Butterflies, Bombyces and Sphinges, was published by the Society during the year. In 1865 many additions to the roll of membership were made, and much good work was done, including the publication of a second list of Canadian Lepidoptera, containing the names of 350 more species. During the following year, 1866, the Society held but few meetings and effected little, owing to the disturbance caused by the Fenian raid and the call made upon many members to leave their homes and join the ranks of the volunteer service. The year 1867 was marked in the annals of the Society by the publication of a valuable list of Canadian Coleoptera, which included no less than 55 families, 432 genera, and 1,231 species, being many times more than had ever been previously enumerated in a Canadian list.

In August, 1868, the Society issued the first number of the *Canadian Entomologist*, a small monthly periodical, devoted to the publication of original papers on the classification, description, habits and general history of Insects. This little serial has been received with much favour by the leading Entomologists of America, many of whom have from time to time contributed to its pages. It has now reached the middle of its *third* volume, and has increased to three times its original dimensions; it has also improved much in style and typographical appearance, as well as in the excellence of its illustrations.

Until December, 1869, the Society received no extraneous assistance or public recognition, but depended wholly for its maintenance upon the efforts of its members. At that time, however, it was voted a grant of \$400, for the year 1870, by the Board of the Agricultural and Arts Association of Ontario, on condition that it furnished an Annual Report, formed a cabinet of insects useful and prejudicial to agriculture and horticulture, and continued the publication of the *Canadian Entomologist*. These conditions were severally complied with by

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the continuance and improvement of our periodical, the formation of a cabinet of insects, arranged in an economical point of view, and placed in the rooms of the Association at Toronto, and by the publication of a report upon the insects affecting the Apple, Grape, and Plum, prepared by Messrs. Saunders, Reed, and myself. The singular favour accorded by the public to this report, and the fact that an edition of three thousand copies was speedily exhausted, sufficiently attest its value.

The present year, 1871, has been signalized by the Incorporation of the Society by the Legislature of Ontario, at the instigation of the Bureau of Agriculture, and the grant to its funds by the Government of \$500 a year. By the same Act, moreover, your President is entitled to take his seat as an *ex officio* member of the Board of Agriculture and Arts. Among the marks of progress of the year, mention must by no means be omitted of the formation of a *third* branch of the Society, at Kingston, which we trust will long continue to grow and prosper. Such, gentlemen, is a brief account of the origin and progress of our Society, the recital of which has not, I trust, proved uninteresting to you. When we look back upon our growth and development, we must all, I am sure, feel cheered and encouraged to continue our work, and strive by our united efforts, to make the Entomological Society of Ontario a credit and a blessing to our land.

Before concluding, I feel that it is my painful duty to remind you of the loss which our Society and the cause of Natural Science generally in this Province has sustained in the recent death of Prof. Hincks, of University College, Toronto. He joined us in our first attempts at organization, and continued our steady friend and supporter till a few months ago. Though his special studies were chiefly devoted to another department of Nature, he yet took a lively interest in Entomology, and was a frequent attendant at our meetings. He died at a ripe old age, and has left a mark upon the scientific records of our country which will not soon be effaced.

Thanking you, gentlemen, for the honour you have done me in calling upon me to preside over you during the past year, and trusting that our Society will continue to grow and prosper, and be zealously maintained by us all,

I have the honour to be, gentlemen,
Your obedient servant,

CHARLES J. S. BETHUNE.

Port Hope, September 27th, 1871.

CATALOGUE OF ENTOMOLOGICAL BOOKS BELONGING TO THE SOCIETY.

Westwood's Introduction, 1839	2 Volumes.
Canadian Naturalist, 1, 2, old series	2 "
Natural History of the Tineina: by H. T. Stainton	12 "
British Tortrices: by S. J. Wilkinson	1 "
Proc. Ent. Soc., Philadelphia, 1861-1867	6 "
Say's Entomology: by Le Conte	2 "
Harris' Insects Injurious to Vegetation: Col. Ed.	1 "
Proc. Acad. Sci., Philadelphia, 1856-1871	10 "
Kirby's Fauna Boreali-Americana: Insecta. Norwich, 1837, 4to	1 "
Brodrip's Zoological Recreation	1 "
Cowan's Curious Facts in Insect History	1 "
Catlow's Popular British Entomology	1 "
The Practical Entomologist: Walsh	2 "
Record of Zoological Literature: Arachnida, Myriapoda, Insecta, 1868-69	2 "
Record of American Entomology: by A. S. Packard, 1868-69-70	3 "
Kirby & Spence. Introduction to Entomology. 8vo. 1826	4 "
<i>Smithsonian Publications.</i>	
Catalogue of the described Lepidoptera of North America: by J. G. Morris, 1860, p.p. 76, 8vo.	1 "
Synopsis of the Lepidoptera of N. America: by J. G. Morris, pt. 1, 1862, p.p. 376, 8vo.	1 "

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CONSTITUTION
OF
The Entomological Society of Ontario,
Incorporated 1871.

SECTION I.—(OBJECTS AND MEMBERSHIP.)

1. The Society shall be called the "Entomological Society of Ontario," and is instituted for the investigation of the character and habits of insects, the improvement and advancement of Entomological Science, and more especially its practical bearing on the Agricultural and Horticultural interests of the Province. The Society shall consist of not less than twenty-five members.
2. The Society shall consist of four classes, viz:—Members Ordinary, Life, Associate, and Honorary.
3. Ordinary Members shall be persons whose pursuits, or studies, are connected with Entomology, or who are in any way interested in Natural History.
4. Life Members shall be persons who have made donations to the value of \$25 in money, books or specimens (the two latter to be valued by competent persons), or who may be elected as such at the General Meeting of the Society, for important services performed, and after due notice has been given.
5. Associate Members shall be persons residing out of the Dominion of Canada, whose pursuits or interests are similar to those of Ordinary Members. They shall have all the privileges of Ordinary Members except that of voting.
6. Honorary Members shall be members of high standing and eminence for their attainments in Entomology.
7. The number of Honorary Members shall be limited to twenty-five.
8. The Officers of the Society shall consist of a President, a Vice-President, a Secretary-Treasurer, and not fewer than three, and not more than five, Directors, to form a Council; all of whom, with two Auditors, shall be elected annually at the Annual General Meeting of the Society, and shall be eligible for re-election. The said Council shall, at their first meeting, appoint a Curator.

SECTION II.—(ELECTION OF MEMBERS.)

1. All candidates for admission into the Society as Members, Associate Members, or Life Members, must be proposed by a member at a regular meeting of the Society, and be balloted for; the affirmative vote of three-fourths of the members present shall be necessary for the election of a candidate.
2. Honorary Members must be recommended by at least three members, who shall certify that the person named is eminent for Entomological attainments; the election in their case shall be conducted in the same manner as laid down for other members.
3. Whenever any person is elected a member in any class, the Secretary shall immediately inform him of the same by letter; and no person shall be considered a member until he has signified his acquiescence in the election.
4. Every person elected a member is required to pay his first contribution within one month of the date of his election; otherwise his election shall be null and void.

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SECTION III.—(CONTRIBUTIONS.)

1. The annual contribution of Ordinary and Associate Members shall be one dollar; all contributions to be due in advance on the first day of January in each year, the payment of which shall entitle the member to a copy of all the publications of the Society during the year. All new members, except those elected at and after the Annual General Meeting, and before the following first of January, shall be required to pay the subscription for the year in which they are elected.

2. Every member shall be considered to belong to the Society, and as such be liable to the payment of his annual contribution, until he has either forfeited his claim, or has signified to the Secretary in writing his desire to withdraw, when his name shall be erased from the list of members.

3. Whenever any member shall be one year in arrear in the payment of his annual contribution, the Secretary shall inform him of the fact in writing. Any member continuing two years in arrears shall be considered to have withdrawn from the Society, and his name shall be erased from the list of members.

4. Life and Honorary Members shall not be required to pay any annual contribution.

SECTION IV.—(OFFICERS.)

1. The duties of the President shall be to preside at all meetings of the Society, to preserve good order and decorum, and to regulate debates.

2. The duties of the Vice-President shall be the same as those of the President during his absence.

3. The duties of the Secretary-Treasurer shall be to take and preserve correct minutes of the proceedings of the Society, and to present and read all communications addressed to the Society; to notify members of their election, and those in arrear of the amount of their indebtedness; to keep a correct list of the members of the Society, with the dates of their election, resignation, or death, and their addresses; to maintain the correspondence of the Society, and to acknowledge all donations to it. He shall also take charge of the funds of the Society, and keep an accurate account of all receipts and disbursements, and of the indebtedness of the members, and render an annual report of the same at the Annual General Meeting of the Society, in the manner required by the Act respecting the Board of Agriculture and Arts.

4. It shall be the duty of the Curator to take charge of all books, specimens, cabinets, and other properties of the Society; to receive and arrange in their proper places all donations of specimens; to keep a record of all contributions of books and specimens, with a list of the contributors; and to oversee and direct any exchange of specimens. He shall, also, report annually to the Society on the condition of the specimens and cabinets under his care.

5. The Officers of the Society shall form a Council, who shall have the direction and management of the affairs of the Society. The Council shall meet once in every quarter, the time and place of meeting to be appointed by the President, and notice to be given to the Secretary at least ten days beforehand.

6. The Council shall draw up a yearly report on the state of the Society, in which shall be given an abstract of all the proceedings, and a duly audited account of the receipts and expenditure of the Society during their term of office; and such report shall be read at the Annual General Meeting.

SECTION V.—(MEETINGS.)

1. Ordinary Meetings shall be held once a month, on such days and at such hour as the Society by resolution may from time to time agree upon.

2. The Annual General Meeting of the Society shall be held at the place and during the same time as the Exhibition of the Agricultural and Arts Association is being held in each year, to receive and deliberate upon the report of the Council on the state of the Society, to elect Officers and Directors for the ensuing year, and to transact any other business of which notice has been given.

3. Special Meetings of the Society may be called by the President upon the written request of five members of the Society, provided that one week's notice of the meeting be given, and that its object be specified.

SECTION VI.—(BRANCHES OF THE SOCIETY.)

1. Branches of the Society may be formed in any place within the Dominion of Canada on a written application to the Society from at least six persons resident in the locality.
2. Each Branch shall be required to pay to the Parent Society fifty cents per annum for each paying member on its list.
3. Every Branch shall be governed by the Constitution of the Society, but shall have power to elect its own officers, and enact by-laws for itself, provided they be not contrary to the tenor and spirit of the Constitution of the whole Society.
4. All the members of the Branches shall be members of the Society and entitled to all the privileges of Ordinary Members.
5. No Associate or Honorary Member shall be appointed by the Branches, but such members may be proposed at General Meetings of the Society by any Branch, as well as by individual members.
6. Each Branch shall transmit to the Parent Society, on or before the first of September in each year, an annual report of its proceedings, such report to be read at the Annual General Meeting.

SECTION VII.—(ALTERATION OF CONSTITUTION.)

1. No article in any section of this Constitution shall be altered or added to, unless notice be first given at an ordinary meeting of the Society, or of a Branch, and the alteration or addition be sanctioned by two-thirds of the members present at the next ensuing meeting; the Secretary of the Society, or of the Branch, shall then notify the Secretaries of all the other Branches; when the sanction of all the Branches has been obtained in the same manner, the alteration or addition shall become law.
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C. V. Riley, I

London,

REPORT

ON SOME OF THE

NOXIOUS AND BENEFICIAL INSECTS

OF THE

PROVINCE OF ONTARIO.

INTRODUCTORY.

In the following Report, the several writers are only responsible for the articles that appear under their respective names. Occupied as they are with their own professions, and having only a small portion of their leisure hours to devote to the study of their favourite science of Entomology, they would crave the indulgence of their readers for any imperfections in this Report. It has been thought advisable to refer briefly to some of the insects described in the Report of 1870, and to notice anything new about their habits or history which the experience of the past year has been able to discover.

Their chief aim has been to lay before the public, in a popular form, all the practical information that they have been able to collect, from facts given on good authority, and experiments conducted with care and perseverance, respecting the habits of the various Insects treated of, and the remedies that have been tried to counteract or terminate their ravages.

If by these Reports any desire shall be aroused to become better acquainted with the wonderful economy and history of the many beautiful and curious little creatures of the insect world, or if any advantage shall be derived herefrom by any agriculturist or horticulturist, the writers will be amply recompensed for their labours.

Acknowledgment is here gratefully made to the proprietor of the "*Canada Farmer*," for the use of many of his admirable engravings, and to the State Entomologist of Missouri, C. V. Riley, Esq, for furnishing electrotypes of his own beautiful drawings.

E. B. REED.

London, Ontario, November, 1871.

INSECTS AFFECTING THE APPLE.

ADDENDA TO THE REPORT OF 1870.

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

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| <p>1. The Oyster-shell Bark-louse (<i>Aspidiotus Conchiformis</i>, Gmélín.)</p> <p>2. The White-marked Tussock Caterpillar (<i>Orgyia leucostigma</i>, Sm. and Abbott.)</p> | <p>3. The Fall Web-worm (<i>Hyphantria testator</i>, Harris.)</p> <p>4. The Codling-worm (<i>Carpocapsa pomonella</i>, Linn.)</p> |
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In our "First Annual Report on the Noxious Insects of Ontario" (published in the Report of the Honourable the Commissioner of Agriculture for 1870), we gave some account of twenty different species of insects that are injurious to the Apple-tree, in one portion or another of its growth, foliage or fruit. To these descriptions we purpose now to add a few remarks, in order to set before the reader any further information that we have obtained during the past year.

1. THE OYSTER-SHELL BARK-LOUSE (*Aspidiotus Conchiformis*, Gmélín).—Since the publication of our remarks upon this insect (First Report, page 73), Dr. Le Baron, the State Entomologist of Illinois, has described a new parasitic insect that, he has good reason to believe, is doing valuable service in reducing the numbers of this noxious insect. In the Western States, and—judging from the cessation of complaints on the subject—in this country also, the Bark-lice are steadily diminishing in number. This decrease is not to be attributed to human agency, but to the increase of parasitic insects that feed upon them, and especially to the labours of the tiny Chalcis fly, now made known to us by Dr. Le Baron. We may judge of the immense service performed by this little creature from the statement of Dr. Le Baron, that among eight hundred and forty-four scales on twigs, taken from different localities in Illinois, he only found fifty-seven, or about one in fifteen, that contained any eggs for another year's crop, and that twice as many of these were destroyed by Chalcides as by all other agencies combined. He gives the following account of the insect in an article in the *American Entomologist*, vol. ii, p. 361 (a most valuable publication, whose suspension we much regret):

"In the early part of the season, whilst examining the lice upon an apple tree, I noticed two or three little yellow Chalcides running along the infested twigs, which I conjectured might be the parasites of the Bark-louse, but had no proof that this was the case. But about the first of August, upon raising one of the scales, I happened to uncover one of these insects in the last stage of its transformation. Its wings were not yet unfolded, but it ran so rapidly that I had some difficulty in keeping it within the field of the lens. As soon as it paused long enough to be examined, it was easily recognized as a Chalcis by its general aspect, and especially by the peculiar vibratile motion of its short geniculate antennae."

"Having once become familiar with its appearance, I have had no difficulty in capturing, in the latter part of August and September, all the specimens I desired on the infested trees. I have repeatedly watched the female Chalcis in the act of inserting her ovipositor through

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the scale of the Bark-louse, for the purpose of depositing her egg in the cell beneath. She always places herself transversely with respect to the scale. Sometimes she mounts upon it, and then her tiny body is seen to be considerably less in length than the width of the scale. Usually she backs up upon it only so far as to bring the tip of her abdomen about opposite the middle of the scale. Then bringing her ovipositor down perpendicular to her body she forces it through the scale by a series of boring or short plunging motions. Having accomplished this she remains stationary for many minutes, whilst by some invisible intestine motion the egg is carried down the ovipositor and deposited beneath the scales. So absorbed is she in this delicate operation, upon the successful accomplishment of which not only her own hopes, but those of the horticulturist, so largely depend, that nothing can deter her from it.

"The egg thus deposited hatches into a little footless larva. This larva is so admirably described by Dr. Fitch, in a single sentence, that I can not do better than copy his description: 'Under these scales I have repeatedly met with a small maggot, three-hundredths of an inch long, or frequently much smaller, of a broad oval form, rounded at one end and tapering to an acute point at the other, soft, of a honey-yellow colour, slightly translucent and shining, with an opaque brownish cloud in the middle, produced by alimentary matter in the viscera, and divided into segments, by faintly impressed transverse lines.'

"The only motion of which this small grub is capable is a slight extension and contraction of its body, particularly at the two extremities, by which its form is correspondingly modified.

"There is usually but one larva under each scale, and I have never seen more than two. In the earlier part of the season it is seen adhering to the body of the Bark-louse, but later it is found in the midst of the eggs or their remains.

"The Chalcis fly itself is a beautiful object under the microscope. Its length is a little less than half a line, or about one-twenty-fifth of an inch, though I have captured a few specimens considerably smaller, being but little more than one-third of a line. I at first supposed that these smaller individuals were males, but all the specimens that I have examined have proved to be females. Their color is a uniform pale lemon yellow. The only variation from this colour is in the minute mandibles, which are reddish brown. There are three coral-red ocelli on the summit of the head, and the ovipositor, which lies in a groove on the underside of the abdomen, exhibits a slight reddish tint. The wings are thickly beset, over nearly their whole surface, with bristly points, and their margin is ornamented with a long fringe."

Dr. Le Baron has given to this useful creature the name of the Chalceous Parasite of the Apple-tree Bark-louse *Chalcis* [*Aphelinus*] *mytilaspidis* Le Baron.)

For the benefit of those of our readers who may not have a copy of our last year's Report to refer to, we append cuts of the Oyster-shell Bark-Louse, by means of which it may be readily recognized. Fig. 1 represents a twig covered with these creatures, about the natural size. Fig. 2 affords an illustration of the



FIG. 1.

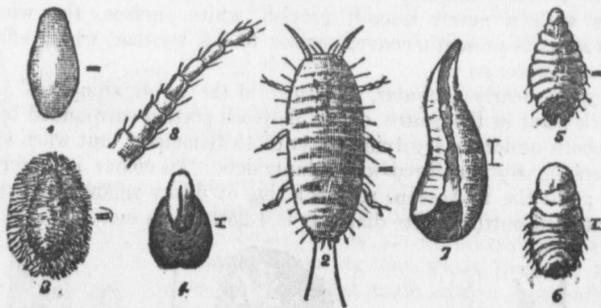


FIG. 2.

insect in all its stages, and highly magnified; the hair lines at the sides show the natural sizes. (1) The egg; natural size scarcely the one-hundredth part of an inch. (2) Larva, as it appears when running over the twigs. (3) Appearance after becoming stationary. (4) The scale after the second secretion takes place. (5) Ventral view of the louse after losing its members. (6) Ventral view of the louse when full grown, and just about to deposit

its eggs. (7) Fully formed louse, as it appears from the under side when raised. (8) Highly magnified antenna of the larva, showing the joints.

2. THE WHITE-MARKED TUSOCK CATERPILLAR (*Orgyia leucostigma*, Smith and Abbott).—Last autumn the moths of this insect were more than usually abundant, and consequently the depredations of the larva have been greater than ordinary. Formerly we were of the opinion that these handsome yellow caterpillars (Fig. 3 represents a full-grown specimen),

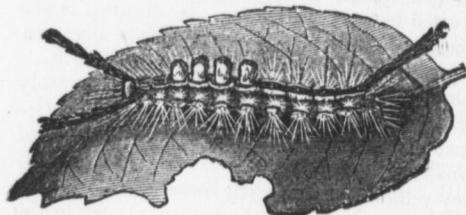


FIG. 3.

with their coral-red heads and knobs, their dorsal tufts, and their long pencils of hairs projecting in front and behind, were but slightly injurious to the apple-trees; but of late years we have been forced to come to a different conclusion. In many parts of the country they are now so numerous as to be a positive pest to the fruit-grower, and in the Western States they are reported to have stripped some orchards perfectly bare of leaves, and in numerous instances, not content with devouring the leaves, to have even attacked and very much injured the fruit itself! We would strongly recommend those of our readers who possess any apple-trees—and who does not?—to carefully inspect them all at some time during the winter, and to pluck off all the withered leaves that they find attached to the twigs. Most of these leaves that persistently cling to the trees in spite of the autumn's storms and rains, and the winter's frost and snow, will be found on examination to be attached to the twigs by a silken web, and to contain a mass of froth-covered eggs—the seed of next summer's crop of caterpillars. As the number of eggs on a single leaf ranges from three to five hundred, it will be readily perceived how great a diminution may be made in the number of caterpillars to be produced next year by the expenditure of very little labour.

Mr. Saunders (*Canadian Entomologist*, vol. iii, page 15) gives the following interesting description of the egg:—

“On removing the 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 100 or more, and their interstices are well filled with this same gelatinous substance, which adheres so strongly to the eggs that when the nest is torn open they cannot be separated without bringing away portions of this material 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 being imbedded in a solid mass, but surrounded by the material worked into a spongy or frothy state. Possibly this may be to economize the amount used. Over all is a heavy layer of the same with a nearly smooth greyish white surface, the whole number of eggs being placed so as to present a convex surface to the weather, which effectually prevents the lodgment of any water on it.

The egg is nearly globular, flattened at the upper side—not perceptibly hollowed—with a dark point in 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 1-25th of an inch.”



FIG. 4.

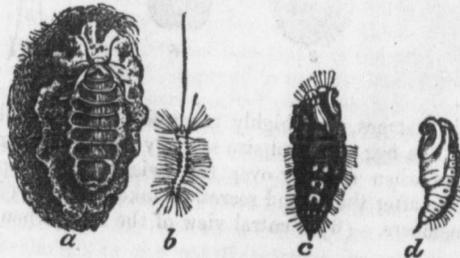


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This insect, as we have before observed, is especially remarkable for the extraordinary difference it exhibits between the male and female moths; the accompanying illustrations will show this at a glance. Fig. 4 represents the winged male, a dull ashen grey insect, with beautifully feathered antennae,

Fig. 5. (a) represents the wingless female attached to her cocoon; (b) a young caterpillar suspended by a silken thread; (c) the female chrysalis; (d) the male chrysalis.

In the State of Illinois, Dr. Le Baron relates in his recent Report (page 16) that of myriads of cocoons found on and about some apple-trees that had been completely stripped of their leaves by these caterpillars, scarcely one out of a hundred had escaped the fatal visitation of parasites. "So that the race of caterpillars, so abundant and destructive this year, may be considered as practically exterminated in this locality." The parasites belonged to an undescribed species of *Tachina* (*T. orgyia*, Le Baron), a genus of two-winged flies, well known for their services to mankind in the reduction of the numbers of injurious caterpillars.

3. THE FALL WEB-WORM (*Hyphantria tex-*
tor, Harris).—This destructive caterpillar, like the foregoing, appears to be on the increase of late years. It is now very abundant throughout the Province, affecting a large number of different kinds of trees, both in the forest and in the garden or orchard. They are essentially nocturnal in their habits, remaining all day closely secluded in their webs, and only venturing out under cover of the darkness of night. We are not aware of any parasitic insect that attacks them. The best and simplest remedy is to cut off and burn the unsightly webs with their hordes of inhabitants.

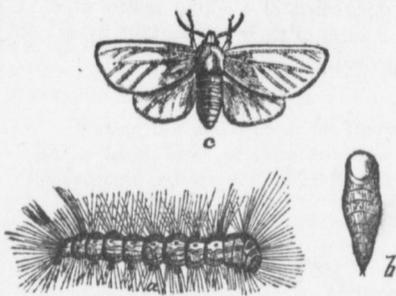


FIG. 6.

Fig. 6 shows the full-grown caterpillar *a*, the pupa *b* which is dark brown and polished, and swells out in the centre, and *c*, the perfect moth, which is white, with a very light yellowish shade, and has dark yellow on the thighs.

4. THE CODLING-WORM (*Carpocapsa pomonella*, Linn.).—The ravages of this horrid creature, which burrows through the fruit, and is often found, to the great disgust of the eater, at the core of the apple that he was enjoying, appear to be still on the increase in this Province. A few years ago its depredations were very serious indeed, so much so that at least a third of the yield of apples was rendered unfit for market. Though it continues to destroy thousands of dollars worth of good fruit every year, it is some little comfort to think that the amount is diminishing. The loss, however, might be still further and very materially lessened if fruit-growers would take the trouble to adopt the bandage system (see our First Report, page 92), and see that all the fallen fruit is gathered up and destroyed.

The accompanying illustration (Fig. 7) represents the insect in all its stages, and a section of an affected apple.

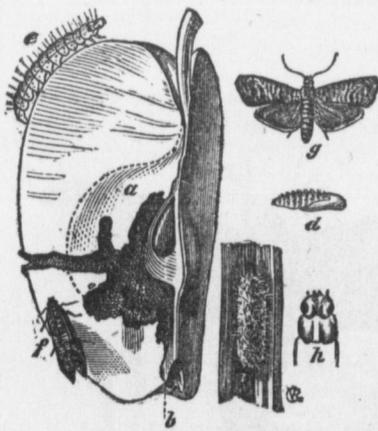


FIG. 7.

The remedies referred to above, and detailed in our previous Report, appear to be the only really effectual ones. Others have been frequently tried, such as fires, lights, bottles of attractive liquid, etc., but with little success, as far as the moths of this insect are concerned. Mr. Riley, in an article in the *Rural New Yorker*, gives his experience on this point as follows:—"During one whole summer, three years ago I had a patent moth catcher constantly in a garden surrounded by several old apple-trees badly infested with this insect, and I never caught a single specimen of *Carpocapsa pomonella*. The trap was made of bright tin, with an inverted cone so placed in a basin that I could attach a light, and fill the basin with sweetened fluid. During the whole of last summer I was in the habit of working till late at night in an office surrounded by apple orchards known to be badly infested. I worked by the aid

of two large kerosene lamps, each having a strong reflector, and the light in the room was so bright as to form a constant subject of conversation among the neighbours. Insects of one kind and another would fly into the room by hundreds, and on certain warm, moist evenings would beat against the windows with such rapidity as to remind one of the pattering of rain. Yet during that whole summer I caught but one or two Codling moths in that room, and there was more reason to believe that they had bred in the house than that they were attracted from without. At the same time I had hung up in an orchard close by, many wide-mouthed bottles, half filled with various liquids, such as diluted syrup, sugar water, and vinegar more or less diluted. Every two or three days these bottles would contain great numbers of insects, which were critically examined. Many of them would be small moths of one kind or another; some of them larger moths known to be injurious, and many—such as beetles, true bugs, wasps, and two-winged flies—that were beneficial. Indeed there were almost as many beneficial as injurious species. From my notes I find that but three Codling moths were caught in these bottles during the summer. Indeed, so small is the proportion of Codling moths which I have caught by the above mentioned process, that the chances of their accidentally flying into such situations are about as great as of their being attracted."

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INSECTS INJURIOUS TO THE GRAPE.

BY W. SAUNDERS, LONDON, ONTARIO.

During the past season, the insects troubling the Grape-vine have not, as far as we were able to learn, been so abundant and destructive as usual. The green sphinx caterpillar, *Cherocampa pampinatrix* (Fig. 8) has been plentiful enough in most vineyards, but we have

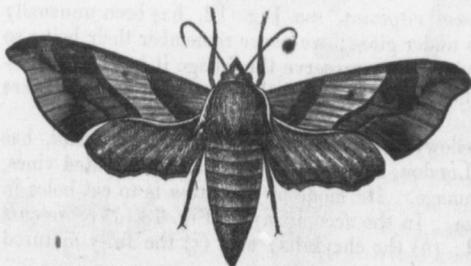
FIG. 8.



Colours—Green, lilac and yellow.

not heard many complaints regarding it. As a rule, it does not seriously damage vines which have acquired some age and strength, for in them the growth is rapid, and the loss of a few leaves is soon made up; but young vines are often entirely defoliated by this voracious larva in a very short period. There have been two broods of the insect this year again. Fig. 9 represents the beautiful olive green moth, from which this caterpillar is produced. It is a night flying insect, and is attracted by light, and often finds its way into houses in the evenings.

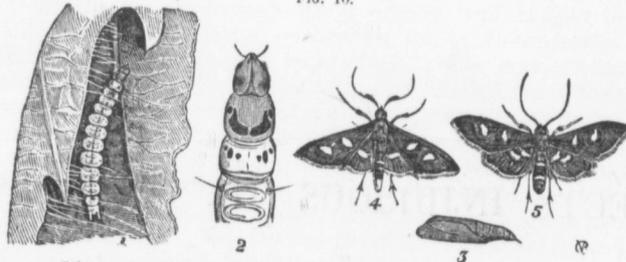
FIG. 9.



Colours—Olive-green and grey.

We have met with a few specimens of the Grape-Vine Leaf-roller (*Desmia maculalis*), a small green caterpillar, which rolls the leaf to a curious little case, and in which it lives. The accompanying fig. 10 shows the insect in its various stages.

FIG. 10.



Colours—1 and 2, grass green; 3, brown; 4 and 5, black and white.

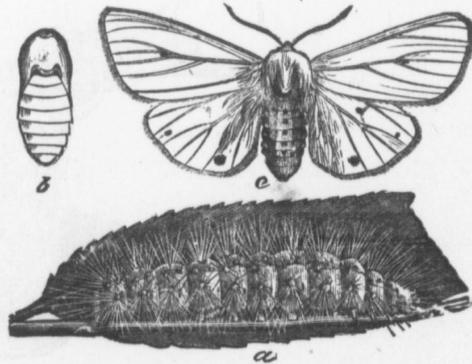
The little yellow hairy caterpillar of the Grape-vine plume moth (*Pterophorus periscelidactylus*), has been very troublesome in some localities. It attacks the foliage just as it is expanding, and consumes it along with the young clusters of blossom, having first drawn them together by a web of silken threads. These larvæ are usually found singly, but this season we have seen two and three feeding together in several instances. The moth, caterpillar and chrysalis are well shown in Fig. 11.

FIG. 11.



Colours—(a) white, (b) light brown, (d) tawny yellow.

FIG. 12.



Colours—(a) yellow or brown (b) shining brown (c) white, black and orange.

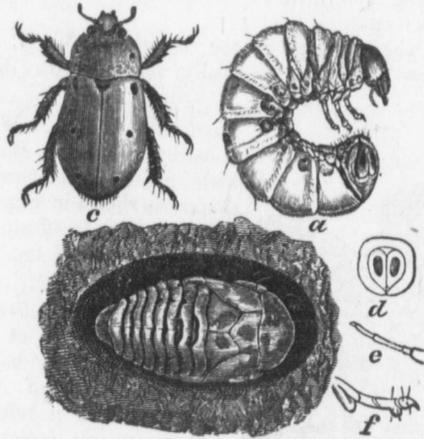
The common yellow woolly bear, *Spilosoma virginica*, see Fig. 12, has been unusually numerous and destructive, especially to grapes under glass; we never remember their being so troublesome any previous season. In many vineries, to preserve the foliage it has been necessary to keep a continual watch for them and hand pick and kill them as fast as they were found.

The large spotted vine beetle, reddish yellow with black spots, *Pelidnota punctata*, has also been numerous in the neighbourhood of London, both on the wild and cultivated vines, but we have not heard of its doing much damage. Its mode of operation is to eat holes in the leaves, sometimes completely riddling them. In the accompanying Fig. 13 (a) represents the larva or grub, which lives in rotten wood; (b) the chrysalis; and (c) the fully matured beetle.

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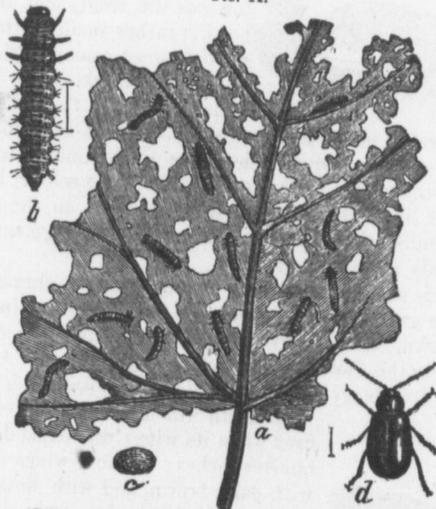
FIG. 13.



Colours—(a) glossy white, (b) yellowish, (c) reddish yellow with black spots.

We have heard a few complaints during the season, of mischief caused by the Grape-vine flea beetle, *Halica chalybea*, but we are inclined to believe, that its ravages have been less alarming than in former years. It is most capable of doing injury just as the buds are bursting in spring, for then the beetle eats its way into them destroying the future foliage and fruit. In the Fig. No. 14, (a), shows a vine leaf, with numerous holes which have been eaten by the young larvæ, (b) the larva magnified, and (d) the perfect insect.

FIG. 14.



Colours (b) shining brown and black (d) steel blue or metallic green and purple.

FIG. 15.

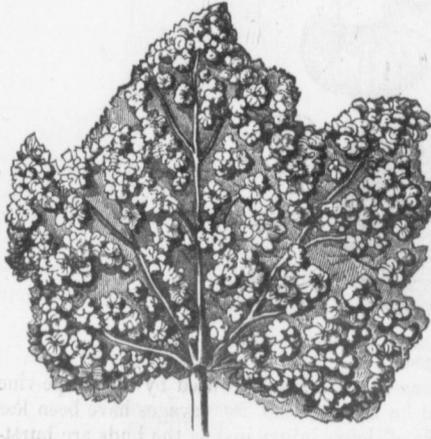


The Thrip, *Tettigonia vitis*, see Fig. 15 has been very abundant in many portions of the country; indeed we have scarcely seen a vineyard free from their attacks this year, and in many cases the vines have been much disfigured and stunted in growth. This insect is one of the worst enemies Grape growers have to contend with; it punctures the leaves with its tiny beak and sucks their juice, causing them to become at first spotted with white, and often where the work is prolonged resulting in

their withering and dropping from the vine. In the figure the insect is magnified; the small hair lines at the sides show its natural size.

During the summer, when looking over the vineyard of W. H. Boulton, Esq., of "The Grange," Toronto, we saw a Clinton vine badly affected with the grape leaf gall louse,

FIG. 16.



Phylloxera vitifolia. When the leaves are assailed by this insect, they soon become covered with green excrescences, of various sizes and shapes, as shown in Fig. 16. In this instance it did not appear to affect more than the one vine, but if not attended to, would no doubt spread rapidly.

A full history of all the foes to grape culture thus far enumerated, as well as some others not mentioned here, may be found in the report of the Commissioner of Agriculture for 1870, to which the reader is referred, see p 324 to 347.

There are two insects injurious to the grape, which were omitted in last year's report, whose history we will detail now.

The green grape vine worm, *Amphipyra pyramidoides*. We have found this caterpillar destructive to vines for several years past, but more particularly affecting those grown under glass, see Fig. 17; it appears early in June.

FIG. 17.



Its length is from one and a quarter to one and a half inches, the body tapering towards the front, and thickened behind. The head is rather small, flattened in front, and of a whitish green colour, with the jaws or mandibles tipped with black. The body is whitish green, a little darker on the sides, with a white stripe down the back, a little broken between the segments or rings, and widening somewhat behind. There is a bright yellow stripe on each side, close to the under surface, which is most distinct on the hinder segments, and a second one of the same colour, but fainter, half way between this and the dorsal line; this latter is more distinct on the posterior portion of the body, and follows the peculiar rise or prominence on the 12th segment as shown in the figure. The under side of the body is pale green.

When full grown this caterpillar changes to a dark brown chrysalis, either at, or a little under the surface of the ground, from which the moth appears in the latter part of July. These which we have reared, have usually appeared about the 20th of the month. We have found this larva feeding on the thorn, as well as the grape, and Mr. C. V. Riley of St. Louis, Mo., has taken it on the Raspberry, the Red Bud (*Cercis Canadensis*) and the poplar.

FIG. 18.



The moth which is well represented in Fig. 18, measures when its wings are expanded about one and three quarter inches; the fore wings are dark brown, shaded with paler brown, and with dots and wavy lines of dull white. The hind wings are reddish, with almost a coppery lustre, becoming brown on the outer angle of the front edge of the wing, and paler towards the hinder and inner angle. The under surface of the wings is much lighter in colour than the upper and the body is dark brown with the hinder portion banded with lines

of a paler hue. When these prove troublesome, we can suggest nothing better as a remedy than hand picking.

Agrotis depressus Grote.—The caterpillar of this moth is of a yellowish green colour, with a few very fine brownish hairs scattered over the upper surface of the body. We have found it feeding on the grape for two summers past and in some places in numbers sufficient to be

troublesome. inches; the surface of the there is a wh est one being ish dots, scar hair.

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INSECTS AFFECTING THE PLUM.

By E. B. REED, LONDON.

1. THE PLUM SPHINX MOTH (*Sphinx drupiferarum*, Smith and Abbott).

Order, LEPIDOPTERA ; Family, SPHINGIDÆ.

As this moth generally makes its appearance in our plum orchards from year to year, we have thought it advisable to give a short history of its different stages for the benefit of our fruit-growers. It is a member of a family of moths to which the great naturalist, Linnæus, gave the name of *Sphingidæ*, on account of the resemblance he conceived some of their caterpillars bore, in certain positions, to the notorious Egyptian Sphinx, and which our artist has faithfully represented in the engraving of the larva. While the ravages caused by this caterpillar are fortunately not very extensive, yet it generally appears in different localities from time to time in numbers quite sufficient to cause considerable annoyance to the plum-growers of those regions. Its conspicuous size, when full grown, and its bright, green-coloured body and mauve stripes, make it tolerably easy of detection, while the leafless twigs, the result of the voracious appetite necessary to sustain its huge carcass, are sure to cause the eyes of the observant fruit-grower to make diligent search after this monster leaf-eater. The larva (Fig. 19) is hatched from an egg, deposited (probably

FIG. 19.



Colours—Apple green, mauve stripes, orange stigmata.

singly on the underside of the leaf. By the kind permission of Mr. Wm. Saunders, we are able to give from his accurate notes a very close description of the appearance of the young larva. On the 2nd of July, a pair of *drupiferarum* were brought to him, which had been taken *in coitu*. They were confined together in a Seidlitz box. The next day the female began depositing her eggs, and continued to do so for two or three days. The following notes will be found of some interest: "Egg: length, .07 inch, slightly oval, surface smooth, colour pale yellowish-green. In from six to eight days the young larvæ made their appearance,

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having eaten their way out through the side of the egg. In some cases one-half or more of the egg-shell was eaten; in others, only a hole just large enough to allow of the escape of the larva, while in a few cases it was almost entirely consumed. July 10. Some out this morning; length, .22 inch; head very large, rounded, pale yellowish-green, with a few very short, whitish hairs, mandibles tipped with dark brown, body above pale yellowish-green, with a few whitish slightly elevated tubercles on every segment, from each of which arises a single short fine hair; those along each side of the dorsal line dark brown, the others yellowish-white. The tubercles are arranged in a double transverse row on the middle and hind segments; caudal horn, .10 inch long, nearly erect, black, thickly covered with very short, stiffish black hairs, slightly furcate at the apex; each tip terminated by a pale brownish hair, longer than the others; under surface similar to upper." The larva, when full-grown, measures about three or three-and-a-half inches. Its colour is a beautiful apple-green; the head is also green, with lateral brown or black stripes. On each side of the body are seven broad oblique bands of a white colour, bordered in front with light purple or mauve. The stigmata or breathing pores are very distinct, and are of a bright orange-yellow colour. The caudal horn is long, of a dark brown colour, with a yellow tint at the base of the sides. The body is cylindrical in form, and smooth to the touch. The caterpillar, after satisfying its appetite, or upon any sudden alarm, assumes the peculiar rigid appearance shown in the cut, and will remain thus, with its head raised, for a considerable period. The formidable-looking horn on the last segment gives the insect a rather alarming appearance; but it is perfectly harmless, and in fact, even at this date, naturalists can find no use, either for offensive or defensive purposes, for this horn, which is peculiar to nearly all the caterpillars of the *Sphinxidae*. The larva of the Plum Sphinx is generally found in Ontario about the month of July, or the early part of August. When it has attained its maturity it ceases eating, and seeks shelter in the earth, where it excavates for itself a convenient chamber, which it lines with a water-proof, gummy cement, and there undergoes its transformation into the *pupa* or chrysalis state.

FIG. 20.

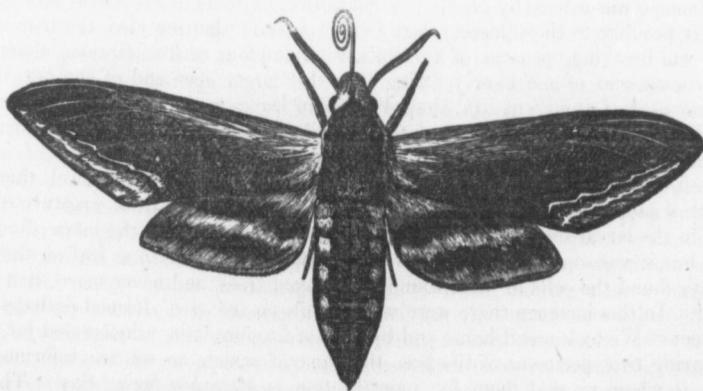


Colour—Dark reddish-brown.

The *pupa* (fig. 20) is about $1\frac{1}{2}$ inches in length; its colour is dark reddish-brown, and it has a short, thick projecting, or, as naturalists term it, exerted tongue-case. The insect remains in the ground all through the winter and spring, and emerges in its perfect winged state about the early part of June.

The moth (fig. 21) is a large one, its wings expanding from $3\frac{1}{2}$ to $4\frac{1}{4}$ inches. The body is about $1\frac{1}{2}$ inches long, varying slightly in the sexes as to length, that of the female being shorter, somewhat thicker and more obtuse at the anal segment, while that of the male

FIG. 21.



Colour—Black and brown, with fawn-coloured white.

is longer, and tapers almost to a point. Describing this moth from five specimens (two mal-

and three female) now before me, there appears very little difference in the markings of male and female. The antennæ are slightly different, but it requires some little experience in entomology to ascertain it. The head and thorax, which are large and thick, are blackish-brown, with a whitish fawn-colour at the side. The eyes are very prominent. The snout-like projection is composed of the *palpi* or feelers, which are two close-fitting shields for the protection of the proboscis, which lies snugly coiled up between them, like the mainspring of a watch. This proboscis, or tongue, which is shown in the engraving (fig. 21), is as long as the body of the moth, and is used by the insect in extracting from flowers the honey, which forms its chief food. To a watchful observer, a sphinx moth presents a most curious appearance, not unlike that of a humming bird, while it hovers over some flower-bed, with its wings humming from their rapid and ceaseless beating, its body poised in the air, and its long tongue projecting like the beak of a bird, and dipping from time to time into the innermost recesses of the various flowers in search of food. The body of the moth is brown, with a black central line, and a black band on either side containing four or five dingy-white spots. On the back of the thorax are several fawn-coloured blotches or markings, which are peculiar to many of the *Sphingida*, and which some of our readers may possibly have noticed in the striking resemblance to a human skull on the thorax of the English death's head moth (*Acherontia atropos*). The wings are long and very narrow, but possessing great strength, and evidently adapted for great swiftness. Their general colour is dark purplish-brown, with a stripe of white on the front edge extending from the white sides of the head, and with a fawn-coloured stripe on the outer edge of the front wing. The hind wings have two whitish wavy stripes with a similar fawn-coloured stripe on their outer edge. There are also three or four black oblique streaks on the fore-wings, and generally a black dot on the white stripe.

The engravings of this insect are the work of Mr. C. J. Beale, of Toronto, Ont.; that of the pupa and larva are adapted, with some alterations, from the excellent designs of Professor Townend Glover, of Washington; but the beautiful figure of the moth was engraved by Mr. Beale from a specimen in our own collection, and is an admirable *fac simile* of the original insect.

2. THE LEAF-CUTTER BEE (*Megachile brevis*. Say).

Order, HYMENOPTERA; Family, APIDÆ.

Our attention was attracted this summer, by the unthrifty appearance of a small plum tree, various branches of which were much disfigured by circular patches being cut out of their leaves, and bore strong indications that "an army of occupation" had forcibly annexed the tree, for their own unlawful purposes. At the first glance we thought part of the damage was caused by *Aphides* or plant lice, as some of the leaves were curled up in the manner peculiar to those insects, but a closer examination revealed the true nature of the enemy. On breaking open one of the coils, we found four or five circular chambers, the smaller and convex end of one closely fitting into the larger open end of another, the whole coil being composed of numerous oval shaped pieces of leaves most ingeniously interwoven, or overlaid, and wrapped outside by the leaf to which it was affixed, the top and bottom of each cell being closed with two or three perfectly circular pieces.

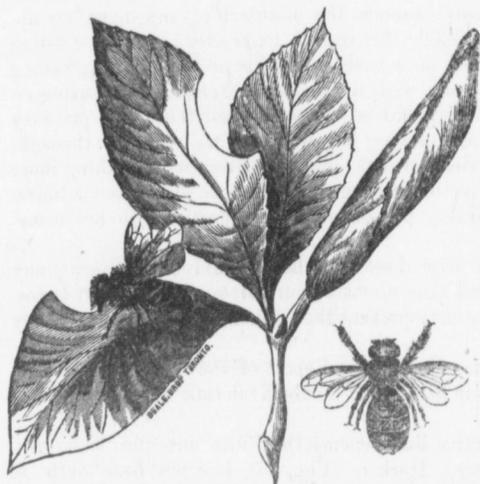
Each cell contained a small white grub or maggot, comfortably ensconced therein, and provided with a supply of pollen or bee-bread, sufficient to last the little creature during its continuance in the larval state. We saw at once that the insect was the larva of some leaf-cutting bee, but it was something new to us to see the cells formed in a leaf on the tree as we had always found the cells in the ground or decayed trees, and never more than one burrow by itself. In this instance there were several coils on the tree, formed perhaps by more than one insect. We took a coil home and by dint of keeping it in a moistened jar, we succeeded in rearing two specimens of the bee, the name of which, as we are informed by Mr. C. V. Riley, to whom we sent them for identification, is *Megachile brevis*, Say. This insect,



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FIG. 22.



(Fig. 22) belongs to a family of Bees called *Apidae*, many of the members of which, from their habits of building their nests, are commonly known as, mining, carpenter, mason, or upholsterer bees. The species *Megachile* to which our insect belongs consists chiefly of solitary bees, not building in societies like the common hive bee. Although it is not probable that any serious damage will ever be caused to fruit trees by this pretty little creature, inasmuch as its operations, are we believe, generally confined to other trees, yet we are tempted to give for the benefit of horticulturists a description from Rennie's admirable little work on "Insect architecture" of the habits of a very similar bee, The Rose-Leaf cutter, *Megachile centuncularis*, Latr. known also as an upholsterer bee, and whose singularly ingenious habits, have long attracted the attention of naturalists.

"The Rose-Leaf cutter makes a cylindrical hole in a beaten pathway, for the sake of more consolidated earth, or in the cavities of walls, or decayed wood), from six to ten inches deep. In this she constructs several cells about an inch in length, shaped like a thimble, and made of cuttings of leaves (not petals), neatly folded together, the bottom of one thimble-shaped cell being inserted into the mouth of the one below it, and so on in succession. It is interesting to observe the manner in which this bee procures the materials for forming the tapestry of her cells. The leaf of the rose-tree seems to be that which she prefers, though she sometimes takes other sorts of leaves particularly those with serrated margins, such as the birch, the perennial mercury, mountain ash, etc. She places herself upon the outer edge of the leaf which she has selected, so that its margin may pass between her legs. Turning her head towards the point, she commences near the foot-stalk, and with her mandibles cuts out a circular piece with as much expedition as we could do with a pair of scissors, and with more accuracy and neatness than could easily be done by us. As she proceeds, she keeps the cut portion between her legs, so as not to impede her progress; and using her body for a *trammel* as a carpenter would say, she cuts in a regular curved line. As she supports herself during the operation upon the portion of the leaf which she is detaching, it must be obvious, when it is nearly cut off, that the weight of her body might tear it away, so as to injure the accuracy of its curvilinear shape. To prevent any accident of this kind, as soon as she suspects that her weight might tear it, she poises herself on her wings, till she has completed the incision. With the piece which she has thus cut out, held in a bent position perpendicularly to her body, she flies off to her nest, and fits it into the interior with the utmost neatness and ingenuity; and without employing any paste or glue, she trusts as Reaumur ascertained, to the spring the leaf takes in drying, to retain it in its position.

It requires from nine to ten pieces of leaf to form one cell, as they are not always of precisely the same thickness. The interior surface of each cell consists of three pieces of leaf of equal size, narrow at one end, but gradually widening at the other, where the width equals half the length. One side of each of the pieces is the serrated margin of the leaf from which it was cut, and this margin is always placed outermost, and the cut margin innermost. Like most insects, she begins with the exterior, commencing with a layer of tapestry, which is composed of three or four oval pieces, larger in dimensions than the rest, adding a second and a third layer proportionately smaller. In forming these, she is careful not to place a joining opposite to a joining, but with all the skill of a consummate artificer, lays the middle of each piece of leaf over the margins of the other, so as by this means both to cover and strengthen the junctions. By repeating this process, she sometimes forms a fourth or fifth layer of leaves, taking care to bend the leaves at the narrow extremity or closed end of the cell, so as to bring them into a convex shape. When she has in this manner completed a cell, her next business is to replenish it with a store of honey and pollen, which, being chiefly collected from thistles, forms a beautiful rose-coloured conserve. In this she deposits a single egg, and then covers in the

opening with three pieces of leaf so exactly circular, that a pair of compasses could not define their margin with more accuracy. In this manner the industrious and ingenious upholsterer proceeds till the whole gallery is filled, the convex extremity of the one fitting into the open end of the next, and serving both as a basis and as the means of strengthening it. This little rose-leaf cutter, pursuing her work with the nicest mathematical art, using no artificial instruments to form her ovals and her circles, knowing that the elastic property of the leaves will retain them in their position—making her nest of equal strength throughout, by the most rational adjustment of each distinct part—demands from us something more than mere wonder; for such an exercise of instinctive ingenuity at once directs our admiration to the great Contriver, who has so admirably proportioned her knowledge to her necessities."

The only remedy that we can suggest in case these little bees should be disfiguring any of our bushes, is to catch and destroy them and thus prevent their further increase; it is possible that the application of diluted hellebore may prevent their touching the leaves, at any rate it is worth a trial.

The three following insects were fully treated of in the Report of the Entomological Society for 1870 where our readers will find their history set forth in detail, we therefore only briefly allude to them now.

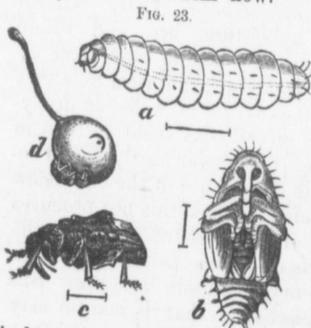
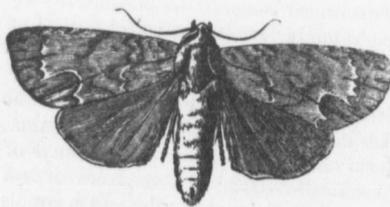


FIG. 23.

Our active little enemy the Plum curculio *Conotrachelus nenuphar*, Herbst, (Fig. 23) has not been quite so plentiful this past season, although in some sections of the country the complaints are as strong as ever against the annoyance of fighting perpetually this troublesome little Turk. The figure well represents the different stages of the insect, the hair lines at the sides shewing the true length.

(a) Gives the larva or grub which is hatched from the egg deposited by the mother beetle in the plum; (b), is the pupa or chrysalis, the intermediate state in which the larva matures into; (c), the perfect beetle which to an ordinary observer may often be mistaken for a piece of chip or dirt as it has the faculty of feigning death, contracting all its limbs and remaining motionless for a considerable time; (d), shews the manner in which the insect performs its operation, first making a crescent shaped slit in the young green fruit, and then depositing an egg therein. We have heard of no fresh remedy, and believe that the old plan of jarring the trees, while a white cloth is spread on the ground beneath them, and then picking up and burning all the insects and fallen fruit, is still the easiest and most practical remedy.

FIG. 24.



Grey Dagger.

The Grey Dagger Moth *Acronycta Psi*, Linn., has this year been devastating the apple, and we have heard less of its damage to the plum orchards.

The moth (Fig. 24) is from one and a half to two inches in width and is of a general pale grey colour, with black markings on the fore wings, and from one of these peculiar marks which bears a strong resemblance to the Greek letter "Psi," the insect derives its scientific name.

It should be destroyed wherever found—hand picking is the best remedy.



FIG. 25.

The Eye-spotted bud moth, *Grapholitha Oculana*, (Fig. 25) is the last on our list. This little leaf-rolling moth has been doing a good deal of mischief this year. Its small size enables it to work almost unnoticed and it is seldom detected before the damage is really done. The larva has the unfortunate propensity of selecting the young fruit buds for its food and by thus mutilating them it effectually prevents any fruit maturing. The fruit grower should keep a watchful eye over his buds and make frequent search to see that his trees are free from insects, "practice makes perfect," and an attentive observer will soon learn to detect the parts that are attacked and to capture the enemy whether he be the large Sphinx worm or the tiny little caterpillar of the Bud Moth.

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INSECTS INJURIOUS TO THE CURRANT AND GOOSEBERRY.

BY W. SAUNDERS, LONDON, ONTARIO.

1. The Imported Gooseberry Sawfly (*Nematus ventricosus*, Klug.)
2. The Native Gooseberry Sawfly (*Pristiphora grossularia*, Walsh.)
3. The Currant Geometer or Measuring Worm (*Ellopiæ (Abrazis) ribearia*, Fitch.)
4. The Spinous Currant Caterpillar (*Graptæ progne*, Cram.)
5. The Green Measuring Worm of the Currant (*Angerona crocotaaria*, Guenee.)
6. The Black Measuring Worm of the Currant (*Priocycla armataria*, Herr Sch.)
7. The Pale Green Measuring Worm of the Currant (*Amphidasys cognataria*, Guenee.)
8. The Oblique Banded Leaf-roller (*Lozotenia rosaceana*, Harris.)
9. The Four-striped Plant-bug (*Capsus (Phytocoris) quadrivittatus*, Say.)
10. The Imported Currant-Borer (*Aegeria tipuliformis*, Linn.)
11. The American Currant-Borer (*Psenocerus supernotatus*, Say.)
12. The Gooseberry Fruit Worm (*Pempelia grossularia*, Packard.)
13. The Gooseberry Midge (*Cecidomyia grossularia*, Fitch.)

INSECTS INJURIOUS TO THE GOOSEBERRY AND CURRANT.

Within the past few years, the Gooseberry and Currant have suffered so much from the depredations of insects, that their culture has been much diminished, and by many parties entirely given up; with the idea that the crops will not pay for the trouble attending the keeping the bushes clear of these pests. It would indeed be a matter for regret, should this example be so far followed as to permanently limit much the production of these excellent fruits, so conducive to comfort and health; and we feel assured that with a little energy, and the use of proper means on the part of those engaged in their culture, the enemies to be contended with may be successfully kept under.

AFFECTING THE LEAVES.

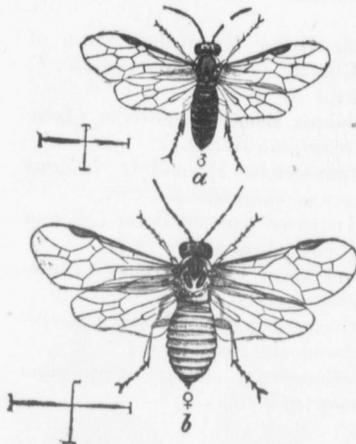
THE IMPORTED GOOSEBERRY SAW-FLY (*Nematus ventricosus*, Klug.)

The larva of this fly—known also as the currant worm—is perhaps the most troublesome of all the insects which the grower of these small fruits has to combat. It is not a native of this country but has been accidentally imported from Europe, where it has long been known. The fly was first described by a German entomologist named Klug, in a magazine published in Berlin, in 1819, but the larva or worm was not described till 1834: and at that time it was said to swarm on both currant and gooseberry bushes. With us it is a comparative stranger, it being only about 10 or 12 years since it first made its appearance in America. It seems to have been first noticed in the neighbourhood of Rochester, and has no doubt been brought over, probably in the chrysalis state, among gooseberry bushes, a large number of which are yearly imported from Europe. Mr. O. Bigelow, of New York, refers to it in the *American Agriculturist* in 1862, as being then first noticed in Onondago County, N. Y.; and in 1864 it was described by Prof. Winchell, of Ann Arbor, Michigan, as occurring there. It is quite probable that it may have been introduced at other points besides Rochester; in any case it has spread very rapidly, for it is found now all over the Eastern States, throughout Canada from Halifax to Windsor; and it has also overrun some of the Western States. In Europe

it does not appear to be so very troublesome as it is in this country; probably its natural enemies are more numerous there, and its increase is thus to some extent checked.

This insect usually passes the winter in the chrysalis, or inactive state, enclosed in a small papery looking, silken cocoon; sometimes at, and sometimes under the surface of the ground, and occasionally fastened on the stems of the currant or gooseberry bushes, on which it has been feeding, or in some convenient nook near by. Occasionally they pass the winter in the caterpillar state, a fact we were the first to notice; a full account of our observations on this point was published in the *Canadian Entomologist* vol. 2, p. 16 and 17 and 47 and 48 to which the reader is referred.

FIG. 26.



The perfect fly, see figure 26, appears very early in spring, the exact time depending much on the weather; when the season opens early they may be looked for about the third week in April—otherwise, not until near the end of that month or the beginning of May. During the past season we found them flying about actively on the 23rd of April, which was some time before the gooseberry or currant leaves had expanded. The two sexes differ considerably in appearance. In the figure, *a* represents the male, and *b* the female, both of which are drawn on an enlarged scale. The hair lines at the sides show their natural size. The male approaches very near in size to the common house-fly, but the body is hardly so robust, and the wings are more glossy. Its head is black, with dull yellow spots, with the horns, or antennæ, brownish black; the thorax, or anterior portion of the body is black, with a yellow spot at the base and in front of each of the fore wings; the abdomen, or hinder portion, is black above, but yellowish underneath and at the tip, and its legs are bright yellow; the wings are glossy, with black, or brownish black veins. The female is larger than the male, as may be seen by reference to the figure, and differs from it in the colour of the warmer parts of the day; at other times they are quiet, indeed almost torpid. In a few days they pair, and soon after the female is ready to deposit her eggs. These are laid on the under side of the leaves, and are generally placed there as soon as the leaves are sufficiently expanded to receive them. Most of the insects known as *saw-flies*, deposit their eggs in little slits, in the ribs or substance of the leaves on which their caterpillars feed. These they cut with a curious little saw-like instrument, which is enclosed in a sheath in the terminal segment of their bodies; but this species is furnished with only a sort of rudimentary saw, of which it appears to make no use, its eggs being laid upon the surface of the leaf, and usually in long rows upon the veins or ribs.

FIG. 27.



In the accompanying figure, 27, a gooseberry leaf is represented, with the larger veins or ribs partially covered with these eggs. In vol. 2, p. 15, of the *Canadian Entomologist*, we published some observations on this subject, which we cannot do better than reproduce here.

While turning up the branches of some gooseberry bushes, about the middle of May, we observed a number of whitish eggs on some of the leaves, arranged lengthwise in regular rows at short distances apart on the principal veins or ribs of the leaf. Usually they were placed singly in the rows, but here and there double. These were the eggs of the gooseberry or currant worm; they were about one-twentieth of an inch long, four times as long as broad, rounded at each end, and with a whitish glossy surface. On the branch then examined there were three leaves with these eggs on; two of them had their principal veins pretty well covered, while the third had but a few on it, as if this

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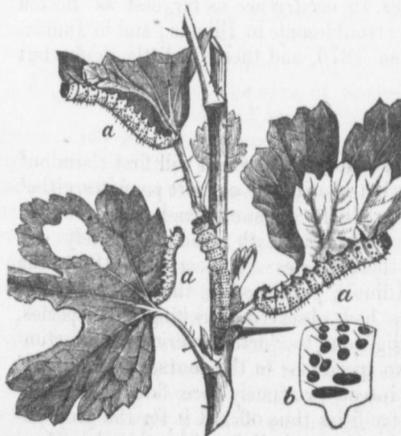
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had been the work of a single insect who had exhausted her stock before the third leaf was covered. On counting these we found there were 101 in all. Having just then caught one of the parent flies, a female who was hovering about as if looking for a suitable place on which to deposit her eggs, we squeezed some eggs out of her body, and comparing them with those on the leaf, found they were only about half the size, showing that the first must have grown considerably after being laid, and that they were probably nearly ready to hatch. In about three hours afterwards we observed that several of the young larvæ had come out of the eggs, and placing the leaf under a microscope, had the good fortune to see some of them escape. The egg consisted of a thin elastic membrane, sufficiently transparent to give a dim view of the enclosed larva. The black spot which is placed on each side of the head in this species served to determine the position the creature occupied. It was somewhat coiled up, and resting on its side, with its jaws against the side of the egg not far from its extremity. We could not perceive that it had any other means of rupturing the egg than by its mandibles, which were working visibly within. In a short time the egg was ruptured, and the head of the larva protruded from the orifice. Withdrawing its two front feet from the egg, it seized the leaf on which it was placed, and by raising up its back and working from side to side, it soon worked itself out. The time occupied in the escape, from the first appearance of the head, varied from six to ten minutes,—for several of them were watched throughout the process. The egg was so thin and elastic that it yielded readily to the motions of the body, and adhered very closely to it, contracting and shrivelling up as the body was withdrawn.

The duration of the egg stage is probably from a week to ten or twelve days, depending on the weather. When the young larva comes out of the egg, it does not eat any portion of the empty shell, as is the case with many caterpillars, but sets to work at once to eat the leaf on which it has been placed. When first hatched, it is about one-twelfth of an inch long, with a large head, of a dull whitish colour, with a dark round spot on each side of it, and a few short hairs. The body, above and below, is whitish and semi-transparent, sometimes with a slight greenish tinge. At first they eat small holes in the leaf, as shown at 2 and 3, in figure 27, varying in size, and they feed in company, from 20 to 40, on a leaf; hence the leaf on which they are placed is soon completely riddled, all its soft parts being eaten out, and nothing but the skeleton framework remaining. Soon, however, they increase in size, and parting company, spread in all directions over the bush; and now they grow still more rapidly, first becoming green, then changing to green with many black dots, and finally reverting to plain green again, tinged with yellow at the extremities, just before the change to chrysalis takes place.

Fig. 28.



When from one half to two-thirds grown, they are extremely voracious, and will, when numerous, often strip an entire bush in the course of two or three days. At this period of their growth they are well represented in fig. 28. During the short period of their caterpillar life, they outgrow their skin several times, which, when it becomes uncomfortably tight, is shed and replaced by an inner and looser one. When they attain full growth, they are fully three-quarters of an inch long, and when they undergo their last moult, or change, they appear, as before stated, in a plain green garb tinged with yellow. Their main business now is to look out for a suitable place in which to pass the chrysalis state, when they will remain for some time—usually from nine to twelve days in summer—in an inactive state, unable to defend themselves from enemies. Sometimes they fix on a spot among dry leaves or rubbish, on the surface of the ground; at other times it is said they go under the ground; and again, we have often found their cocoons attached to the stems, and sometimes to the leaves of the bush on which they have been feeding. The locality having been fixed on, the larva begins to contract its length, and to spin a cocoon over itself, which, when finished, is nearly oval, smooth, of a brownish colour, and papery texture; and within this it changes to a small brown chrysalis, from which the fly escapes

late in June or early in July. Soon again eggs are deposited, from which another brood of worms are sent forth upon their destructive mission, which complete their growth before summer closes, and in most instances change to chrysalids before winter. With regard to their location during the winter months, Mr. G. J. Bowles, of Quebec, communicates the following (see *Can. Ent.*, vol. 3, p. 9): "I had occasion during October to remove two gooseberry bushes which had been infested with the saw-fly larva, and although I carefully examined the earth from their roots, I could not find any cocoons. About the same time I examined a dying plum tree which grew near, the bark of which was loose and full of holes, in which, as well as in the forks of the branches within three feet from the ground, I discovered many of them. From this it might be inferred that these larvæ do not *invariably* seek the earth before pupating in autumn, but sometimes follow the example of their predecessors, and construct their cocoons in a sheltered place above ground."

Whether there are more than two broods during the season, we are unable to decide; certain it is, that there are not many weeks during the summer months when you cannot find the larvæ on the bushes in some stage of their growth. It is well known that the flies composing the separate broods do not all make their appearance at once; some are weeks later than others, and hence it follows that their progeny are considerably behind time as compared with the first comers; but whether this tardiness in maturing, on the part of some specimens, is sufficient to account for the continual presence of the larvæ during almost the entire season, from May to September, or whether there are more than two broods, is a question we cannot at present undertake to settle. Suffice it to say, that constant watchfulness is required by the cultivators of the gooseberry and currant, if they wish to preserve the foliage of their bushes from destruction by these foes.

These insects do not confine their attentions to the cultivated gooseberry, for we have repeatedly taken them on the wild gooseberry bushes in the woods. We have also, in one instance, found them feeding on the leaves of the black currant, and also on those of the plum. (See *Can. Ent.*, vol. 2, p. 147.)

With regard to their spread in Canada, it is not more than three or four years since their ravages first attracted much general attention in Ontario; but within that period they have increased to an enormous extent, so that there is now scarcely a farm or garden anywhere free from them. In the sister provinces, too, they are making rapid headway. Mr. G. J. Bowles, of the City of Quebec, in the *Can. Ent.*, vol. 3, p. 8, says, "they have become very troublesome there in some gardens, while others are (or were last year) still exempt." Mr. J. M. Jones, of Halifax, Nova Scotia, notes their appearance in that locality during the past summer, and if these extreme points have been reached, there is little doubt but that the intervening country is also occupied. In the United States, its occurrence as far east as Boston is reported by Philip S. Sprague. It is also becoming troublesome in Illinois; and in Indianapolis, Indiana, it was found by J. W. Byrket, in June, 1870, and there is little doubt but that it is common enough in other States adjoining.

REMEDIES.

These may be divided into *natural* and *artificial*, the former of which will first claim our attention. There is scarcely an injurious insect but what has its one or more parasites, either internal, feasting and fattening on its victim, till it is gradually consumed and dies, or external, attacking with greater violence, and causing more sudden death; and fortunately our gooseberry saw-fly is not without its enemies in both these classes. As early as 1866, the late Mr. Benjamin D. Walsh, State Entomologist of Illinois, published in the *Practical Entomologist*, p. 120, some notes on a parasite which he had observed attacking this species. It was a small fly (*Brachypterus micropterus*, Say), indigenous to North America. Unfortunately this fly is rare, Mr. Walsh having taken only two specimens in the course of some years' collecting. It often happens, however, that when an insect, previously rare, finds food abundant and suitable, it soon becomes plentiful from the facilities thus offered it for the propagation of its species; still there has not as yet been much help received from this friend. More recently, Mr. J. A. Lintner, of Albany, N. Y., has found a minute parasite attacking the eggs of this insect, and with him they were so abundant, that out of fifty eggs which he collected, he only found some four or five which hatched into currant-worms; all the others produced the little parasitic fly. We have not heard of this friend being found in any other locality as yet; but it is doubtless capable, where it prevails, of rendering efficient aid.

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a dozen nearly sumed them all sumption was a time we fed th have over-fed th friendly mission the natural incr While we admit that thus tide of the inva collected severa failed to find a crease sufficient must be had to nately a very sim bore mixed in p which is a native

In the *Canadian Entomologist*, vol. 2, p. 9, a third parasite is described by Mr. B. D. Walsh, under the name of *Hemiteles nematocorus*, which was reared from the cocoon of the saw-fly, by our esteemed friend the Rev. C. J. S. Bethune, of Port Hope, Ont. In his notes on its history he says, "On June 29th (1869) I observed, to my surprise, a saw-fly cocoon of *Nematus ventricosus* attached to a leaf high up on a gooseberry bush, instead of on or under the surface of the ground, as usual. Thinking that the unwonted situation might be the effect of a parasitic attack upon the larva, I brought the specimen in, and in a few days afterwards found that this parasite had emerged from it." Mr. Walsh remarks that this same species of *Hemiteles* has been found near Rock Island, Illinois, where at that time the gooseberry saw-fly had not reached; hence, in all probability, this is an indigenous insect, which has taken kindly to this pest, thus showing that a native parasite does sometimes acquire the habit of preying upon an imported insect, a fact of great practical importance as well as scientific interest. In July, 1870, we observed a small ichneumon fly at work on the gooseberry worm, and communicated the facts to the *Canadian Entomologist*, vol. 2, p. 146, as follows: On the 21st of July, at a quarter past seven in the evening, we were among the currant and gooseberry bushes, watching the manipulations of a few of those well-known foes, the larvæ of *Nematus ventricosus*. They were feeding away voraciously, when a disturber of their peace appeared among them, in the shape of a small black ichneumon fly, which fastened itself on the body of one of their number, and began to deposit its eggs, by means of a sharp ovipositor, dexterously thrust through the skin of its victim, whose jerks and writhings, while indicating a very uneasy state, failed to shake off the tormentor. The fly remained some time attached, and so intent was it upon fulfilling the instincts of its nature that a capture was made of both fly and larva, by the sudden movement of a pill-box; but while endeavouring to transfer them to a glass, so that their further operations might be better observed, the fly suddenly escaped and was seen no more. The larva also died before reaching maturity, so that the further history of the parasite could not at that time be elucidated. Possibly this may be the same insect as that last referred to.

FIG. 29.



The accompanying figure, 29, represents another insect friend, belonging to the *Heteroptera*, or true bug family, and known under the name of *Podisus placidus*, Uhler. It is represented much enlarged at *a* so as to show its markings more distinctly; the smaller outline figure below shows its natural size. We were the first to note the fact of this insect in its immature state preying on the saw-fly larvæ, and communicated our observations to the *Canadian Entomologist*, vol. 2, p. 15. About the middle of August, 1869, we first observed these friends at work on the worms. They were nearly round, about the size of a common lady-bird, having the head, thorax and legs black, and the abdomen red, with an elongated black spot in the centre, divided across by a whitish line. Approaching a caterpillar, they thrust their proboscis into it, and quietly suck its juices until it shrivels up and dies. With the view of testing the probable amount of good these friends were capable of accomplishing, we shut up two of them in a small box along with a dozen nearly full grown caterpillars, and at the end of three days found that they had consumed them all. Also six in another box with one bug, and in this instance the rate of consumption was about the same, two larvæ a day for each of these little creatures. The second time we fed them they did not get through their work quite so quickly; possibly they may have over-fed themselves at first. We have since repeatedly met with this useful insect, on its friendly mission, but as yet its numbers are quite insufficient to act as a material check on the natural increase of the saw-fly.

While we are not disposed to undervalue the labours of these friendly insects, we must admit that thus far, their combined efforts have been sadly insufficient to stem the advancing tide of the invading hosts. As confirmative of this, we would cite the fact that, in 1870 we collected several hundreds of the full grown worms, from which we reared the flies, but we failed to find a single parasite among the lot. We hope, however, that in time they will increase sufficiently to afford material aid to the agriculturist; but in the meanwhile recourse must be had to artificial measures, so as to bring sudden destruction upon the foe. Fortunately a very simple and effective, as well as economical remedy, is at hand, in powdered hellebore mixed in proper proportion with water. This is the root of *Veratrum album*, a plant which is a native of the mountainous districts of Europe, growing abundantly in the Alps and

their hold fell to the ground. After the excitement produced by the sudden heat was over they remained quiet for a time, as if wishing to "cool off," before commencing work again; some few did not recover from the application, but most of them were soon as active as ever. We would not suggest this remedy as a substitute for hellebore, but where this latter cannot be procured at once, the hot water may be temporarily used with advantage, and when once on the ground, the larvæ may have the life trodden out of them with the foot, or beaten out with the spade, or some other implement; in any case, many of them would never reach the bushes again, for when off their beaten track, enemies beset them on every side. It was interesting to see how busy a colony of ants were, which had a home at the base of a tree near by; lugging these large caterpillars along, a single one of which would take three or four of them to manage. The worms were twisting and writhing as if wondering whose hands they had got into, while the ants were hanging on with their sharp jaws, and slowly dragging their prey along; until by and by they had quite a little pile accumulated, which would no doubt furnish them or their progeny, with a feast of fat things for some time to come. Then there are the tiger beetles, (*Vicinideliidae*), and the *Carabs* large and small, with a host of others, ever running about, looking for stray objects of this sort on which to make a dainty meal.

It has been urged against hellebore that it is poisonous, and great outcries have been made against it on this account; chiefly by parties interested in the sale of other articles, and the public have been cautioned against using the fruit after such an application. It is quite true that the hellebore is poisonous when taken internally, in quantities; but if used in the manner we have indicated, no fear need be entertained of the slightest injury resulting from it. Examined immediately after a thorough sprinkling with the hellebore mixture the quantity on any bunch of fruit will be found to be infinitesimal, and the first shower of rain would remove it all. If it be found necessary at any time to apply the mixture to bushes where the fruit is ripe, and just ready to be picked, it might then be washed in water before using, which would readily remove every trace of the powder. During the past ten years, many thousands of pounds of hellebore have been used in Europe and America, for the purpose of destroying this worm, and we know of no case on record where injury has resulted from its use.

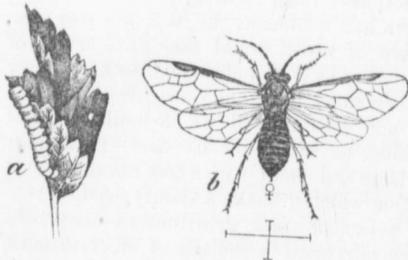
Carbolate of lime has also been recommended as a remedy for this insect pest. This is a dark-coloured powder, with a strong smell of coal tar, and seems to be very variable in its composition, as prepared by different manufacturers. While we are not prepared to reject all such preparations as worthless for this purpose, still, from the experience we have had in their use, we hold them in but little esteem, ranking them very far below hellebore in effectiveness and in economy also; for although the carbolates are sold at a less price per pound, it takes so much more to go over the same number of bushes that it is really far more costly than the hellebore. The following experiments which we made with carbolate of lime during the past summer will show what success we had with it:—On the 24th of May we found the saw-fly larvæ plentiful on some gooseberry bushes, so, selecting a bush to experiment on, we first sprinkled it well with water, then, having marked one of the branches we counted the number of larvæ on it, and found them to number thirty; this branch was then well dusted with the carbolate. It was now evening. The next morning we examined the branch, and found 24 on it still feeding. We then gave it a second dusting, and during the day twelve of their number fell to the ground, but they were still living and crawling about. We then gathered the remaining twelve, and placed them in a glass with the dusted leaves, but they all survived, and soon went into the chrysalis state. This powder being so variable in its composition, it is possible that some may succeed better with it than we have done. All we can say is, that we got the best we could find, and conducted the experiments fairly; the results speak for themselves. Our own view is, that while so safe, economical and speedy a remedy as hellebore is to be had, it is not worth while wasting time in applying preparations so much inferior.

Hand-picking.—This, although almost a hopeless task when the larvæ have attained to any size, and have scattered, may be very advantageously followed while they are young, and feeding in groups of from 20 to 40 on a leaf. An experienced eye will soon detect them, usually on the lower leaves on the bushes, the little holes they eat in the leaves serving as a ready means of discovering their location. Many a brood may thus be destroyed, and one has the satisfaction of knowing that when taken in this young state, the evil they would otherwise accomplish is "nipped in the bud."

No 2. THE NATIVE GOOSEBERRY, OR CURRANT SAW-FLY. (*Pristiphora grossulariae*, Walsh).

This insect, although not common in Canada, has been observed by Mr. G. J. Bowles, of Quebec, on his gooseberry bushes, and hence is worthy of mention. In figure 30

FIG. 30.



we give a representation of a female of this species, on a magnified scale—the hair line behind it showing the natural size—from which the reader will see that there is a close resemblance between the native saw-fly and the imported one. There are, however, differences which the skilled entomologist can readily detect, in the distribution of the veins on the wings, which locates it in a different family, *Pristiphora*; and moreover, a more palpable difference in the relative size of the insects, the native being but two-thirds the size of the imported species, in all its different stages. Mr. Benjamin D. Walsh, who discovered this insect, gives in the *Practical Entomologist*, p. 123, some additional distinctive features. The larva of the native saw-fly is always green, and never bears the numerous black spots so characteristic of the imported species; neither does it ever go under ground to spin its cocoon, but constructs that cocoon among the twigs and leaves of the bush on which it feeds. The winged insect of the second brood comes out the same season, instead of remaining in the chrysalis state all winter, so that it cannot then lay its eggs upon the leaves, but must necessarily lay them upon the twigs of the infested plants. Otherwise, if it laid them upon the leaves in September, which is the month in which the fly of the second brood appears, the eggs would be scattered along with the leaves in their fall, far away from the infested bushes, and the young larvæ would starve when they hatched out the next spring, and the species become extinct. The very young larvæ do not gather in numbers upon one particular leaf, as in the imported species, but distribute themselves pretty evenly over the whole bush. The sexes also resemble each other very closely in the native insect, as remarked by Mr. Walsh in a second excellent paper on this saw-fly in the *American Entomologist*, vol. 2, p. 20.

The first brood of these larvæ may be looked for about the end of June, and the second during the latter part of August; and while they infest both the currant and gooseberry, they appear to show a decided preference for the latter. Their effects on the bushes, when numerous, are very similar to those of the imported insect, and, if necessary, they may be treated with the hellebore mixture with similar good results. From the reports of Messrs. Walsh and Riley, it would seem that they are common, and often troublesome, in the States of Illinois and New York.

No 3. THE CURRANT GEOMETER OR MEASURING WORM. (*Ellopiæ* [*Ab-raxis*] *ribearia*, Fitch).

This is a very common insect in many portions of Canada, but has shown itself more destructive thus far in the eastern than in the western parts of our country. It may be readily distinguished from the saw-fly caterpillars by its peculiar mode of progression—for having its feet placed at each extremity, it arches its body into a sort of loop at every step, and is hence popularly called a measuring worm, or span worm.



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FIG. 31.



Colours—(1 and 2) yellow, black and white; (3) Mahogany brown.

to the progress of this branch of fruit culture. In our own neighbourhood we had not met with it in any profusion until some three or four years since, when we found that in some gardens it had stripped the currant bushes quite bare, and since then its presence has become more general.

When full grown, this caterpillar measures from an inch to 1-1-10th inches in length. Its head is medium sized, white, bilobed, with a large round black spot on the upper part of each lobe, a short black stripe across the front, a little above the mouth, with a small spot of the same colour on each side of it. Its jaws also are black, and there are a few short black hairs scattered over its surface. The body above is whitish, with a number of black spots of different sizes on each ring or segment. There is a wide yellow stripe down the back, and another of the same character along each side, but somewhat broken. The under side is white, with a slight tinge of pink, and also spotted with black, with a wide yellow stripe down the middle. The feet are blackish, pro-legs yellow, dotted with black.

There is but one brood of this insect in a year, hence there is no probability of its ever becoming so formidable a pest as the imported saw-fly. It survives the winter in the egg state, on the twigs and limbs of the bushes, and remains in this condition until late in May, or when the bushes are in full leaf. Then the eggs are hatched, and, in about three or four weeks after, reach their full size. With us, they are usually full grown from the 20th to the 25th of June. They then descend to the ground and burrow a short distance under the surface, where their bodies become much shortened, and then soon change into dark brown chrysalids about half an inch long, in which state they usually remain from fourteen to twenty days, when the moth is liberated. The duration of the chrysalis state given is the result of observations on the insect in confinement. A considerable number of specimens which we reared entered the chrysalis state on the 23rd and 24th of June, and produced the moths from the 7th to the 12th of July.

FIG. 32.



Colour—Pale yellow, with dusky spots.

The moth, (see figure 32,) is of a pale yellowish colour, with several dusky spots, varying in size and form, and more prominent in some specimens than in others; sometimes they are so arranged as to form one or two irregular bands across the wings; These latter when expanded measure about $1\frac{1}{2}$ inches. Soon after the moths' escape they pair, and then the female deposits her eggs on the twigs and branches, where they endure the remaining heat of summer without hatching, and also the piercing cold of winter without being destroyed, awaiting the arrival of their proper time for hatching the following spring.

In figure 31 this caterpillar is well shown in various attitudes. This excellent figure, as well as many others which illustrate these reports, is from a drawing from nature by C. V. Riley, State Entomologist of Missouri. Besides its peculiar method of walking, this larva possesses the power of spinning at will, from its hinder extremity, a silken thread, by means of which it is enabled to lower itself suddenly from the bush when danger threatens, and remains suspended, as shown at (2), until it can safely return to its former position; in this respect, also, differing from the saw-fly larvæ, which have no such provision.

This measuring worm is a native insect, which, in former times, was confined to the wild gooseberry and currant bushes in the woods, where we still frequently find them. On the 26th of May, of the present year, we found a quantity of them, about half grown, destroying the foliage of the wild gooseberries, but since the introduction and cultivation in our gardens of the European varieties of the gooseberry and currant, this insect has taken a wonderful liking to them, and has increased prodigiously as compared with its former numbers, until now, in many districts, it has become a serious impediment

Mr. Walsh says that this insect has been a severe pest for a great number of years in some of the more eastern States, especially in New York and Pennsylvania. It is also common in some portions of Missouri. Mr. J. G. Bowles, of Quebec, says that he has found it common on the black currant, as well as on the red currant and gooseberry.

The same remedy which was recommended for the saw-fly larvæ, viz., hellebore, may be used with advantage here also, and in the same manner. Hand-picking can be more easily followed out with this species than with some others. The habit the larva has of letting itself down from the bush with a silken thread and remaining suspended, may be turned to practical account as an aid to their capture; for, if after tapping the bush a forked stick or some similar instrument is passed under it, all the hanging threads may be caught, and the larvæ thus drawn out in groups and crushed with the foot. By repeating this operation frequently the bushes may in a short time be pretty well cleaned. We are not aware of any parasites having been found attacking this species.

No. 4. THE SPINOUS CURRANT CATERPILLAR. (*Grapta progne*, Cram.)

Dr. Asa Fitch, State Entomologist of New York, first refers to this insect as attacking the currant, in his third report. For several years past we have taken it on both the gooseberry and currant, and also on the wild gooseberry bushes. Mr. Bowles has also found it in Quebec, feeding on red currant; and in the recent report on the noxious insects of Illinois by Dr. W. Le Baron, State Entomologist it is mentioned as being troublesome there, and in one section had done considerable mischief by stripping the leaves from the currant bushes. Although the insect is very widely distributed on this continent, we do not apprehend that it will ever cause any very serious trouble; still it is well that all should be familiar with its history, so that, should it increase unexpectedly, our readers may be enabled to recognise it.

FIG. 33.



The perfect insect is a butterfly, and a very handsome one too. It is represented in fig. 33: The pair of wings which are attached to the body show the markings of the upper surface, and the detached pair those of the under surface. Its fore wings are dull reddish orange, with the outer edge widely bordered with dark brown, and within there are many spots of brown and black. The hind wings are dark brown, tinged with red behind shading into reddish towards the front. The under surface of both wings is dark brownish, traversed by many greyish lines and streaks, and on the fore wings is a very wide band towards the outer edge of a paler colour. The wings are very irregular in outline, with curious notches and prominences. This butterfly passes the winter in the perfect or winged state, hiding in some sheltered nook, where it remains torpid during the cold of winter, and awakes to life again with the genial warmth of spring. They may be found very early in the season, skipping about with their peculiar jerky flight about the openings in woods, basking now and then on the sunny side of a tree, or sipping the sweet juice exuding from a freshly cut stump. When its wings are spread it measures from $1\frac{1}{2}$ to $1\frac{3}{4}$ inches. There are probably two broods of this insect during the season. Mr. Bowles has taken the larva at Quebec full grown on the 28th of June, while we have taken them in the same stage from the 20th of July to early in August. It is likely that Mr. Bowles' specimens belonged to the first brood, and ours to the second. The colour of the caterpillar varies from light brownish to dull greenish yellow with many longitudinal lines of black, whitish and yellow, more or less distinct. It is about an inch or a little more in length, and its body is thickly set with branching spines, varying in colour from yellow to orange and dark brown, many of the branches being tipped with black.

When full grown it seeks some secluded spot in which to change to chrysalis, sometimes the under side of a leaf, or twig is selected, and here after spinning on the surface a small web of silk, it hooks its hind legs in the fibres and suspends itself head downwards. In this state it remains for a day or two, gradually contracting in length, until finally the caterpillar skin is shed, revealing a rugged looking brown chrysalis, prettily ornamented with silvery spots. With regard to the duration of the chrysalis state, Dr. Harris places it at from eleven to sixteen days, while Dr. Le Baron has had them appear in seven days, very probably the heat of

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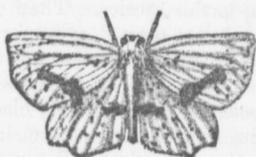
the weather may have much to do with their development. The flight of the butterfly is very graceful, as it hovers over the tips of the branches of the currant and gooseberry bushes, where it places its eggs among the young and tender leaves. The eggs are generally placed singly, and it is not often that there are many on any one bush.

Should this insect ever become sufficiently numerous to require attention, it may be destroyed by hellebore or lessened in numbers by hand picking.

No. 5. THE GREEN MEASURING WORM OF THE CURRANT. (*Angerona crocotaria*, Guenee.)

The moth from which this caterpillar is produced, is also very generally common, although seldom sufficiently abundant to be destructive. The currant is not the only food plant of the larvæ for it has been found also upon the strawberry, and probably feeds on other plants besides. This moth is a native of America, and may often be seen flying about the openings, on the edges of the forest, for it takes wing by day. It is not a robust flier, and hence is not difficult to capture. Its wings are yellow, see figure 34, varying in shade from deep to pale; with dusky spots and dots, sometimes few in number or altogether wanting, while in other specimens they are very numerous, the larger ones arranged, so as to form an imperfect band across the wings. The underside of the wings is usually a little deeper in colour than the upper. When expanded they measure from one and a quarter to one and a half inches, the specimen figured is rather under the average size. When in its native haunts,

FIG. 34.



the larvæ probably feeds on the wild currant, gooseberry, strawberry, and perhaps other plants as well, and the fact of its being so general a feeder will perhaps account for the little attention which has thus far been given to it.

This insect is a very prolific one; a female which we captured last year, late in June, deposited on the 27th of the month 220 eggs, which were laid in patches or clusters, on different parts of the box in which it was confined, each group containing from ten to forty or fifty. They were of an oval shape about 1/33rd of an inch long, and 1/50th wide. When first laid they were yellow, but in a day or two afterwards, they changed to a bright red, changing afterwards to greyish brown before hatching; they came out between the fourth and seventh of July, showing the duration of the egg stage to be from eight to eleven days. The young caterpillar just hatched, was about 1/10th of an inch long, with a large pale brown head, and a yellowish green body, with a dark brown stripe along each side, below which the body was paler with a whitish bloom over its surface, and a few short brownish hairs, which were most numerous on the terminal segment.

FIG. 35.



The accompanying figure 35, represents the larva a little more than two thirds grown, feeding on a gooseberry leaf. At this period it does not differ materially from the full grown larva, which has been so well described, along with the chrysalis by Mr. G. J. Bowles, in the *Canadian Entomologist*, vol. 2, p. 10, that we cannot do better than to quote his own words.

"Mature larva (Quebec).—Fed on red currant; length, 1.50 to 1.75 inches; body gradually increasing

in size from head to pro-legs; general colour, yellowish green.

"Head square, and flattened above, with three longitudinal purplish brown and whitish stripes, which are continued on first segment. There are also two small projections like rudimentary antennæ, one on each side of the head, .03 long.

"Body yellowish green, an indistinct whitish dorsal line, a rather broad whitish line on each side, just below the spiracles, bordered above with faint purple, which increases in depth of colour towards the posterior rings, and becomes a purple stripe on anal pro-legs, forming a resemblance to an inverted Λ . Beneath same colour as above, but with faint interrupted longitudinal lines; spiracles white, bordered with purple; above, on each segment from second to seventh inclusive, are five minute black dots (four in a square, and one in front towards the head), and all the rings have a yellowish band on the swelled part, where the succeeding segment is inserted; legs pale green.

"The pupa is .50 to .60 inch in length, and of a dark, olive-green colour, with the exception of the abdomen, which is pale greenish yellow, and has a row of black dots on each side, and another dorsal row. The wing-cases are very prominent, and from their strong contrast with the abdomen in colour, make the chrysalis a pretty object. I found them fastened by the tail, and reposing in a slight net-work of silken threads, with which the caterpillar had drawn the edges of a currant-leaf half way together, so as to form a kind of cradle. The structure could not be called a cocoon,—in fact, the chrysalis, which was very lively, had wriggled itself out of its bed in some cases, and hung outside, fastened only by the tail; the moth appeared in from 10 to 14 days afterwards."

The remedies already referred to will apply to this insect also, should it become at any time sufficiently numerous to cause alarm.

No. 6. THE BLACK MEASURING WORM OF THE CURRANT. (*Priocycla armatoria*, Herr Sch.)

On the 15th of July, 1870, we found some nearly black geometric larvæ feeding on currant and gooseberry bushes, which afterwards proved to belong to this species. They fed on the foliage of the black currant, as well as that of the red, and in fact seemed to prefer it. When first taken they were about half an inch long, with the body tapering a little towards the head, thicker along the middle and hinder portions; the head was small, and of a brownish black colour, spotted and streaked with white. The body above was dark brown, nearly black, dotted and marked with bright pale yellow; on each segment or ring from the fourth to the last, was a whitish, crescent-shaped spot on the back, most distinct on the fifth, sixth and seventh segments; these, with the eighth segment, were all enlarged at the sides and projecting, while the spaces between them were unaltered; the sixth and seventh segments bulged out more than the others. On the sides of the eighth, ninth and tenth segments, was placed a patch of a bright yellow; there was also a row of raised dots along each side, those on the front and middle segments dark brown, while those on the posterior segments were tipped with yellow. The hinder segment had a fleshy hump, or prominence, composed of two round tubercles, with a patch of yellow on the outside of each; there were also a few short brownish hairs scattered over the surface of the body. The under-side was blackish brown, the feet and pro-legs of a similar hue, the anterior pair of pro-legs having a stripe of yellow on the outside. Before maturing this caterpillar attained a length of three-fourths of an inch or more, but retained the same markings, excepting on the head, which became pale brown, dotted with black. The larva entered the chrysalis state early in the fall. It constructed a slight web, composed of silk, interwoven with portions of leaf and fraas, and stretched across the corner of a wooden box in which it was confined, and within this the change was effected. One specimen produced the moth on the first of June following, the other on the eighth of the same month.

FIG. 36.



In figure 36 we have a representation of the moth, which is a little below the average size. The colour of its wings is yellowish brown, shaded with purplish, especially on the hind wings; the streaks and dots are of a deeper shade of brown; the under surface is of a deep yellow, dotted with reddish brown, and with a line of the same colour crossing the wings, a little beyond the middle; behind this line, on the posterior wings, the colour becomes pale purplish brown.

While this insect may be ranked among those that are injurious to the fruit-grower, inasmuch as it is destructive to the gooseberry and currant, still it is comparatively rare, and has not thus far, at any time, presented itself in such numbers as to attract much attention from those interested in this department of industry.

No. 7. THE PALE GREEN MEASURING WORM OF THE CURRANT. (*Amphidasys cognataria*, Guenee.)

Mr. G. J. Bowles, of Quebec, was the first to notice this insect as injurious to the currant. In a communication to the *Can. Ent.*, vol. 2, p. 11, he says: "On the 3rd of August my attention was drawn to a small black currant bush, by its peculiar appearance

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On a closer examination, I found a number of geometric caterpillars, which were resting themselves in their customary manner, by clinging to the branches with their anal legs, and holding their bodies extended. At a little distance they closely resembled the bare stalks of leaves, and it was this resemblance which led me to seek the cause of the bush being affected in such a manner. I gathered twenty-four of these caterpillars, which were all nearly full grown, and fed them on black currant leaves in a box of earth; but by the 7th of August they had all descended and changed to pupæ, on or just beneath the surface of the ground, without forming any cocoon. The following is a description of this larva:

"Mature larva, fed on black currant—length, $1\frac{3}{4}$ to 2 inches, nearly cylindrical, gradually enlarging to the posterior extremity; general colour, pea green.

"Head, greyish green; body, pale green, with a darker green interrupted dorsal line, and indistinct broken transverse lines of the same colour; a yellow cross line on posterior end of each segment, and two small tubercles on second segment close to head. The body is also dotted with very small whitish tubercles, and a few short black hairs; spiracles reddish; feet, pale green. Some of the largest of these larvæ had a small brown tubercle on each side, in front of each spiracle on segment before the first pair of pro-legs, and a purplish brown ridge on last segment from one spiracle to the other.

"The chrysalis is from 6-10ths to 7-10ths of an inch long, very stout, and of a dark brown colour, with a strong point or thorn at the end of the abdomen, which is slightly flexible.

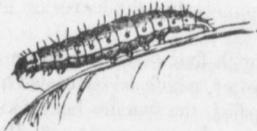
"These pupæ remained in the earth till early spring, when I became impatient, and brought a few in a small box into a warm room, hoping to hasten their development. On the 2nd of April I was rewarded by finding in the box a very fine female specimen of that handsome grey geometer (*Amphidasys cognataria*, Guenee), which had escaped from one of the chrysalids."

"The moth measures, when its wings are expanded, from 2 to $2\frac{1}{2}$ inches. Both fore and hind wings are grey, dotted and streaked with black, and with a wavy black line or light band crossing the wings a little beyond the middle; the body is also grey, dotted with black. The under surface is similar to the upper, but a little paler." This moth occurs in our own neighbourhood, but we have never met with it on currant bushes. We had always thought that it fed on pine, as we had several times taken it about pine woods; indeed we have an impression that we once bred it from pine, but did not take any record of it; hence we do not feel quite sure about it. Should it so turn out that the same larva feeds on such widely different food as pine and black currant, it would be a very interesting fact.

No. 8. THE OBLIQUE BANDED LEAF ROLLER. (*Lozotenia rosaceana*, Harris.)

This insect, which was described in the last year's report, by Mr. E. B. Reed, as injurious to the plum, we have found troublesome to the gooseberry and currant also; in fact it is a very general feeder, attacking the apple, pear, cherry, raspberry and strawberry as well, and probably other plants besides. It belongs to the family of moths called leaf-rollers, from the habit the larvæ have of rolling up the leaves or portions of them, thus constructing a rude case in which they live, and where they are partially protected from birds and other enemies.

FIG. 37.



The caterpillar is three-quarters of an inch long or more, of a yellowish green colour, with a pale brown head and a few fine whitish hairs scattered over its surface, arising from very small, slightly elevated shining tubercles or dots, scarcely visible without a magnifying glass. It changes to a dark brown chrysalis, usually within the case in which it feeds, and works its way partly out before the moth escapes. In the annexed figure, 37, the caterpillar is shown a little enlarged, while the brown chrysalis is placed underneath from which the moth has escaped.

The moth, see figure 38, measures, when its wings are spread, from three quarters of an inch to an inch. Its fore wings are of a light cinnamon brown colour, crossed with bands and lines of a darker shade. The hind wings are pale yellow. For a fuller description

FIG. 38.



the reader is referred to the paper already spoken of by Mr. Reed, in the report of last year.

Doubtless this insect would soon become very much more numerous and destructive than it is were it not kept in check by parasites which prey upon it in the larva state. We have repeatedly reared small ichneumon flies from the caterpillars of this moth, and hope by another

year to be able to give some interesting details regarding their history.

Besides the moths already referred to we have found another species of geometer, and another leaf roller, the latter particularly destructive to the gooseberry, but we have not been able to work out their life history sufficiently full to present them in this report. We hope to give some information relating to these after we have watched them through another season.

No. 9. THE FOUR STRIPED PLANT BUG. (*Capsus* [*Phytocoris*] *quadrivittatus*, Say.)

In the first annual report on the noxious insects of the State of Illinois, recently published by the new State Entomologist, Dr. W. Le Baron, we find this insect referred to as injurious to the currant. We have also seen it on currant bushes here, but never in numbers sufficient to do much damage, but as we have it common enough with us, and have seen it almost entirely destroy patches of mint and other plants; we have no doubt that should it acquire a strong liking for the foliage of the currant, that it would soon make its presence apparent. It is a true bug, belonging to the order Heteroptera, and family of Capsidae. We quote the following from Dr. Le Baron's excellent report:

"Upon going into my garden on the morning of the 7th of June, my attention was arrested by the blighted appearance of the leaves on some of the currant bushes. Upon examining them, they were found to be more or less densely sprinkled with little, dried, somewhat square or angulated spots, not much larger than pin-heads. Some of the leaves were completely withered, and a number of parsnips which had been left for seed were found still more severely affected, some whole branches and their leaves being as dead and brown as if they had been severed from the plant for a week. I examined the plants carefully, and could find no adequate cause for the mischief, and I was inclined to think either it was some kind of blight or that if any insects had been damaging them they had run their course and disappeared. I saw on most of the bushes a small number of the pretty black and yellow hemipterous insect whose name is placed at the head of this article, but they did not seem to be in sufficient numbers to account for the evil. I observed them, however, puncturing the leaves; and upon referring to the *American Entomologist*, I found, on page 246 of the first volume, a notice of these same insects having been sent to the editor, by Mr. M. B. Bateman, of Painsville, Ohio, with the statement that they were found injurious to the currant bushes, and various kinds of shrubs."

"This is an interesting insect, by adding another to the comparatively small list of noxious insects belonging to the order of Heteroptera. This list includes the chinch bug (*Micropus leucopterus*), the brown squash-bug (*Coreus tristis*), the large grey plant-bug (*Brochimena annulata*) and the lined plant-bug (*Capsus linearis*.) The last species, also known as the tarnished plant-bug, is one of our most pernicious insects, and belongs to the same genus as that now under consideration. All these insects do their damage by puncturing the leaves or stems of the plants, and wilting them by the abstraction of their sap."

This insect is about three tenths of an inch long, yellow, with four black stripes on their wing covers. The females are furnished with a blackish ovipositor, which is concealed under the abdomen when not in use. The sexes are easily distinguished, the females being known by their swollen abdomen, which when opened, according to the statements of Mr. Le Baron, are found to contain from 15 to 24 oblong subcylindrical flask-shaped eggs, pale, with white tips. How and where these eggs are deposited has not yet been ascertained. These insects are very active especially during the hotter parts of the day and instantly take to flight when alarmed. In the early morning when the air is chilly they may be easily captured by jarring or brushing them off into a pail or pan partly filled with water which will prevent them from rising again.

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AFFECTING THE STEMS.

No. 10. THE IMPORTED CURRANT BORER. (*Egeria tipuliformis*, Linn.)

This insect has for many years been a great impediment in the way of successful currant culture. In the larva state it burrows up and down the centre of the stems of the bushes making them so hollow and weak that they often break off with the weight of the foliage or by the action of the wind.

FIG. 39.



The parent of this destructive grub is a pretty little wasp-like moth, see figure 39, which when its wings are expanded measures about three quarters of an inch across. The body is of a bluish black colour, the abdomen being crossed by three narrow golden bands; while on the thorax, at the base of the wings are streaks of a similar colour. The wings are transparent, but veined and bordered with brownish black, with more or less of a coppery lustre. The bordering is much the widest on the front wings, which are also crossed with a band of the same colour beyond the middle. The antennæ or horns are brownish black, and the legs are of the same colour, streaked and dotted with golden yellow. The under surface of the wings is paler than the upper,

This currant borer is not a native insect, but has been introduced from Europe, where it has long proved troublesome. The exact period of its importation into this country is unknown, but it must have occurred many years since as it is now very generally disseminated. The moth makes its appearance about the middle of June, when it may be found in the hot sunshine, darting about with a rapid flight, gathering the nectar of flowers or basking on the leaves, alternately expanding and closing its fan-like tail or sporting actively about in search of suitable places for the deposit of its eggs. In the cooler portions of the day, it is quite sluggish and may then be often found resting on the under side of the leaves of the currant bushes, and so torpid as to be caught and destroyed with but little difficulty.

The female deposits her eggs singly, near the buds where in a few days they hatch into small larvæ which eat their way through the outer portions to the centre of the stem, and here all through the summer they burrow up and down, enlarging the channel as they grow older, and thus forming a hollow several inches in length, which so weakens the affected stems that they are very easily broken. When full grown this is a whitish fleshy grub, of a cylindrical form, with brown head and legs. Before entering the chrysalis state a passage is made nearly through the stem, leaving merely the thin outer skin unbroken, thus preparing the way for the escape of the moth. Within the cavity which has afforded secure shelter to the larva, the change to chrysalis is effected, and here it sleeps peacefully while the bleak wintery winds howl among the branches. Early in June the chrysalis wriggles itself forward, and pushing against the thin skin covering its place of retreat finally ruptures it, and then thrusts itself partly out of the opening. By carefully examining the bushes about this period they may often be found in this half protruded position, and after remaining but a comparatively short time in this state, the moth bursts the chrysalis and effects its escape.

Were it not that the larva has the instinct thus to prepare the way for the escape of the chrysalis, the insect would be a perpetual prisoner within the hollow of the stem; for the chrysalis has neither mouth nor limbs, and the moth no teeth or jaws, with which to work a passage through a hard substance, the mouth of the moth being simply a hollow, flexible tube, which it uses to thrust into flowers to extract their sweets; under the sure guidance of the Great Architect of the Universe, no such mishap is ever likely to occur.

Soon after the escape of the moths they pair, and then shortly the female begins to deposit her eggs, which require the remainder of the season to develop, as already detailed; hence there is only one brood during the year.

In Harris' "Insects Injurious to Vegetation," published in Boston, Mass., in 1852 this insect is referred to as very common in the Eastern States. Dr. Fitch, State Entomologist for New York, also refers to it in his third report. In the *American Entomologist*, vol. 1, p. 79, reference is made to it as common in many parts of the Western States, and in the *Canadian Entomologist*, vol. 3, p. 9, Mr. G. J. Bowles, of Quebec, refers to the damage done to his currant-bushes by this same insect pest. Throughout the western portions of Ontario, the imported currant borer is very numerous and destructive, and while with us it chiefly infests the red currant bushes, it is not confined to them, but attacks the black currant also, and occa-

sionally the gooseberry. Where the perforated stems do not break off, indications of the presence of the borers may often be found in the sickly look of the leaves, and inferior size of the fruit; sometimes, indeed, so badly affected are they, that both fruit and leaves wither and die.

To lessen their numbers and check their increase, efforts should be made to destroy as many of the moths as possible in their season, and when pruning the bushes in the spring all canes found to be hollow should be cut out and burnt. Dr. Fitch, in his third report, says on this point, "The utter carelessness with which the currant is treated in most of our gardens, with a thicket of young shoots annually left unpruned, and crowding upon and smothering each other, gives these borers and other pernicious insects the utmost facilities for working unmolested, and pursuing their devastating work without interruption. Were this shrub suitably trimmed and kept thinned out to only three or four stalks from each root, these stalks, growing freely exposed to the light and air, would be little infested by these depredating insects."

No. 11. THE AMERICAN CURRANT BORER. (*Psenocerus supernotatus*, Say).

This species was first described by Thomas Say, one of the fathers of entomology in America, in a communication made to the Academy of Natural Sciences, Philadelphia, in 1823; he found it in Missouri. Although not abundant in Ontario yet it is found occasionally, and is deserving of notice. In the larva state, this insect is similar in its habits to the preceding species, but may then be distinguished by its lesser size, and its being destitute of feet. In the perfect state it is a small brown beetle, whereas the last mentioned was a wasp-like moth. In the *Practical Entomologist*, p. 22. Mr. Walsh thus describes this pest: "The larva of this insect is a small, cylindrical, white, footless grub, with the head brown and the jaws black. It feeds upon the pith of the stalks, and therefore killing them; it passes its pupa state in the stalks, and in the latter part of May, or beginning of June, changes to a small, narrow, cylindrical, brownish beetle, darker behind the middle, with a whitish dot a little before the middle of each wing-case, and a large, slightly oblique mark of the same colour just behind the middle; the horns, or antennæ, are slender, and nearly as long as the body."

Dr. Fitch referring to this insect in his third report says "In all our gardens numbers of the currant stalks perish every season. To such an extent does this mortality prevail that this fruit would soon disappear from our country were it not that the roots of this shrub are so vigorous sending up a multitude of new shoots every year whereby the places of those that perish are constantly re-supplied."

"After the leaves have fallen in the autumn and during the winter, these dead stalks are readily distinguished from the live ones by being dotted over with a pretty little fungus the size of a pin head, and of a pale bright red colour and corky texture."

This beetle is a day-flying insect also, but much less active and hence more easily captured than the preceding species. It may be found in its season on flowers, and the method already recommended of cutting out and burning the infested canes may be adopted in this instance also with great advantage.

AFFECTING THE FRUIT.

No. 12. THE GOOSEBERRY FRUIT WORM. (*Pempelia grossulariæ*, Packard.)

The first notice of this insect as a species injurious to the gooseberry was given by Dr. Fitch in his third report in which he calls the larva, "the caterpillar of the gooseberry moth." He had not, however, raised it to the perfect state and knew nothing of the appearance of the moth or of its habits. We may safely claim the credit ourselves of being the first to work out its history which we did in 1865; and it was from some of the specimens then reared that Dr. Packard's description and figure given in his work were taken, see *Packard's Guide to the Study of Insects*, p. 321.

FIG. 40.



The accompanying figure 40 well represents the moth with the cocoon along side of it. The fore wings are pale gray 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 of the wing is another transverse band enclosing a

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whitish zigzag 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 on the upper side. When its wings are expanded it measures nearly an inch across.

This insect spends the winter in the chrysalis state, enclosed in a brown, papery-looking cocoon (see figure 40 *a*), secreted amongst leaves or other rubbish, on the surface of the ground, and appears in the winged state during the latter part of April; soon afterwards they seek their mates, and the females are ready to deposit their eggs as soon as the fruit has well set. These are probably attached singly to the fruit, and here in a few days the young larva is hatched, when it begins at once to burrow its way into the berry, where it remains safely lodged. As this larva increases in size, it fastens several of the berries together by silken threads, now and then biting the stems off some of them so that they may be more readily drawn into any required position, and within this retreat revels on their substance at its leisure. This larva makes but one hole in a berry, and that but barely large enough to admit its body, and when disturbed, it displays great activity, wriggling and working its way backwards out of the fruit very quickly, and dropping part way or entirely to the ground by means of a silken thread. Out of the single hole in the berry its *frass* is thrust, which sometimes accumulates in a little heap around the orifice.

When fully grown, the larva measures about three-fourths of an inch in length, with the body thickest in the middle, tapering slightly towards each extremity; the head is very small, pale brown, and horny-looking, with darker coloured jaws; the body is of a very pale shining green colour, with a slight yellowish tint, and semi-transparent; some specimens have a reddish hue. Behind the head is a pale brown horny-looking patch, very similar in appearance to the head. The under side is of the same colour as the upper, the feet pale brown, and the thick, fleshy pro-legs pale green. When ready for its change, which is usually from the 15th to the 18th of June, it lowers itself to the ground, and there spins its little silken cocoon amongst leaves or rubbish, as already stated, and remains there in this inactive state, in a small brown chrysalis within the cocoon, until the following spring; hence there is only one brood of this insect during the year.

The fruit infested by this larvæ soon indicates their presence by becoming discoloured; if sufficiently advanced it ripens prematurely, otherwise it soon becomes dull whitish, and withers.

We have found this pest attacking the currant also, both the red and white varieties; neither does the black currant entirely escape, although it is more rarely affected. In these instances the fruit is not large enough to contain the worm, so it draws the clusters together, and, fastening the berries to each other with silken threads, lives within the enclosure.

Remedies.—The most satisfactory way yet known for extirpating this insect is by hand-picking, and its habits are such that evidences of its presence are not difficult to detect. Any berries found discolouring prematurely should be carefully looked over, as this is the first indication of its workings, and as the larva slips out and falls to the ground very quickly, watchfulness is needed to prevent their escape in this way; follow them up and give them no quarter, for where neglected they soon increase to an alarming extent; we have several times seen upwards of half the crop destroyed by these enemies in a short time.

We have tried dusting the bushes with fresh air slacked lime about the time of the appearance of the moths, that is late in April, and we think with good results, the moths seem to avoid in great measure bushes so dusted, for all insects dislike such alkaline materials. This is a remedy easily got at, costs but little, and is easily applied; for these reasons it should be further tested as opportunity offers. We have reared a number of specimens of this insect, but thus far, have not found them attacked by any parasites. Mr. C. V. Riley, of St. Louis, in his "First Report," says that "if chickens are allowed to run amongst the bushes after the fruit has gone, they will materially assist in checking this pest by devouring such chrysalids as are within their reach."

No. 13. THE GOOSEBERRY MIDGE. (*Cecidomyia Grossulariæ*).

Dr. Asa Fitch, of New York, is the only Entomologist who has written on this insect as affecting the gooseberry; we have had no experience with it ourselves, but thinking it probable that some of our readers may have met with it, we give Dr. Fitch's remarks in his first report

on the "Noxious Insects of the State of New York," p. 176, for their information and guidance. "It is common to find upon the gooseberry bushes in our gardens, some of the young fruit of a prematurely ripe appearance, turning red and dropping to the ground. Some years much of the fruit is lost in this way. This premature ripening of the gooseberry is caused by insects puncturing and depositing their eggs in it. One of these appears to be a species of moth which I have not yet obtained in the perfect state." (Dr. Fitch here refers to *Pempelia grossulariæ*, the moth last described.) "The other is the larva of a midge, or a small two-winged fly, of the genus *Cecidomyia* and family TIPULIDÆ. On examining some of these affected gooseberries early in July, their pulp was found to be putrid, and infested with small maggots of a bright yellow colour and oval form, their bodies divided into segments by five impressed transverse lines, and their whole appearance being closely like the larva of the wheat midge found in the ears of wheat. These completed their transformations and gave out the winged flies in the latter part of the month of July.

"The gooseberry midge is scarcely a tenth of an inch in length to the tips of the closed wings. It is of a pale yellow colour, the thorax paler than the abdomen, and of a wax-yellow hue; eyes black; antennæ blackish, of twelve joints, separated by hyaline pedicels one-third as long as the joints, which are short, cylindrical, with rounded ends, their length scarcely more than double their breadth; legs straw yellow, faintly tinged with dusky towards their tips; wings hyaline, faintly tinged with dusky.

"It is probable that those flies which come out the latter part of July deposit a second crop of eggs in the gooseberries, or else resort to some other fruit of a similar nature, and that the larvæ which come from these eggs lie in the ground during the winter; for we do not perceive how, otherwise there can be flies in June to deposit their eggs in the young fruit.

"All fruit upon the gooseberry bushes which is found prematurely decaying and assuming a ripened appearance, and all which falls to the ground should be gathered and thrown into the fire, to destroy the worms which the berries contain. By attention to this measure the haunts of this insect in the garden can be easily broken up, whereas, if this step is neglected, the evil will be liable to continue year after year."

We have received from Mr. G. J. Bowles, of Quebec, a third enemy to the fruit of the currant; it is a small fly a species of *Trypeta*, whose larva lives within the berries. We hope by another season to be able to give the details of the history of this insect with an enlarged figure of the fly.

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INSECTS AFFECTING THE WHEAT CROPS

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

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| <p>1. The Wheat Midge (<i>Cecidomyia tritici</i>, Kirby).</p> <p>2. The Hessian Fly (<i>Cecidomyia destructor</i>, Say).</p> <p>3. The Chinch Bug (<i>Micropus leucopterus</i>, Say).</p> <p>4. The Grain Aphis (<i>Aphis avenæ</i>, Fabr).</p> | <p>5. The Joint Worm (<i>Isosoma hordei</i>, Harris).</p> <p>6. The Angoumois Moth (<i>Butalis cerealella</i>, Oliv.).</p> <p>7. The Army-Worm (<i>Leucania unipuncta</i>, Haworth).</p> <p>8. The Wheat Wire-Worm (<i>Agriotes mancus</i>, Say).</p> |
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During the past two years, thanks to a merciful Providence, the wheat-crops of this Province—the great staple of the country's wealth—have been almost entirely free from the ravages of insects. In some localities, it is true, there have been complaints of loss occasioned by the depredations of the midge, or the Hessian fly; but these have been few in number, and limited in extent, and, regarding the country as a whole, have hardly affected the general harvest returns to any appreciable extent. This immunity, however, that we now congratulate ourselves upon, and which has no doubt been one great subject of the expressions of gratitude and thankfulness that were poured forth by the inhabitants of the land upon the recent day of General Thanksgiving,—this freedom from the attacks of insects has been of no long duration, though we earnestly hope and pray that it may not soon be brought to a termination. It requires but a very slight effort of memory to recall the days when the name of Midge was a word of horror and execration throughout the length and breadth of the land, and when the Hessian fly was regarded as one of the greatest obstacles to the country's prosperity. During a long series of years, hundreds of thousands—nay, millions—of dollars' worth of grain were annually destroyed in this Province by the armies of these insects that, in countless myriads, invaded our fair fields. Year by year, however, as their nature and habits became better understood,—as improved modes of cultivation were adopted,—as a more scientific rotation of crops became the rule instead of the exception among farmers,—as superior varieties of wheat, adapted to withstand their insect foes, were more widely distributed,—and as parasites and other destroyers of insects increased, our crops became more and more free from attack, until we this year hear of hardly a county or township where any serious damage has been inflicted.

Such being the state of things, it may be thought too late in the day for us to bring before the public any detailed account of these creatures, as they no longer attract the universal attention of the community, and that our time and labour might be more usefully spent in the description of other and more immediately pressing foes. This objection would undoubtedly be of much force had this series of Reports been issued in previous years during the height of the ravages of wheat insects, but as this is only our second year of publication, we have not hitherto had an opportunity of affording the public a condensed and available account of these creatures, and it does not appear to us advisable to wait for fresh invasions before suggesting some modes of defence. The reader will, moreover find elsewhere reports on the great scourges of the day—the Colorado beetle, the Currant saw-fly, the Cabbage butterfly, and other insects that have been special subjects of anxiety of late. Without further apology, then, we shall pass on to the consideration of some of the worst and most notable pests of the wheat grower in this Province.

1. THE WHEAT MIDGE --(*Cecidomyia tritici*, Kirby.)

DIPTERA—TIPULIDÆ.

It is a singular and noteworthy fact that nearly all the species of insects that have proved the greatest enemies to the products of our farms and gardens have come to us from the other side of the Atlantic, and that they have in no long time as far surpassed in number and power the kindred species of native insects as the white immigrants have the aboriginal Red Indians. This is especially exemplified in the instances of the Wheat Midge that we are now treating of, the Hessian fly (*C. destructor*, Fab.) the Currant Saw fly (*Nematus ventricosus*, Klug), the Onion fly (*Anthomyia ceparum*), the Oyster-shell Bark-louse (*Aspidiotus conchiformis*), the Meal-worm (*Tenebrio molitor*), the Cockroach, the Bee-moth, the Codling moth, the Cabbage Tinea, the Asparagus beetle, the Red Currant borer (*Egeria tipuliformis*), the Grain Aphis, the Cheese maggot, the House fly, the Carpet and Clothes moths, the Larder beetle and numbers of others, the date of whose importation cannot always be definitely determined, though it is an established fact that they are not indigenous to this continent, but have been brought to our shores by commerce or immigration.

The Wheat Midge, with which we are now especially concerned, long known in Europe for its destructive power, was first observed on this side of the Atlantic in the year 1820, when it appeared in north-western Vermont; it is, however, probable that it arrived in this country some few years earlier, and was introduced at Montreal or Quebec in some wheat imported from Great Britain. (For a detailed account of its appearance in different years down to 1856, see *Hind's Essay* page 77-85.) For some years little notice was taken of the insect, as it was confined to a small locality and committed but little damage to the crops. But in 1828 it became so numerous and destructive as to cause considerable alarm in Lower Canada and the adjacent State of Vermont; and from that year onward it continued to increase and spread, till it gradually overran almost all the wheat producing regions of North America and became a frightful scourge to the whole community. We cannot better illustrate its powers of destruction and the enormous pecuniary loss it occasioned than by quoting at length the following account of its ravages from Dr. Fitch's admirable report upon the subject. (*Sixth New York Report*, 1865, page 10.)

"The year 1854, proved to be one of the most disastrous to the wheat crop over the whole country that had yet been experienced. It was devastated as it had never been before, except when the insect had newly arrived, and in some localities it was even more destructive now than it had been then. When many of the wasted fields were still remaining in public view, at the August meeting of the American Institute, Mr. John Robinson pronounced this insect to be the most terrible pest ever encountered by wheat growers. In my own vicinity many of the fields were not harvested. As illustrating the personal losses sustained by our agricultural population from this scourge. I may here state that one of my neighbours had sowed fourteen acres with wheat, on lands in excellent condition for this crop. But at harvest time there was nothing to gather therefrom, save the yellow larvæ, of which a handful, or at least a palmful, might be obtained on slightly rubbing any one of the ears; and after toiling to feed and fatten the vermin he demurred against granting them the additional favour of a shelter within his barn. But for the midge, his land would have yielded at least fifteen bushels per acre, showing his loss from this pest that year to have been upwards of two hundred dollars, estimating wheat at its usual price. And this is only an ordinary case, every neighbourhood throughout the country abounding in similar instances among our common farmers, whilst on the larger farms, where fifty and a hundred acres or more are customarily sown to this grain, the individual losses have been greater in the same ratio.

"And when we attempt to reckon up the amount of damage sustained by the State of New York from this minute and seemingly powerless and insignificant insect, we almost distrust the evidence of statistics and figures, they present us with sums which appear so fabulous. The wheat crop of the State, notwithstanding the diminution it was receiving from the midge, amounted in 1850, according to the census of that year, to over thirteen millions of bushels. Now, if we suffer only one-third of this amount to have been wasted by the midge in 1854, estimating the wheat at \$2.15 per bushel, which was its average value in our markets during the autumn and early winter of that year, it presents us with over nine million four hundred and three thousand dollars as the loss sustained. But this amount, enormous

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as it appears, is but an approach to the real loss, as we perceive when we recur to the facts that the crop on which this estimate is based was itself materially diminished by this insect,—that a much larger crop was sown in 1854 than in 1849–50, and that far more than a third of the crop was probably destroyed, since many fields were totally lost, and others scarcely repaid the expense of harvesting; whilst those from which anything that could be regarded as a fair crop was obtained were few indeed. Over large sections of the State it was reported that not a third or a fourth of an ordinary yield was received. The most authentic information, probably, that this subject is susceptible of, was obtained by the State Agricultural Society, which, in gathering the agricultural statistics of that year, inserted in its circular the query: “To what extent was the wheat crop in your vicinity injured by the midge?” The secretary informed me that, on getting together all the replies to this enquiry, and placing everything at the lowest figure, so as to be certain the estimate was within the truth, the wheat which this insect had that year destroyed in our State, at its then current market price, exceeded in value *fifteen millions of dollars!* This amount would be more than a third larger, if estimated at the price to which wheat afterwards rose that winter. Indeed, the more we examine this subject, the more we become impressed with the justness of the remark that “the loss or damage to our country, caused by this yellow mite, *it is hard to over-estimate.*” Such was the fearful damage wrought by this tiny insect in one year, and in the single State of New York. Two years later the loss in Canada alone was estimated to exceed two and a half millions of dollars. The following year (1857) it destroyed one-third of the entire wheat-crop of this Province, amounting to about *eight millions of bushels!* And so it continued to carry on its work of destruction, varying slightly from year to year, down even to 1868, when, as we related in an abstract of the crop returns for the season (*Canada Farmer*, 1869, page 96), “the ravages of the midge were something frightful to contemplate.” Since that time, however, a wonderful change has taken place; the midge has almost entirely disappeared; the cultivation of wheat has become once more the great work of our farmers, and the country at large is manifesting a vastly increased prosperity in every respect.

But let us turn now from the description of the devastations committed by this pest to some consideration of its appearance and habits.

In the month of June, when the air is so warm as to cause one to sit with open windows in the evening, or, as Dr. Fitch so well puts it, when the white glories of the locust are beginning to fade and drop to the ground, when the first sparkling fire-fly is seen through the gloom, when the farmer turns to hoe for the first time his Indian corn, now peeping a few inches above the surface, then the tiny flies of the wheat-midge commence to come abroad. On such evenings, if they are in the neighbourhood at all, we generally find them in numbers about our study lamp, and thickly scattered over our papers beneath. They may be at once recognized by their orange yellow bodies, presenting in this respect a striking difference from the host of minute creatures that accompany them to the lamp that lures them to destruction. Of course we do not say that all the tiny yellow bodied insects that one sees are wheat-midges, for there may be other species with the same characteristic; but all of this colour, taken about our lamp in June that we have examined with a powerful lens, have proved to belong to this destructive species.

FIG. 41.

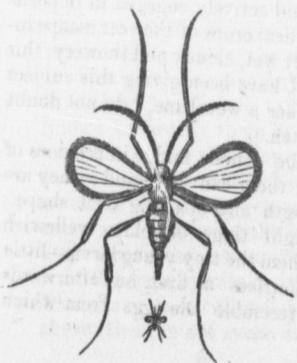


FIG. 42.



These tiny little flies—they are not more than one-tenth of an inch long (Fig. 41, represents a highly magnified specimen, with the wings expanded; Fig. 42, with closed wings)—appear to come forth from the pupa state about sundown, on such evenings as we have just alluded to. Fields where wheat was grown during the preceding season are the winter quarters of the insect; there it remains in the earth as a motionless and, apparently, lifeless, larva till the warm weather completes the transformations to the winged state, and brings out the tiny fly in countless numbers. A little before the middle of June, 1868,—as we noticed in the *Canada Farmer* at the time—we received a lump of clay containing an enormous number of these orange-yellow larvæ

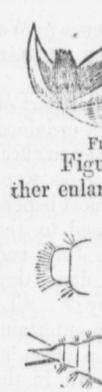
from Mr. Alex. Belch, proprietor of the *St. Mary's Argus*. The clay had been taken from a field in the township of Blanchford, in which midge-infested wheat had been grown during the previous year. This handful of earth produced for us a great quantity of specimens, both male and female, and gave us such an opportunity of studying the creature as is not always easy to obtain. As a general rule, though many variations are to be found, the female flies,—the sex usually met with,—have clear, glossy, rarely smoky wings, with two conspicuous leading veins running lengthwise through the middle of the wing, and a small cross vein near the base; their antennæ, which are about the same length as the body, are composed of twelve joints; the body is nearly one-tenth of an inch long of a bright orange yellow colour, though sometimes paler, and with a darker tinge on the back. In addition to the colour of the body, the great characteristic of these insects is to be found in their remarkable antennæ. In the male they are double the length of the body, and very slender and delicate. They are composed of twenty-four round joints, separated from each other by a thin stem twice the length of the joint itself, around each joint is a single whorl of fine hairs; the whole antenna thus resembles a string of widely-parted minute beads. This sex of the insect is very rarely seen, remaining apparently near the spot where it issues from the pupa, and not frequenting the fresh crops of wheat. We were fortunate enough, however, to obtain a number of specimens from the lump of earth referred to above. The antennæ of the female, which at once distinguish it from the male, when regarded through a strong magnifying glass, consist of twelve instead of twenty-four joints; they are about the same length as the body, or only half the length of those of the male. Each joint is oblong, slightly narrowed in the middle, and surrounded by two whorls of hairs. The stems uniting them are only about one-fourth the length of the joints; the whole are thus very different from the corresponding organs of the other sex. We mentioned above that there are two conspicuous leading veins running lengthwise through the middle of the wing. These are all that would be apparent to a casual observer; but besides them there are two others, one close to the front margin or costa of the wing, the other near the middle, but so faint as only to be visible when regarded in a particular light. A cross veinlet, uniting the marginal vein to the conspicuous middle one (the post-costal) near the base, is only visible in dried specimens, and disappears if wet. (For a minute and detailed description of the appearance and structure of the insect, see Dr. Fitch's *6th N. Y. Report*, pages 23-24).

The wheat-midge, in all its stages, is very sensitive to dryness and moisture. In a dry atmosphere it becomes sluggish and inactive, while dampness renders it full of life and activity. It is on this account that the female fly performs its work of depositing its eggs upon the wheat-heads, only during warm damp evenings, and hides itself as soon as the returning rays of the sun dry the air. Upon damp cloudy days also the insect remains at its work as active as during the night; or if a tree be standing in the field, or a forest borders it upon one side, within the shade thus produced it continues its operations more or less during the day. And hence, as has often been noticed, those spots which are shaded by trees have been severely devastated, or even destroyed, when all the rest of the field was but little injured. Hence, also, wheat-fields upon low lands, in the valleys and upon the flats along rivers, are always more injured by the midge than those upon the more dry uplands and hills. This has been noticed everywhere; and where a field has low marshy spots within or adjoining it, the grain adjacent to such spots is very perceptibly injured, to a greater degree than it is elsewhere. As it is from the middle to the end of June that this fly is abroad, and actively engaged in depositing its eggs, if the weather at that time is extremely dry, the wheat crops of the year escape injury; whilst, on the other hand, if the last half of June is unusually wet, cloudy and showery, this grain will be severely devastated. From the close observation I have been giving this subject the past and present years, (1865) the one having a dry, the other a wet June, I do not doubt but that I am safe in stating the above as a general rule." (Fitch.)

The eggs figure 43, are deposited by the female midge in crevices of the wheat blossom, wherever a receptacle for them can be found; they are about the hundredth part of an inch in length and of a long oval shape; their colour is almost transparent with a slight tinge of golden yellowish red. In about a week there hatch out from them the tiny young larvæ—little footless maggots, quite transparent and colourless at first, but afterwards becoming deep yellow or orange, figure 44. In shape they resemble the eggs from which



FIG. 43.



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FIG. 44.

Figure 45 represents the larva highly magnified, with the first and last segments further enlarged.

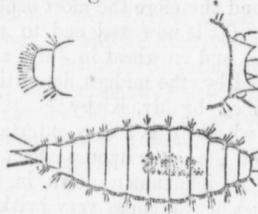


FIG. 45.

and indeed, in one passage speaks of the larva as being amphibious in its nature. Though so fond of moisture the larva can yet live without it for an immense time; it will remain dry stiff and motionless for weeks and even months, and then, when rain comes, it absorbs the moisture and becomes active once more. "The wheat is for the most part nearly ripe and the ears and straw nearly juiceless and dry about the same time that the chief portion of the larvæ it has nurtured have become mature and ready to descend to the earth. But until a rain occurs to wet the straw and thus enable them to crawl down it to the ground, they are obliged to remain in their retreats within the ear. Thus multitudes of them ere they have the opportunity to make the descent, dry and shrink and become cased larvæ. When a rain at length comes on, saturating the wheat ears with moisture, these larvæ become active, and breaking out from their cases, descend to the ground, leaving these whitish cases or cast skins within the florets from which they respectively came."—Fitch.

In the ground, or in the ear—for a considerable proportion of the larvæ do not abandon the ear—the insect remains in its larval state all winter. Late in the following spring it assumes the pupa state for a short time, and then emerges as we have already described about the middle of June as a two winged fly—the parent of further generations of this pigmy but most formidable destroyer.

Having now given some account of the natural history of the wheat-midge, as well as a description of its ravages, we may advantageously turn our consideration to any modes there may be of counteracting its devastations. The "remedies"—to use a generally current expression—are two-fold, natural and artificial; that is to say, means provided by nature for keeping the number of individuals of the species within due bounds, and modes adopted by man, either direct or indirect, for accomplishing the same object or at least modifying its facilities of attack.

The *natural remedies*—unless our present immunity from the destroyer is occasioned by some unrecognized parasitic benefactor, as is by no means unlikely—are unhappily of but little avail in this country, though immensely serviceable in Europe. In England the ravages of this pest are so comparatively unimportant that the insect attracts but little general attention, though it has been long known to entomologists and farmers. The largest amount of wheat it has been known to destroy there in a single season, so far as we have been able to ascertain, was five per cent. of the whole crop. In the United States, on the other hand, and in Canada also, it has been reckoned to have frequently rendered worthless *fifty* per cent.—ten times as much as in the old country; sometimes even as much as *eighty* or *ninety* per cent. in a particular county. Such being the case, we are led at once to enquire why there should be this great difference in the destructive powers of the insect on the opposite sides of the Atlantic. Can it be the same species or is there anything in this climate that peculiarly favours its increase? There is no doubt that it is the same species, and, knowing its love of moisture as related above, there is not much doubt that the humid climate of England would be more favourable

than the dryness of this to its ready development. What then occasions the difference? We reply: *In England this midge has at least three parasites to keep it in check; HERE IT HAS NONE!*

Mr Kirby, one of the most eminent of British Entomologists during the earlier part of this century, has described three minute parasitic insects "which seem to have been ordained by the Author of the universe to limit the depredations of the wheat midge, and they so effectually execute their mission, that it has often happened, a year or two after the midges were in excess, not a specimen could be found." The most abundant, and therefore the most beneficial of these parasites is one named *Ichneumon Tipulæ*, Kirby. (It is now assigned to the genus *Platygaster*.) This insect is found upon grasses in June, and on wheat in July and August, when it runs over the ears and searches out those affected by the midges, depositing a single egg in each of the larvæ. This operation is thus described by Mr. Kirby:* "To see our little ichneumon deposit its egg in the caterpillar of the wheat-fly is a very entertaining sight. In order to enjoy this pleasure I placed a number of the latter upon a sheet of white paper at no great distance from each other, and then set an ichneumon down in the midst of them. She began immediately to march about, vibrating her antennæ very briskly. A larva was soon discovered upon which she fixed herself, the vibratory motion of her antennæ increasing to an intense degree; then bending her body obliquely under her breast she applied her anus to the larva, and during the insertion of her *aculeus* (sting-like ovipositor) and the depositing of the egg, her antennæ became perfectly still and motionless. Whilst this operation was performing the larva appeared to feel a momentary sensation of pain, for it gave a violent wriggle. When all was finished the little ichneumon marched off to seek for a second, which was obliged to undergo the same operation; and so on to as many as it could find in which no egg had been before deposited, for it commits only a single egg to each larva. I have seen it frequently mount one which had been pricked before, but it soon discovered its mistake and left it. The size of it is so near that of the *Tipula* (the midge) that I imagine the larva of the latter could not support more than one of the former, and therefore instinct directs it to deposit only a single egg in each; besides, by this means one ichneumon will destroy an infinite number of larvæ.

Mr. Kirby's second parasite is named *Inostemma inscens*; its larvæ destroy the eggs of the wheat-midge. The third, *Macroglenes penetrans*, he found inserting its ovipositor into the flowers of the wheat, and considered that its object was to lay its eggs in the midge larvæ. The same three parasites are found in abundance at the present time in France as well as in England; unhappily, however, they have not yet been observed on this side of the Atlantic.

It may not unnaturally be a source of wonder and enquiry why it is, if the midge was imported into this country from England—as it undoubtedly was—that its parasites have not come with it. The Hessian fly (to which we shall presently draw attention) is another imported insect, but it is almost exterminated by its parasites which have accompanied it—why should there be this remarkable difference between two such closely allied species of insects? The reason is that (see our articles on this subject, *Canada Farmer*, 1868, pp. 134 and 350,) their natural history is very different. The larvæ of the Hessian fly lie dormant in the depression they make in the straw for a considerable time, and are then liable to be carried wherever the straw is taken; its parasites live inside the larvæ and therefore they are just as liable to be carried about also. But in the case of the wheat-midge, a large number of the larvæ lie dormant for months in the dry wheat-heads and may then be carried anywhere, so long as the wheat is unthreshed, or if it is not thoroughly cleaned. The parasites on the other hand,—at least those belonging to the principal species (*Platygaster tipulæ*)—only attack the larvæ when they are exposed, crawling on the outside of the wheat-ears or down the straw to the ground. A considerable proportion of the larvæ descend into the ground to undergo their transformations, while some remain permanently in the ear. The latter escape the ichneumon's attacks, and are thus imported uninfected by the parasite; the former get largely stung in their passage to the ground, whence there is little probability of their being accidentally removed. Kirby's second parasite attacks the eggs in the flower of the wheat and so escapes importation; while as for the third, it is very doubtful whether it preys upon the wheat-midge or is parasitic upon one of the other parasites.

*Curtis' Farm Insects, Page 279.

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We have often thought and have given expression to the opinion, that these ichneumonized larvæ might be imported into this country, in order to afford us a supply of defenders against the midge. The difficulties in the way are no doubt great, as the objects are so very minute and their capture at the proper time so uncertain; yet we feel sure that it could be accomplished if sufficient energy and skill were devoted to the task. So much were we impressed with the idea in 1868, that we corresponded on the subject with our esteemed friend, Mr. Frances Walker, F. L. S., of the British Museum (Entomological Department), London,—one of the principal English authorities on the order *Diptera*, to which the midge belongs. In reply, he remarked; "I doubt much whether the parasites of the wheat-midge can be introduced successfully into Canada. I can hardly attend to the matter this year, and I know only three Entomologists who are acquainted with the tribes of insects to which the parasites belong, and I have written to them on the matter. In many cases I think that insects are more kept in check by other means than by their parasites. *Platygaster tipulæ* is the chief parasite of the wheat-midge; the British species of *Platygaster* are very numerous; there are probably several species in Canada; and, perhaps, one of them may become a parasite of the wheat-midge. Besides the wheat-midge, there may be in Canada some species of *Cecidomyia* feeding on grapes, and each attacked by a species of *Platygaster*; the latter when it assumes the fly state, might be placed close to the wheat-midge, and perhaps in time it will take to it as its prey." In regard to the latter suggestion we remarked at the time that although we have many species of *Cecidomyia* in this country, and most of them have their parasites, yet we did not think it likely that the parasite of one midge would take to another, except where it was entirely shut out from its own proper species, and that where both are exposed to its attacks, it would prefer the species natural to it rather than the other. The following year the ravages of the midge became so immensely diminished that we did not think it worth while to pursue the subject further. We are still, however, of opinion that, should our country be again visited by the pest, something might be done by the importation of parasites to lessen its devastations, and that at any rate the experiment is worth trying.

The only other natural remedy for this pernicious insect that we are aware of, is the beautiful yellow-bird, or goldfinch (*Chrysomitris tristis*, Linn.), that is so common throughout this Province. We have long regarded this sprightly creature as a special friend of the farmer, from its habit of devouring the seeds of thistles and other annoying weeds; but we learn from Dr. Fitch (*Sixth Report*, p. 79,) that it deserves additional commendation from its being also a destroyer of the wheat-midge. His account of its proceedings is well worth quoting:—"This bird causes that rough and ragged appearance of the wheat-heads which is the most conspicuous indication we have that the grain is infested by this insect. The bird alighting, grasps the wheat-stalk just below the ear, clinging fearlessly to it even when it is swayed to and fro by the wind, and with its bill it parts the chaff from the kernel, picking off and devouring the larvæ to which it thus gains access. When the larvæ are yet small, before the end of June, it begins to feed upon them, and if the wheat is badly infested, in a short time afterwards a large flock of these birds, both male and female, become collected upon it, and return to it day after day. The bird never attempts to obtain all the larvæ from the wheat-heads; it only opens those florets in which the larvæ are the most numerous, namely, the outer florets of the headlets, seldom, if ever, disturbing the inner florets. It parts the bearded chaff from the kernel of these outer florets, and devours the larvæ which are thus exposed, leaving the kernel in its place, sometimes with one or two larvæ remaining hid between the kernel and the inner chaff. Its operations seem to be of a most purely benevolent character, doing for man the best service in its power. Its aim appears to be to thin out and diminish these larvæ from the wheat-heads to such an extent, that part of the kernels—those which it leaves wholly untouched—will be able to fill and become good wheat. To obtain all the larvæ, it would be obliged to part the chaff from all the kernels, whereby no wheat whatever would be produced. Thus we are indebted to this bird that the grain which we do gather is not dwarfed and shrunken to a much greater degree than it is. And were the natural parasites of the midge introduced into this country, it is very evident that the additional aid which this bird would give to their work would subdue this insect here much more effectually and completely than it is subdued in Europe."

Artificial Remedies.—Though we are so deficient in natural remedies for the devastation of the wheat-midge, there is no doubt that much can be and has been done by the farmers

themselves. These methods of reducing the insect's ravages are now so familiar to all our intelligent agriculturists, and are so simple in themselves, that we may be excused for dwelling but briefly upon them. (1.) Be careful to burn all the "screenings" of the wheat after it has passed through the fanning-mill; these, when the midge is prevalent, often contain thousands of the yellow larvæ, which will live through the winter, and produce flies for another crop, if not thus destroyed. (2.) Plough deeply in the fall any field that has been attacked by the midge during the previous summer, and take care to occupy it with some totally different crop during the following year. (3.) When the midge is in the neighbourhood sow only the improved "midge-proof" varieties of wheat. (4.) If spring wheat, sow as late as is consistent with safety, in order that the plant may not come into blossom until after the midge's period of active operations is over. (5.) If fall wheat, sow early, in order to anticipate the appearance of the midge. (6.) Avoid sowing wheat upon low, damp ground, as it especially favours the midge. (7.) Thoroughly prepare and cultivate your ground, in order that you may obtain as strong and healthy a growth as possible. After all this has been done, we may add (8), put your trust in Providence. As we may at any time be afflicted with another visitation of this scourge, though probably not for some few years now, remember—when it does threaten—that there is much truth in the old adage, "An ounce of prevention is worth a pound of cure!"

2. THE HESSIAN FLY (*Cecidomyia destructor*, Say).

DIPTERA—TIPULIDÆ.

As we have already remarked, when treating of the wheat-midge, 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 parts 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 acknowledgment of the source from which the 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 most eminent of the early American Entomologists—under the name of the Destructive Midge (*Cecidomyia destructor*). "This

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insect—Dr. Fitch relates—as a general rule, passes through two generations annually. The first of these occupies 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 development, 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. Herriek:—“The little wrinkled maggot or larva creeps out of its delicate membranous 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 imbedded in a stalk, serve to weaken the plant and cause 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. 46.)

FIG. 46.



"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 grayish 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 *Platygyaster*. 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 flies from obtaining any young wheat upon which to lay their

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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.

3. THE CHINCH BUG (*Micropus leucopterus*, Say).

HEMIPTERA-HETEROPTERA—LYGÆIDÆ.

The two species of insects that we have already described—the Wheat-midge and the Hessian fly—are undoubtedly the worst foes that the Canadian wheat growers have to contend against; but in the Western and Southern States the farmer has another pest that inflicts, if possible, even more injury upon his grain crops, of all descriptions, than these do in this country. The name of "Chinch Bug" has, in the west especially, as appalling a sound in the ears of the agriculturist as that of the "midge" has ever had amongst us. Happily, the creature is but little known in this Province, and, from its habits, is not likely ever to be so destructive here as in its own more congenial regions beyond the lakes; still it may obtain a foothold amongst us, and prove a source of evil, as it has already been observed in Ontario. It appears desirable then, that we should give some information respecting its nature and habits when describing the special enemies of the wheat plant.

As far as we have been able to ascertain, the Chinch Bug was first observed in the Province of Ontario in the autumn of 1866, by Mr. Johnson Pettit, of Grimsby—a most zealous and efficient Entomologist, whom we have often had to thank for valued and interesting specimens of rare insects; to whom, indeed, we owe many of the most highly prized specimens in our cabinet. In October of that year, Mr. Pettit sent us a number of specimens of the Chinch Bug that he had found hidden away for the winter under the bark of old logs, and thus afforded us an opportunity of giving the creature a minute inspection. Since that time we have not heard of its occurrence in any other part of the Province. That so little is known of it in this country ought to be, to us, a subject of sincere congratulation, especially when we read of its ravages elsewhere. Dr. Fitch has spoken of it as "unquestionably one of the most pernicious insects which we have in the United States; the locusts of Utah and California are the only creatures of this class which exist within the bounds of our national domain whose multiplication causes more sweeping destruction than does that of this diminutive and seemingly insignificant insect."

In the United States, it was first noticed as long ago as the year 1783, at the close of the War of Independence, when it committed some ravages upon the wheat of North Carolina. It was then supposed to be identical with the Hessian fly, and for fifty years afterwards—possibly even to this day—it was supposed by the rural inhabitants of that State to have been left by the British soldiers as they passed through the country. For some years they continued excessively numerous in North Carolina, and destroyed the grain to such an extent that the sowing of wheat had to be abandoned for a considerable time. In 1831 the insect was scientifically described for the first time by Mr. Say, the great entomologist of the period, who captured a single specimen in Virginia. In 1839, and for some successive years, it was again numerous and destructive in the Carolinas and Virginia. About the same period, also, it was observed in the Valley of the Mississippi, and as far north as the State of Illinois, where it was known as the "Mormon Louse," from the absurd supposition that it was introduced by these fanatics when they commenced their establishment at Nauvoo, in 1840. Since that time they have been a permanent plague to the farmer in the west, appearing every few years in perfectly incredible numbers, and sweeping everything before them almost as completely as a swarm of locusts. The following vigorous and unvarnished account of their proceedings, by an Illinois farmer (it is only one out of many that we might quote), will convey to the reader some idea of the havoc they create:—

"There never was a better 'show' for wheat and barley than we had here the 10th of June, and no more paltry crop has been harvested since we were a town. Many farmers did not get their seed. In passing by a field of barley where the chinch bugs had been at work for a week, I found them moving in solid column across the road to a corn field on the opposite side, in such numbers that I felt almost afraid to ride my horse among them. The road and fences were alive with them. Some teams were at work mending the road at this spot, and the bugs covered men, horses and scrapers till they were forced to quit work for the da

The bugs took ten acres of that corn clean to the ground, before its hardening stalks—being too much for their tools—checked their progress. Another lot of them came from a wheat-field adjoining my farm into a piece of corn, stopping now and then for a bite, but not long. Then they crossed a meadow 30 rods into a 16-acre lot of sorgho, and swept it like a fire, though the cane was then scarce in tassel. From wheat to sorgho was at least sixty rods. Their march was governed by no discoverable law, except that they were infernally hungry, and went where there was most to eat. *Helping a neighbour harvest* one of the few fortunate fields, early sown—and so lucky!—we found them moving across his premises in such numbers that they bid fair to drive out the family. House, crib, stable, well-curb, trees, garden-fences—one *creeping* mass of stinking life. In the house as well as outside, like the lice of Egypt, they were everywhere; but in a single day they were gone.”*

The Chinch-Bug—for it is now time for us to give some description of the creature's appearance—is, in its perfect state, a tiny black insect about three-twentieths of an inch in length, with the wings and wing-cases white, the latter having a conspicuous black spot near the termination of each. The accompanying illustration (Fig. 47), represents on the left

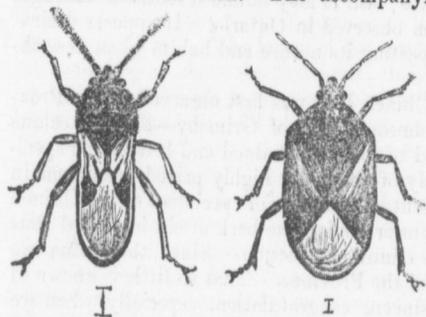


FIG. 47.

hand side a highly magnified specimen of the Chinch Bug; and on the right an ordinary bug. The lines at the bottom show the natural size. Like all true bugs (*Hemiptera*), it is provided with a sucker or beak through which it imbibes the juices of the plants on which it feeds. In the autumn it goes into winter quarters, sheltering itself from the severity of the weather under the bark of trees and logs, and in other protected situations. In the spring, when the grain has commenced to grow, it issues forth from its hiding place, and proceeding to the fields lays its eggs on the roots of the tender grain, wherever it can gain access to them. These eggs soon hatch and produce another brood, which, in their larval state, are at first red, and then as they increase in size become gradually darker, changing from brown to dull black, and in all cases with a white band across the middle of the body. After a time they attain their full size, acquire wings, and proceed to provide for the continuance of the species. In the Western States the bug appears to have at least two broods in the year, and in the South even more. This fact, as Mr. Riley remarks, coupled with its habit—like other true bugs—of taking food from the day of its birth to the day of its death without the intermission of a quiescent pupal state, renders it so destructive and so difficult to combat. It exhales, we should mention also, a very loathsome smell, like another sometimes too familiar species of the same order of insects.

In the figure above, representing the ordinary American Chinch Bug, it will be observed that the white wings reach to the extremity of the body, and are thus long enough to enable the insect to take flight. The Canadian specimens, found by Mr. Pettit at Grimsby, differ remarkably from this in having the wings only half as long as the abdomen, instead of the same length. (Fig. 48). This shortness of wing is no doubt, a very effectual check upon the spread of the insect, preventing it from flying in swarms from one locality to another as it often does in the Western States.



FIG. 48.

Natural Remedies.—There are two great causes which serve to keep in check these noxious creatures; first, the prevalence of numerous heavy showers of rain, and second, the onslaught made upon them by various carnivorous insects. To quote the words of Mr. Riley, who has published a long and exhaustive account of this insect in his *Second Missouri Report* (pp. 15-37).

“As the Chinch Bug, unlike most other true bugs, deposits its eggs underground, and as the young larvæ live there for a considerable time, it must be manifest that heavy soaking rains will have a tendency to drown them out. The simple fact, long ago observed and recorded by practical men, that this insect scrupulously avoids wet land, proves that moisture is naturally injurious to its constitution. Hence it was many years ago remarked by intelligent farmers, and we have ourselves

* Proceedings of N. Y. Farmers' Club, June, 1865.

repeatedly will begin to shower their operations many hours animation is again.” By the air out of the insect, such its health in fore, for far and that in

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repeatedly observed the same thing, that very often when the spring opens dry Chinch Bugs will begin to increase and multiply in an alarming manner, but that the very first heavy shower checks them immediately, and repeated heavy rains put an almost entire stop to their operations. It is very true that nearly all insects will bear immersion under water for many hours, and frequently for a whole day, without suffering death therefrom; for although animation is apparently suspended in such cases, they yet as the phrase is "come to life again." But no insect, except the few that are provided with gills like fishes and extract the air out of the water, instead of breathing it at first hand, can stand a prolonged immersion in water without drowning. And it must be obvious to the meanest capacity, that an insect, such as the Chinch Bug, whose natural home is in the driest soil it can find, will have its health injuriously affected by a prolonged residence in a wet soil. It will be well, therefore, for farmers to bear in mind that, in a hot dry season Chinch Bugs are always the worst and that in a wet season it is impossible for them to do any considerable amount of damage."

The Carnivorous Insects that prey upon this bug are stated by Mr. Riley to be four kinds of Ladybird, especially the spotted species (*Hippodamia maculata*, De Geer), represented in Fig 49; which also preys upon the eggs of the Colorado Potato Beetle and a number of



FIG. 49.
Hipp. maculata.
Colours: Pink and black.

other destructive insects; and the Plain Ladybird (*Coccinella munda*, Say), represented in Fig. 50,—both of these species are found in Canada. A species of Lace-winged fly (*Chrysopa Illinoisensis*, Shimer), and various other parasitic insects also share in the useful work of keeping this pest in check.

Artificial Remedies.—Many modes of combatting the Chinch Bug have been suggested from time to time in various agricultural publications. Those that appear to be most highly approved of are thus summed up by Mr. Riley: (1) "Chinch Bugs hibernate in the perfect or winged state in any old dry rubbish, under dead leaves, in old straw, in corn shucks and corn stalks, among weeds in fence corners, etc. Therefore all such substances should be burned up, as far as possible, in the spring. (2.) The earlier small grain can be sown in the spring, the more likely it is to escape the Chinch Bug; for it will then get ripe before the spring brood of bugs has had time to become fully developed at the expense of the grain. (3) The harder the ground is when grain is sown, the less chance there is for the Chinch Bug to penetrate to the roots of the grain and lay its eggs thereon. Hence the importance of fall ploughing and using the roller upon land that is loose and friable."

Should this insect, which is so terribly destructive in the United States, become at any time sufficiently numerous to cause alarm in this country, we shall feel much obliged to any observer who will afford us information upon the subject. It is not probable that it will become with us a permanent plague as it is in the West, but yet we may at any time receive a visitation from it and suffer great, even though only temporary, loss. Happily our Canadian variety, as we have noticed above, possesses wings too short to enable it to fly from place to place, we need therefore feel little fear that it will ever do more than affect some limited locality; what we should dread, however, would be an invasion from the long-winged American Bug.

4—THE GRAIN APHIS (*Aphis Avena*, Fabr.)

HEMIPTERA HOMOPTERA—APHIDÆ.

We come now to another insect pest that has been introduced into America from Europe, where it has been known for years as injurious to wheat, oats and other grain. Very little notice was taken of it, however, on this side of the Atlantic till the year 1861, when it attracted general attention from its appearance on grain crops of all kinds, both throughout Canada and the neighbouring States. Much alarm was excited by it, and the periodical press teemed with notices of its ravages and numbers, and with suggested remedies for its destruction. The next year it appeared again, but in much diminished numbers, and without creating the same alarm or excitement; since then, though observed here and there every year, it has remained in unnoticed obscurity, so far as the public in general are concerned. This change is not much to be wondered at, as it is the nature of this insect, like others species of plant lice, to appear suddenly in countless myriads in places where its existence even was

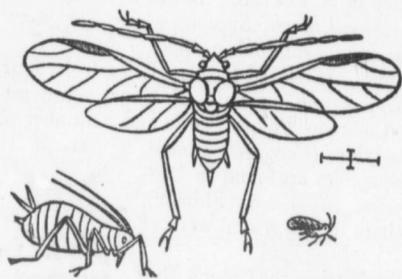


FIG. 50.
Cocc. munda.
Colours: Light brick red, white and black.

quite unsuspected; it is not at all unlikely, then, that we may some day have another visitation similar to that of 1861.

In our report of last year on "Insects affecting the Apple," (*First Annual Report*, page 77), we gave a description of the Aphis or plant louse that is often so injurious to the orchard, and made some remarks upon the general natural history of this singular family of insects. We need not, then, enter upon any further description of their extraordinary fecundity or other peculiarities. The Grain Aphis (*A. avenae* Fab.) differs from that of the Apple (*A. mali*, Fab.), Fig. 51, in little more than colour and food-plant; its structure and general appearance is much the same. When feeding upon the stem or leaves of the plant, the Grain Aphis is green; but when it shifts its quarters to the ear, and feeds upon the grain, very few green specimens are found, the great majority being yellow, reddish-yellow, or brownish-red.

FIG. 51.



The accompanying illustration (Fig. 51) representing a highly magnified winged male and a wingless female, displays the structure and shape of the insects. Fig. 52 represents a female on a still larger scale. They live at first upon the leaves, scattered about singly or in groups; afterwards, densely gathered together upon the stems of the flowers and heads of grain. Their food consists of the sap of the plant, which they draw out by means of a sucker or beak, on the underside of the head. They thus take away from the grain the elaborated sap which was intended to build it up, and so cause it to become more or less shrunken and deficient in size and weight.

When they occur in excessive numbers, they, of course, diminish the yield of grain very materially; but it is not often that they are so abundant as to cause appreciable loss.

FIG. 52.



As in the case of the Apple Aphis, the remedies for these creatures are chiefly those provided by nature. Artificial remedies, such as dusting with lime or sulphur, would be obviously impracticable in the case of a large field of grain; and in time and labour would hardly be counterbalanced by the reduced inroads of these minute depredators. The natural remedies consist of various carnivorous or parasitic insects,

FIG. 53.



FIG. 54.



that prey upon plant-lice of all kinds. The most common and useful are the different species of lady-birds (Fig. 53); the Lace-winged Flies (*Chrysopa*), both in their perfect state (Fig. 54), and in their larval condition

FIG. 55.



FIG. 56.



FIG. 57.



(Fig. 55); the Syrphus Flies in their larval state (Fig. 56); Fig. 57 represents a winged Syrphus Fly; Dragon-Flies, &c.; all of which should be heartily encouraged by the husbandman.

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5. THE JOINT-WORM (*Isosoma hordei*, Harris.)

HYMENOPTERA—CHALCIDIDÆ.

The wheat crops in the United States, and probably in Canada also, are frequently attacked by a minute insect in the stem, close to the first or second joint from the root. The effects of the attack are so like those produced by the Hessian Fly, that it is very often confounded with the latter insect, and not suspected to be a different enemy, belonging to a widely different order of insects. As it is so likely to be overlooked, we say that it has probably wrought mischief among the wheat fields in this country as well as in the neighbouring States; that it certainly has affected barley in this Province, we can testify from our own observation.

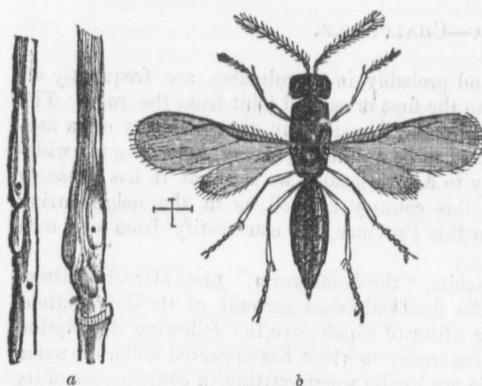
This insect, popularly termed, from its habits, "the Joint-worm," first attracted attention in Virginia about the year 1848, while the first published account of its depredations appeared in the *Southern Planter* in 1851, the editor of which gave the following description of its ravages*:—"A new and most destructive enemy to wheat has appeared under the name of the Joint-worm. Many crops in Albemarle are hardly worth cutting in consequence of its attacks, and all that we have seen or heard of, except one, are badly hurt by it. In the area it has traversed, and the completeness of its devastation within it, it has no rival amongst insects in this country. The dreaded Hessian Fly is nothing to it, and no atmospheric calamity can pretend to a comparison. It sweeps whole districts, and everywhere, we hear, has done great damage, and, it is feared, will do much more before it is checked or destroyed." Prof. Cabell, of the University of Virginia, afforded similar testimony, stating that "in 1851 some farmers did not reap as much as they sowed," and that the loss occasioned by this insect often amounted to one-third of the average crop. In 1860—to quote an account in the *American Entomologist* for April, 1869—"the rye crop was considerably injured by this pest in Lycoming Co., Pennsylvania, and according to Mr. Norton, the species is very common upon rye in Connecticut, and probably the other New England States. As long ago as 1829 it had been noticed in various parts of the New England States to attack the barley, causing it in some places 'to yield only a very small crop, and on some farms not much more than the seed sown,' although since that date it does not appear to have been materially troublesome in that region. But in Central New York, formerly the great barley-growing district of America, it has been ruinously destructive to the barley since about 1850. In the words of Mr. George Geddes, the late President of the N. Y. State Agricultural Society, 'Formerly we expected forty bushels of barley to the acre; now we cannot rely on more than twenty.' And he goes on to state that this falling off is principally due to the depredations of the Joint-worm, and that, unless some relief from it is found, the farmers of Central New York will have to discontinue raising this crop." In the years 1866 and 1867 it was found by our friend, Mr. Pettit, to be abundant upon barley in the neighbourhood of Grimsby, in this Province. (See *Canada Farmer*, 1867, pp. 238, 267.)

From the foregoing notices it will be seen that this insect attacks not only wheat, but also rye and barley, and that where it occurs it inflicts very great damage upon the crop. Some have supposed that these different crops are attacked by different, though very similar species; but it has been satisfactorily shewn by Mr. Walsh that all these Joint-worms, even though they present occasional variations in colour, are to be referred to the species described by Dr. Harris under the name of *Eurytoma* [*Isosoma*] *hordei*. With regard to the genus of the insect (the first of the two scientific names), there has been much discussion also; but in a report of this character it is unnecessary to trouble the reader with it. We shall merely state that we hold the opinion that the insect belongs to *Isosoma* (to which also pertains the grape-seed insect [*I. vitis*, Saunders], described by our coadjutor, Mr. Saunders, in last year's Report, p. 109), and not to *Eurytoma*, a genus of parasitic flies.

The Joint-worm is a tiny footless grub or maggot, about one-eighth of an inch in length, of a pale yellow colour and with dark brownish jaws. It occupies a little swelling or cell

*Quoted by Dr. Fitch, 7th N. Y. Report, p. 145.

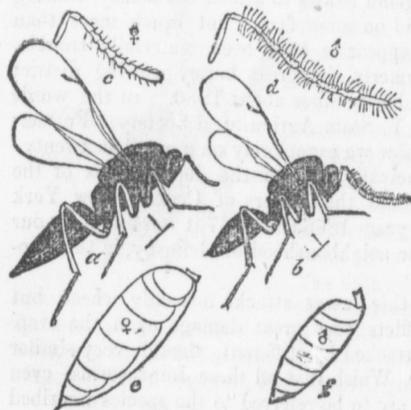
FIG. 58.



the Joint-worm produces its destructive effects upon the small grain may be readily explained. Not only is the sap of the plant extracted on its road to the ear, in order to form the abnormal woody enlargement or gall, in which the larvæ are imbedded, each in his own private and peculiar cell, but a very large supply of sap must be wasted in feeding the larvæ themselves. Hence the ear that would otherwise be fully developed becomes more or less blasted and shrivelled; although we are told that, in the case of barley more particularly, the plant tillers out laterally, so as partially to supply the loss of the main crop of ears."—*American Entomologist*, i. 150.

In Canada the Joint-worm fly (fig. 58. *b*, represents a female, regarded from above, and fig. 59, *a*, one of the same sex viewed laterally; *b*, in the latter illustration, is the male insect,)

FIG. 59.



other, apparently to make sure that it has not already been oviposited in. Head downward, they then begin by bending the abdomen downward, and placing the tip of the ovipositor on the straw at right angles with the body, when the abdomen resumes its natural position, and the ovipositor is gradually worked into the plant to its full extent. With the aid of a good lens, and by pulling up the plants on which they were at work (which did not appear to disconcert them in the least), I could view the whole operation, which, in some cases, was accomplished in a few minutes, and in others was the work of an hour or two. When a puncture was completed, they usually backed up a little and viewed it for a few seconds, and then apparently satisfied, moved to one side and commenced another."

In a few days the eggs hatch out, and the worm (fig. 60) commences to feed, snugly enclosed in its cell; when the grain becomes ripe, and the straw consequently hard and dry, the worm is generally full grown, but in this state it for the most part continues unchanged till the following spring,

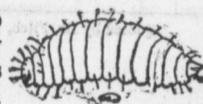


FIG. 60.

inside the substance of the straw, and placed generally a little above the first or second joint from the root. These swellings, or "galls," are clearly shown in the accompanying illustration (fig. 58, *a*); the black dots indicate the holes through which the insect has finally escaped in its winged state (*b*). "At first sight, these knotty swellings of the stem are apt to elude observation, because, being almost always situated just above the joint or knot on that stem—whence comes the popular name "Joint-worms"—they are enwrapped and hidden by the sheath of the blade; but on stripping off the sheath, as is supposed to have been done in the engraving, they become at once conspicuous objects. The mode in which

makes its appearance about the beginning or the middle of June, and after pairing, proceeds—in the case of the female—to deposit its eggs on the young growing plants. In more southern latitudes the flies, as usual appear considerably earlier. Mr. Pettit, of Grimsby, to whom we were indebted at the time for a number of specimens of affected barley containing the insect, gave the following interesting account of the process of ovipositing in the *Canada Farmer* (Sept. 1867, p. 268):—"About the 8th of June of the present year the perfect insects began to make their way out of the galls. Being desirous of knowing more of their habits, I watched the growing barley, and on the 10th of June found them actively at work ovipositing in the then healthy stalks of the plant. Before commencing operations they walk leisurely up one side of the plant as far as the last leaf, and then down the

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when it assumes the pupa state, and finally emerges as a four-winged fly in the month of June. This fly is about one-tenth of an inch in length; its wings are clear and transparent, its body black, and its legs dull pale yellow, sometimes darker, and even black. In fig. 59, *a* represents the female, *b* the male, *c* the antenna of the female, *d* that of the male, *e* the abdomen of the female, enlarged to show the rings or segments of the body, and *f* that of the male.

The best, in fact the only remedy that we can recommend for these insects when they prove abundant and destructive, is to burn all the stubble in the affected field and also all the refuse straw after the grain is threshed. By this means the larvæ enclosed in their cells will be consumed, and in them the parents of the next year's brood will be effectually got rid of. To ensure complete immunity from a second attack, it will be necessary that all the farmers in a neighbourhood should adopt the same method, else the insects hatched on one farm will easily fly over to another.

6. THE ANGOUMOIS MOTH (*Butalis cerealella*, Olivier.)

LEPIDOPTERA—TINEIDÆ.

The five great enemies of the wheat-plant that we have thus far described are all known to inhabit this country, though two of them—the Chinch Bug and the Joint-worm—not in any great numbers; and they have all, to a greater or less extent, come under our own observation. Besides these five species, there are several other insects that inflict depredations upon wheat, and often cause great loss to the owner; but happily they are most of them entirely unknown to us in this country, and of some of them we have never even seen a specimen, living or dead. Among these may be mentioned the insect whose name we have prefixed to this section.

The Angoumois Moth, according to Dr. Fitch, is one of the most destructive insects to wheat, barley, oats and Indian corn, in France, and was long ago introduced into the Southern States, where it has become fully naturalized. From thence it is frequently brought into New York in cargoes of grain, but the climate appears to be too cold for it to thrive and establish itself. We need not, then, feel much alarm respecting it in Canada.

The larva is a smooth, white worm, which attacks grain when stored in the bins of granaries or storehouses. Each individual worm attacks a single kernel of the grain, and consumes all the flour inside without injuring the external shell. It passes the pupa state also in the grain, and comes out in May, or in November as a tawny, dull yellowish-grey moth, having its fore-wings commonly sprinkled with a few black dots, and expanding half an inch.*

The most effective remedy for the insect is to subject the infested grain to the heat of an oven, or of a very warm, dry room. To accomplish this, in France machines called "insect mills" have been invented. They consist of a large hollow iron cylinder, much resembling an ordinary coffee-roaster, into which the infested grain is put, and then the instrument is placed over a fire and revolved, heating the grain up to a certain point. In this way all the insects in the grain are killed in a short time, and with little expense. This might be found a useful mode of dealing with the Pea-weevil (*Bruchus pisi*), which is often very destructive in this country.

7. THE ARMY-WORM (*Leucania unipuncta*, Haworth).

LEPIDOPTERA—NOCTUIDÆ.

This is another redoubtable foe that the wheat grower has to combat in many parts of the United States. The insect is very familiar to us here; we have frequently taken dozens of the moths by the process of "sugaring," on a warm summer's evening; but though abundant, we have never heard of its larvæ appearing in Canada as they do in the United States, in countless myriads, marching on in regular column, and devouring everything in the shape of grain or grass that comes in their way.

The following description of the insect we quote from the *American Entomologist*, (vol. 1, p. 215):—"The eggs hatch during the early part of May, in the latitude of South Illinois and Missouri, and the young worms may feed by millions in a meadow without attracting attention; but when they have become nearly full grown and have stripped bare the fields in

*Vide Dr. Fitch's 7th N. Y. Report, pp. 127-133, from which our account is chiefly compiled.

which they were born, they are forced from necessity to travel in search of fresh fields, and it is at such times that they first attract general attention. A curious instinct leads them to travel in vast armies, and as they are now exceedingly voracious, devouring more during the last three or four days of their worm-life than they had done during the whole of their previous existence, they are very apt to strip the leaves from the blade of grass or grain on their way. On the other hand, they are attacked by at least five different parasites, and when we understand how persistent these last are in their attacks, and how thoroughly they accomplish their murderous work, we cease to wonder at the almost total annihilation of the Army-worm the year following its appearance in such hosts. Furthermore there may be influences at work, other than parasitic, which cause an increase or decrease in the numbers of this pest. It is a significant fact that almost all great Army-worm years have been unusually wet, with the preceding year unusually dry, as Dr. Fitch has proved by record. The present year, wherever they have so far appeared, forms no exception, for the summer of 1868 was unusually dry and hot, while the present year has been decidedly wet.

"The Army-worm, like all other insects, hatches from an egg, and this egg is evidently deposited by the parent moth at the base of perennial grass stalks. The worm varies but little from the time it hatches to the time when it is full grown. Some specimens are a shade darker than others, but on many thousands of specimens examined, we have found the markings very uniform, as represented in the next cut (fig. 61). When full fed, which is generally about four weeks after hatching, it descends into the ground, where it forms an oval chamber and changes to a shiny mahogany-coloured chrysalis (fig. 62). Sometimes it scarcely penetrates beneath the surface, but forms a rude cocoon under what dry herbage there happens to be on the ground. Thus the worms vanish from sight very suddenly, and this sudden disappearance is as mysterious to those who have no knowledge of natural history, as was their abrupt advent. We doubt very much if a single one of the hosts which so recently animated the meadows, can be found in any of the localities above mentioned, by the time this reaches the eyes of our readers.

"After remaining in the chrysalis state about two weeks, the perfect moth appears (fig. 63). The general colour of the moth is light reddish brown or fawn colour, and it is principally characterized by, and receives its name from, a white spot near the centre of its forewings, there being also a dusky oblique line running inwardly from their tips."



FIG. 61.



FIG. 62.



FIG. 63.

S.—THE WHEAT WIRE-WORM (*Agriotes Mancus*, Say)

COLEOPTERA—ELATERIDAE.

Curtis, no mean authority, makes the assertion that "of all the insect enemies with which the farmer has to contend there are none which are more fatal in their effects, and more difficult to overcome, than the wire-worms." Certainly, when we consider the omnivorous character of the members of this family, the number of species belonging to it, and their general diffusion, we may feel inclined to agree with him. They attack every kind of production of the field and garden—fruits, flowers, grain, roots, grass, vegetables; nothing appears to come amiss to them. Over a hundred different species of the family (*Elateridae*) are known to exist in Canada; a large number of them, however, are not especially destructive, but feed upon decaying vegetable matter, and may hence be deemed rather beneficial than otherwise. Still, enough remain to give us trouble and despoil us of a portion of the crops that we are endeavouring to raise.

Everyone, probably, is familiar with the appearance of the common species of wire-worms, that are so frequently turned up by the spade or plough in farm or garden. They are usually of a pale yellowish colour, with a darker head; the body is round, smooth, and hard, so as to be well adapted for penetrating the earth. After a long period of existence in the larval or worm state they turn into beetles that are familiarly known as "spring backs," "snapping,"

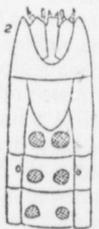
or "click-beetles" when laid upon their backs.

The wire-worm is known to feed upon its larval state (see *iv.*, p. 2) by its voracity.

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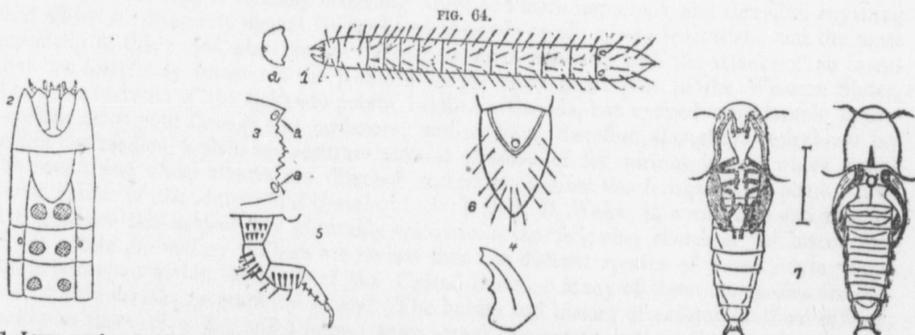
or "click-beetles," from their possession of the singular power of springing up into the air, when laid upon their backs, and thus recovering their proper position.

The wheat wire-worm, with which we are now more especially concerned, has long been known to farmers from the havoc it has frequently wrought in their fields of grain; it is only recently, however, that its natural history has been traced out. For the following account of its larval and pupal stages we are indebted to an article in the *Canadian Entomologist* (vol. iv., p. 2) by Mr. Pettit, a very careful and accurate observer. He relates as follows:—

"In the fall of the year 1870, so unusual an amount of damage was inflicted upon the wheat crops in this vicinity by this wire-worm that I was led to try and breed it to the perfect state, with a view to ascertaining what species it was the larva of. By digging about the roots of the wheat plants, I obtained about a dozen specimens, which were placed with a few wheat plants in a large flower pot, where they were kept supplied with food by planting occasionally a small quantity of wheat. With the first cold weather they ceased to eat, and were then placed in a sheltered situation until the return of warm weather in the spring, when they were restored to the breeding cage. They soon gave evidence of being alive, and possessing unimpaired appetites; their rapid consumption of the wheat plants rendered it necessary to renew the supply quite as often as before. They were fed in this way until the month of July, when my absence from home caused them to be neglected; on my return there was not a vestige of food left. Thinking that the worms had probably died of starvation, I paid no further attention to them until the 26th of August, when on removing a part of the earth from the pot, a pupa was disclosed, and on the 3rd of September the first imago appeared, which proved to be a specimen of *Agriotes Mancus* Say. As only two more specimens came out during the remainder of September, I turned the earth out of the pot and carefully examined it; the inspection revealed seven specimens of the imago in the little cells in which they had transformed, and one larva.

"Among the larvæ collected, I had noticed one less than half the size of the others, and evidently much younger, which would account for the one still in the larval state. It had attained, however, a size fully equal to that of the others when first brought in during the previous autumn; and hence I have formed the opinion that the larval state does not last longer than three years. This opinion has since been strengthened by the observation of a large number of larvæ, which appeared readily separable into *two sizes*, corresponding to those originally collected for breeding. Westwood, in his "Modern Classification of Insects," (vol. 1. 238), states respecting the larva of an allied species (*A. obscurus*) which, in Europe, feeds upon the roots of wheat, rye, oats, barley and grass, that according to Bjerkander, a Swedish Naturalist, "it is five years in arriving at the perfect state." Curtis, in his "Farm Insects," (page 161) makes a similar statement upon the same authority, and adds that those which he had himself feeding for ten or twelve months scarcely increased in size during the time. As already stated, however, I am of opinion that our species is by no means so long lived, but that it attains maturity in three years—a period quite long enough, the agriculturist must think, in which to inflict damage upon the crops."

The following illustration (Fig. 64), drawn by Dr. Horn, of Philadelphia, represents the wire-worm in its larval and pupal states:—



1. Larva much magnified, (natural size |—————|) 1 a. Transverse section. 2. Underside of head and first three or thoracic segments, showing the parts of mouth and the position of first spiracle. 3. Margin of front; a. Position of antennæ. 4. Mandible. 5. Leg. 6. Terminal segment beneath. 7. Pupa, upper and under view. The line between re-

Should any of our readers desire a full technical description of this insect, they will find a carefully prepared account of the larval and pupal states appended to Mr. Pettit's article in the *Canadian Entomologist* above referred to, and a description of the imago in Say's *Entomology*, (vol. ii., page 111.)

Wire-worms are usually found to be most destructive in freshly-broken up pasture lands, and during dry seasons. As we have elsewhere remarked, (*Canada Farmer*, 1871, p. 220), all sorts of remedies for them have been suggested and tried, but few are satisfactory. When a field is observed to be badly affected by them, it ought to be ploughed up and kept in fallow for a season, taking care to keep ploughing it as often as possible, and to burn up all rubbish, stubble, &c.; this will destroy the eggs and starve out the worms. Lime and soot, to be applied to the soil before sowing any grain, are highly recommended by some, but are of doubtful efficacy. Salt on sandy soils is considered to be efficacious, but not on heavier clay lands. In a garden or small field they may be got rid of by strewing about slices of potato, turnip, or apple, and examining the under side every morning when numbers will usually be found feeding upon the bait. Moles are very useful in destroying them in meadows, and a large number of our small birds devour them with avidity; ducks, turkeys and fowls will pick them up in ploughed fields, and toads are not averse to making a meal upon them. Our advice then is, break up and fallow the infested fields, ploughing often, and burning up the rubbish, and encourage in every way the farmer's best friends, the small birds. Make it an absolute law of the household that not one of them is to be shot or stoned, get your neighbours to do the same, and believe us, not many years will pass before you will find your insect plagues enormously diminished.

Another American, though not Canadian, enemy of the wheat plant that might be mentioned, is the Wheat-maggot (*Meromyza Americana*, Fitch), the larva of a two-winged fly; it has been observed by Mr. Riley in Missouri to inflict considerable damage upon the growing wheat crop. As, however, it is not likely to trouble us in this Province, we may dismiss it from our consideration without further description.

In concluding this portion of our report we would respectfully request those among our readers whose grain crops may be affected by these or other pests to afford us some particulars respecting the attack; information regarding the time of appearance of these insects, their duration, mode of operation, and the estimated loss they occasion, would all be of great practical interest not only to us but to the agricultural community at large.

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INSECTS INJURIOUS TO THE POTATO.

ATTACKING THE FOLIAGE ONLY.

BY E. B. REED, LONDON, ONT.

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| <p>1. The three-lined Leaf Beetle (<i>Lema tri lineata</i>, Oliv.)</p> <p>2. The Colorado Potato Beetle, or Ten-lined Spearman (<i>Doryphora 10-lineata</i>, Say.)</p> <p>3. The Striped Blister Beetle (<i>Epicauta vittata</i>, Fabr.)</p> | <p>4. The Ash-Gray Blister Beetle (<i>Epicauta cinerea</i>, Fabr.)</p> <p>5. The Potato or Tomato Worm (<i>Sphinx quinquemaculata</i>, Haw.)</p> |
|--|--|

With the exception of wheat, that staff of human life, there is, we imagine, no other crop so universally cultivated both in farm and garden, and so important as an article of diet for all classes of the community, as that of the potato. Esteeming this vegetable so highly as we all do at this present day, it is somewhat amusing to glance back over its early history, and gather the opinions of some of our ancestors. At the end of the sixteenth century, nearly one hundred years after its introduction into Great Britain, we find a writer remarking that "they are much used in Ireland and America as bread, and may be propagated with advantage to poor people." The popular taste for this esculent tuber took a long time for its education, and it was not until the middle of the last century that the potato came into general use both in England and Northern America. It was even then long disparagingly described by the gluttonous wisecracks of the time, as "a root found in the New World, consisting of little knobs, held together by strings; if you boil it well, it *can* be eaten; it *may* become an article of food; it will certainly do for hogs; and, though it is rather flatulent and acid in the human stomach, perhaps, if you boil it with dates, it may serve to keep body and soul together, among those who can find nothing better." To us, of this nineteenth century, this verdict may seem most ridiculous, but we ought not to forget that there must be a very wide difference between "the little knobs" of those early days, and the magnificent growth to which proper cultivation has now brought the potato. In this noble Province of Ontario, we find that this crop is annually becoming larger and more important, and therefore anything that affects its prosperity cannot fail to be of interest to all our agriculturists, and the more especially at this period when we are threatened most seriously with the attacks of an insect that has completely devastated the potato fields for some years past in the Western States. The recent advent of the Colorado potato beetle in Canada, has excited considerable apprehensions among our farmers and gardeners; and we have, therefore, thought it desirable to lay before our readers, a plain and accurate account of some of the various insects which infest the potato, and whose attacks are directed exclusively against the foliage of the plant. The senior Editor of the *American Entomologist*, the late B. D. Walsh, in a very able and exhaustive article on this subject, has admirably epitomised the following sketch of the insect foes of the potato, he writes: "There are no less than ten distinct species of bugs, preying upon the potato plant within the limits of the United States. Many of these ten species are confined within certain geographical limits. The habits and history of several of them differ as widely as those of a hog and a horse; some attack the potato, both in the larval state, and in the perfect or winged state; others in the perfect or winged state alone: and others again in the larval state alone. In the case of seven of these insects, there is but one single brood

every year, while of the remaining three, there are every year from two to three broods, each of them generated by females belonging to the preceding brood. Eight of the ten feed externally upon the leaves and tender stems of the potato, while two of them burrow like a borer exclusively in the larger stalks. Finally almost every one of these ten species has its peculiar insect enemies, and a mode of attack which will prove very successful against one, two, or three of them will often turn out to be utterly worthless when employed against the remainder." While happily for Ontario, our potato crops are not as yet subject to the attacks of quite so many noxious insects as appear to afflict our neighbours over the lines; yet we have already a sufficient number to make us very anxious to ascertain any mode of destroying them, and to become acquainted with those friendly insects whose chief mission seems to be to assist the agriculturist in his arduous efforts.

1st. THE THREE-LINED LEAF BEETLE, (*Lema tri lineata*, Oliv.)

Order, COLEOPTERA; Family, CHRYSOMELIDÆ,

Eating the leaves of the potato both in the larval and perfect state.

This beetle belongs to a family of destructive insects that spend the chief part of their lives upon the leaves of various plants, and which as they derive their entire nourishment both in the larval and perfect state from leaves only, may fairly be called leaf beetles.

FIG 65.



Colours, Pale Yellow and Black.

FIG 66.

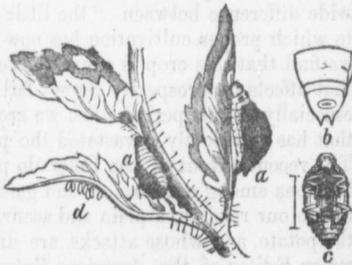


Colours, Yellow and Black.

the last few joints of the abdomen of the larva magnified and viewed not in profile, but from above. The vent of the larva as may be seen from this last figure is situated on the upper surface of the last ring, so that its casting falls upon the back, and by motions of the body is with each successive discharge pushed forward towards the head, until the whole back of the insect is entirely coated with it. When the load becomes too heavy, or gets hardened by exposure to the air, it is thrown off by the insect, and the process is commenced anew. Former writers have thought that this curious device was intended as a protection from the rays of the sun, for the tender and soft bodies of the larvæ, but we do not agree with this view, for there are many other larvæ, of various species, destitute of any such protection, whose skins are equally tender and sensitive, and we incline to the more rational opinion, that this singular shield is provided as a security against the attacks of Ichneumon flies, who frequently deposit their eggs in the living bodies of their victims. It is also possible that this repulsive covering may be of service against the attacks of birds, for we do not remember ever to have noticed any birds feeding on these larvæ. Fig 67 (c) presents a somewhat magnified view of the pupa.

The perfect beetle Fig No. 65 is of a pale yellow colour with three black stripes on the wing cases; the intervening spaces of yellow are thickly covered with small punctures or indentations; and on the thorax or throat are two black spots. It bears a very strong resemblance to the common cucumber beetle, (*Diabrotica vittata*, Fabr.) Fig No. 66, from which however, it may readily be distinguished, by its somewhat darker shade of yellow, its slightly larger size and by the peculiar formation of the thorax, which is what naturalists term "constricted" or what may be better described as being pinched in at the sides after the fashion of a modern young lady's waist. It also differs in some other respects which are less obvious. The larva of the three-lined leaf beetle may at once be known from all other larvæ that feed on the leaves of the potato by its peculiar and unsightly habit of covering its back with its own castings. In Fig 67 (a, a) the larva which is of a dull white colour, is shewn in profile, both full and half grown, covered with the soft greenish excrementitious matter which it discharges from time to time. (Fig. 67 b) shows

FIG 67.



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There are two broods of this insect every year: the first brood of larvæ may be seen on the potato vines during the month of June. The grubs are rather short, and almost cylindrical, being thickest in the middle, they are of a greyish-white colour with a blackish head, and two black spots on the next segment of the body; they have six legs arranged in pairs beneath the first three segments. Dr. Harris, the late talented Entomologist of the State of Massachusetts, points out as another noticeable peculiarity of this larva "that, in eating, the grub moves backwards, never devouring the portion of the leaf immediately before the head, but that which lies under it." When the grubs are about a fortnight old, they are fully grown; they then cease eating and leave the vines, descending into the earth where each larva having formed for itself a small oval cell lined with a gummy cement, changes into the pupa, Fig 67 (c) from which after the lapse of another fortnight the perfect beetle emerges. After coupling in the usual manner the female lays its oblong yellow eggs (which are glued to the leaves in parcels of six or eight together) fig 67 (d), on the underside of the leaves of the potato; from these eggs the larvæ usually make their appearance about August. This second brood remains in the ground all winter in the pupal or inactive state. The perfect beetle when held between the fingers emits a shrill creaking noise. It is common everywhere in Ontario, and indeed in many parts of the Province of Quebec, and has been known to Canadian Entomologists for a long period. This insect is very prolific, and the larvæ are very voracious, so that the ravages they commit on the vines are sometimes of a serious character; in the neighbourhood of Kincardine, the beetle this year did great mischief, in some cases affecting nearly the whole crop and by its numbers and enormous appetite causing the farmers of that district to believe that the "True Simon Pure," the Colorado potato bug, had at last got amongst them. Specimens of the insect in its different stages were sent to us for identification by the editor of the "*Bruce Herald*" and a short sketch of its history was furnished by us to that paper. We have also heard from several other portions of this Province, that this beetle has during the past year caused an unusual amount of damage among the field potatoes. It is almost always present more or less in our gardens, and is often especially annoying to those who cherish ardent hopes of that *summum bonum* of vegetable felicity, "an early dish of young potatoes." We notice that a correspondent of the "*American Entomologist*," writing to that periodical states "That the early Goderich potato seemed to be peculiarly subject to the attacks of this beetle." This may be an exceptional case, for we do not remember ever to have noticed any such peculiarity in the various sorts of potato vines including the early Goderich that we have found infested with *Lema trilineata*.

As a remedy we have ourselves sometimes obtained good results from dusting the leaves and young larvæ with a mixture composed of one-third air-slacked lime, and two-third's ashes. We have also caught incredible numbers of the perfect beetle in a very short time, by brushing them off the leaves into an open pan or dish of warm water, if this is done in the early part of the season when the insect first appears, it is obvious that their numbers can be considerably lessened. In these remedial efforts, however, as in everything else in this world of ours, "union is strength." In towns especially, where our gardens are so surrounded by those of other people, these remedies are often rendered practically useless, by the neglect of our neighbours to make similar efforts to destroy the enemy, and as the perfect insect is a lively beetle and active on the wing, it is very aggravating after clearing out our own garden to find it immediately reinvested by hosts, which drop over the fences from our neighbour's lot, where they have been lazily suffered to accumulate at their ease.

2ND.—THE COLORADO POTATO BEETLE, OR, TEN-LINED SPEARMAN.—*Doryphora—10-lineata*, Say.)

Order, COLEOPTERA—Family, CHRYSOMELIDÆ.

Immense numbers eating the leaves of the potato all through the summer both in the larval and perfect state.

The summer of 1870 will be noted among Canadian entomologists as being the unlucky period when the Colorado potato beetle first made its appearance on the western shores of the Dominion. Previous to that date Canada had been comparatively free from any insects that affected to any great extent the general growth of the potato, but the advent of this beetle will,

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we fear, seriously affect the yield of the crop throughout the districts infested by this pest, unless some remedial measures are adopted. For some years past rumours have reached us of the great ravages caused by this insect in the Western States, and observers among us have marked its steady onward march which nothing seemed to check, but now that, utterly regardless of international treaties, this beetle has crossed the boundary line and forcibly annexed this fair Province of Ontario and is endeavouring to establish the "Monro doctrine" among our potato crops, we think it will be well worth our while to enquire into the history of this Coleopterous Fenian and see what remedies we can devise to check its operations.

As this insect is comparatively new to Canada, although its history has been fully investigated in the United States, we have condensed much of the following report from American writers, who have carefully experimented on this beetle. We allude especially to Dr. Asa Fitch, of New York State, Messrs. Walsh and Riley, the editors of the *American Entomologist* and Dr. Henry Shimer, of Illinois.

The Colorado Potato Bug, as it is generally called, is not really a bug, but a true beetle belonging to the order of insects known as the *Coleoptera*, a word signifying wings enclosed in a sheath. Mr. Thomas Say, the celebrated American entomologist, who first discovered this insect placed it among a family of beetles named *Doryphora*, a Greek word meaning "a spear bearer" in allusion to a long conical horn projecting from the breast, which many South American species of this genus possess, although in the Colorado beetle and one or two others of the same family this typical peculiarity is wanting. Our species is named *10-lineata* from the ten lines on its wing cases.

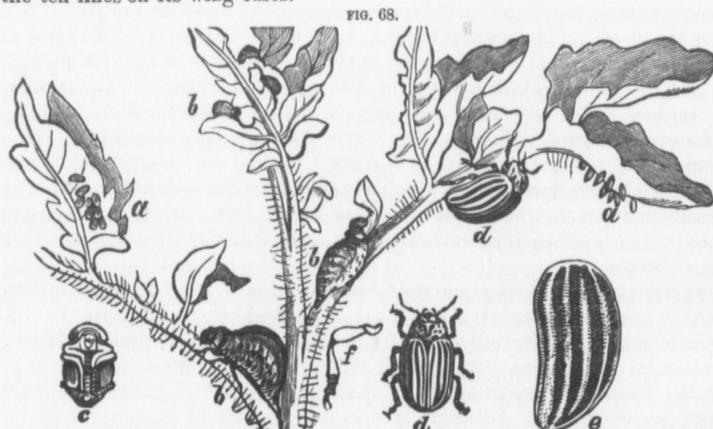


FIG. 68.
Colors—(a) deep orange; (b) and (c) venetian red, inclining to cream color; (d) and (e) cream color and black.

perfect beetle; (e) one of the wing cases enlarged to shew the five lines; (f) the leg enlarged.

The plants that this beetle selects for its food belong chiefly to the genus *Solanum*, a sub-family of the order *Solanaceæ*—an order which, although it furnishes but few plants that add to the comforts, or supply the wants of mankind, contains two which enter largely into the consumption of the dwellers in temperate climates. We allude to the POTATOE and TOBACCO. In addition there are the Egg Plant and the TOMATO, the latter being also cultivated on this continent as a field crop.

In 1824, Mr. Thomas Say, while acting as naturalist to Long's exploring expedition to the Rocky Mountains, described this insect from specimens obtained by him on the Arkansas and Upper Missouri rivers. It appears from his account to have been tolerably common there. Its natural food has been presumed to be a wild species of potato (*Solanum rostratum* of Dunal) peculiar to the regions of the Rocky Mountains, and not found east of the Mississippi: for in 1864 Dr. Velie, the ornithologist of Rock Island, Illinois, and Dr. Parry, the botanist of Davenport, Iowa, while in Colorado, saw numbers of this insect feeding on the *Solanum rostratum*, and forwarded numerous specimens to Mr. B. D. Walsh, the late State Entomologist of Illinois, who was satisfied that they were the same species as that feeding on the cultivated potato. Occasionally it may feed on the tomato, and Mr. Walsh records hav-

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ing noticed a few specimens feeding on the ground-cherry (*Physalis*) and on the imported Jamestown weed, or gypson weed (*Datura*). Mr. J. Egerton, of Gravity, Iowa, appears to have been the first person who called attention to the injurious properties of the Colorado potato beetle. In a letter to the *Prairie Farmer*, of August 29th, 1861, he writes "that they made their appearance upon the vines as soon as the potatoes were out of the ground, and there being a cold spell of wet weather about that time, they devoured them as fast as they were up." How they came to attack the cultivated potato is ingeniously explained by Mr. Walsh in the *Practical Entomologist* of October 30th, 1865, in the following manner:—

"But it will be asked, where does this insect come from? And how does it appear that it did not trouble the Iowa farmers before 1861, and the Illinois farmers before 1864? I believe I can explain this satisfactorily. Unlike several other noxious insects, it is not a general feeder, but is confined to plants belonging to the botanical family *Solanaceae*, and especially to the *Solanum rostratum*, a plant (as we have seen) not found east of the Mississippi. Assuming, therefore, that this wild *Solanum* is the natural food of the insect, and that the region of the Rocky Mountains is its natural home, its range for a long series of years would be limited by the range of the plant it feeds on. But in progress of time civilization marched up to the Rocky Mountains; potatoes were planted in Kansas, Nebraska, and Colorado, and the insect discovered that one species of *Solanum* was about as palatable as another. Having thus acquired a taste for potato leaves, it would naturally spread eastward from potato patch to potato patch, until it overspread Iowa, and finally overleaped the Mississippi into Illinois. In confirmation of this theory, R. W. Hagen, of Fremont, Dodge County, Nebraska, says that 'the potato bug which is so destructive in that region was first discovered in 1859, about 100 miles west of Omaha City, whence they have been marching eastward annually.' From Omaha City to Rock Island, Illinois, is over 260 miles, so that if the above statement is correct, it appears that the insect has travelled about 360 miles in six years, or at the average rate of sixty miles a year. At this rate of progress it will reach the Atlantic in about fourteen years." This prediction of Mr. Walsh appears to be in a fair way of being realized, although in a far speedier manner than he anticipated. Commencing in the State of Colorado, this beetle has gradually worked its way through the States of Kansas, Nebraska, Iowa, Minnesota, Illinois, Michigan, Wisconsin, Missouri, and Indiana. It has also spread over a great part of Ohio, and Dr. Trimble, of New Jersey, reported some time ago that it had appeared in Pennsylvania. And now, since 1870, it has fairly established itself in the Western Peninsula of Ontario, and is fast extending eastward. Time will show whether Canadians, profiting by the sad experience of their American friends, will use any proper exertions to stay the ravages of this destructive pest. To be forewarned is to be forearmed, and we will have but ourselves to blame if we sit still, and with folded hands suffer the Colorado beetle to work its own way without let or hindrance.

The mature insect or perfect beetle, (Fig 68 *d. d.*) is about one-third of an inch in length the female being slightly larger.

It is of a regular oval form, very convex above and flat beneath: its wing covers which are smooth and shining are of a yellowish cream colour with ten black lines or stripes (five on each wing case) placed lengthways, the wings are of a bright rosy hue, the body is cream coloured. With this combination of colours the insect presents a beautiful and attractive sight as it flies about in the bright sunshine.

The perfect beetle makes its first appearance about the end of May or the early part of June, having left the ground where it has passed the winter in the pupa stage (Fig 68 *c*). The eggs, (Fig 68 *a a*), which are deposited on the under-side of the leaves hatch in about a week after being laid. The young larva is at first almost black, but shortly becomes of a lighter colour. It is a most voracious feeder. In about a fortnight the larva attains its full growth and ceases eating. From experiments made by Dr. Henry Shimer, of Illinois, he estimated that during the time that elapses between the birth of the larva and its arrival at maturity it increases its original size and weight nearly two hundred times, shewing the enormous eating powers possessed by this insect. Its appearance at this period is of a reddish orange colour, the head and legs are black, the hind part of the second segment is also black, the anterior part being a pale yellow, there are two rows of black spots on each side of the body, and the abdomen is large and swollen. Dr. Shimer states that it uses its tail to assist its movements, and when alarmed by being touched it curls up and "plays possum." The larva being now full grown seeks shelter in the earth, where in the course of three or four days it changes

into the pupa state, (Fig 68 a), from which in about ten days afterwards the perfect beetle makes its appearance, being just about one month from the date of hatching and five weeks after the laying of the eggs. According to Dr. Shimer, the beetle "in about seven days after its maturity begins to pair, and at about the fourteenth day on an average begins to lay its eggs, thus in fifty days after the egg is laid the offspring begins to propagate." The same gentleman also states as some of the results of a most carefully conducted series of experiments that "from an equal number of males and females, well fed and made as comfortable as possible in confinement, I obtained an average of 719 eggs to each female; but in the fresh pure air, sunlight and freedom of nature under propitious circumstances, I have no doubt of its exceeding a thousand. They laid some eggs every day for forty days, commencing July 15th and ending on the 1st September. The smallest average was in the first part of the time, being $7\frac{1}{2}$ eggs per day to each female; the greatest average was about the middle of the time 75 eggs, the last day they averaged $12\frac{1}{2}$ eggs." Mr. Walsh in the *American Entomologist* states "That there are about three broods of larvæ every year in North Illinois and Central Missouri, each of which goes under ground to pass into the pupa state, the two first broods coming out of the ground in the beetle state about ten or twelve days afterwards, while the last one stays under ground all winter and only emerges in the beetle state in the following spring, just in time to lay its eggs upon the young potato leaves." We thus see that at almost any period during the summer months the insect can be found in all its stages. Assuming Dr. Shimer's average of 700 eggs for each female and that there are three broods per annum, and also assuming that one-third of the eggs produce fertile females, we might thus obtain in the course of one season the enormous number of thirty-eight million three hundred and thirty thousand larvæ as the produce of one single pair of beetles. Bearing in mind what we have stated about the voracity of the larva, we may well tremble for our potato crops when the Colorado beetle gets fairly established among us. This beetle, like many noxious insects, will be more numerous and do more damage some years than others, owing to various circumstances, such as propitious weather, and the lack or cessation of the attacks of its various insect enemies, but we may as well make up our minds to seeing this obtrusive stranger permanently located in Ontario whether we like it or not. Mr. Walsh wrote "That we shall have the Colorado Bug, in smaller or larger numbers, always among us, I have no more doubt, than that we shall have always more or less thunderstorms in the valley of the Mississippi."

It now remains for us to see how we are going to fight this prolific foe. In the first place, kind Mother Nature has as usual come to the rescue, and we are able to enumerate some 22 kinds of insects which prey upon the Colorado Potato Beetle, and in all probability the list will increase as our investigations become more perfect. We give below a tabular list of these insects.

COLEOPTERA.

1. *Tetracha virginica*, Hope.—Not taken in Ontario.
2. *Passimachus elongatus*, Lec.— " " yet.
3. *Calosoma calidum*, Fabr.—Common in Ontario.
4. *Harpalus caliginosus*, Say.— " "
5. *Hippodamia maculata*, Geer.— " "
6. " *13 punctata*, Linn.— " "
7. " *convergens*, Guerin.—Not common in Ontario.
8. *Coccinella*, *9 notata*, Herbst.—Very common in Ontario.
9. *Mysia*, *13 punctata*, Oliv.—Not uncommon in Ontario.
10. *Epicauta cinerea*, Fabr.— " "
11. " *vittata*, Fabr.—Common in Ontario.
12. *Lebia grandis*, Hentz.—Rare in Ontario.
13. *Philonthus*, Sp. undetermined.

HEMIPTERA.

14. *Reduvius raptatorius*, Say.—Taken in Ontario.
15. *Arma spinosa*, Dallas.— " "
16. *Harpactor cinctus*, Fabr.— " "
17. *Coreus tristis*, De Geer.—Common in Ontario.
18. *Perillus circumcinctus*, Say.—Taken in Ontario.
19. *Stiretrus fimbriatus*, Say.— " "

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Colour—Black and orange.



ARACHNIDA

20. *Phalangium*.—Common in Ontario.

DIPTERA.

21. *Promachus apivorus*, Fitch.—Not taken in Ontario.

22. *Lydella doryphoræ*, Riley.— “ “

Of this array of insects, some 12 are tolerably common in Ontario; and these we will introduce, with all the honours, to our readers, contenting ourselves with a brief reference to the others.

Tetracha Virginica (No. 1), and *Passimachus elongatus* (No. 2), are two handsome ground beetles, and, in all probability, will not be found in Ontario.

Epicauta cinerea (No. 10), and *Epicauta vittata* (No. 11), will be treated of hereafter as enemies, although they appear to have the credit of attacking the larvæ of the Colorado Beetle. Until their reputation for good is somewhat better established, they should be looked upon with every suspicion.

Lebia grandis (No. 12), is an active beetle, with dark blue wing-covers, and yellowish brown head, thorax and legs.

Promachus apivorus (No. 21), is a large, savage, two-winged fly; it is commonly known as the Nebraska Bee-killer.

Lydella doryphoræ (No. 22), the Colorado Potato Beetle parasite, is also a two-winged fly. It closely resembles, in colour and size, the common house-fly, having, however, a brilliant silver white face, by which it may readily be distinguished. It deposits its eggs in the body of the living larva, and the grubs hatching therein finally destroy the larva. Mr. Riley, who appears first to have noticed this insect, states, that in 1868 it destroyed in his garden ten per cent. of the first brood, and fifty per cent. of the second brood, of the Colorado Beetle; so we will gladly welcome this friend to our shores, and trust that he will follow his enemy without waiting for the ceremony of an invitation from us.

We now come to those insect friends that we meet with in this Province. The five that we are now about to describe attack the Colorado Potato Beetle in the *egg* and *larval* state only. They belong to an order of beetles called *Coccinellidæ*, and more popularly known as Lady-birds or Lady-cows. These titles are remnants of the olden times, when the Roman Catholic religion was the only Christian system, and these insects, being supposed to be under the special protection of the Virgin Mary, were honoured with her name, and called the Birds of our Lady, or Cows of our Lady, just as in France the children still give them the names of “*Bêtes de la Vierge*,” “*Bête à bon Dieu*,” or “*Vaches à Dieu*.” The perfect beetle, when touched, exudes from its abdomen a dark yellow mucilaginous liquid, of a pungent and disagreeable odour. This was formerly supposed, by the ignorant, to be a sure remedy for the toothache.

All the larvæ of the Lady-birds bear a strong family resemblance to each other, and figure 69 will give a tolerably good idea of their appearance. They are very active, and generally very numerous. When the larva has eaten all it can manage, and is arrived at maturity, it fastens itself to a leaf by the extremity of its tail, and then the skin splits off and leaves the pupa, from which, in about twelve days, the perfect beetle emerges. Their eggs, which are somewhat similar to those of the Colorado beetle, being, however, smaller in size, and laid in lesser groups, are often deposited quite convenient to those of the Colorado beetle, so that the young larva, when hatched, has seldom very far to search for food. We may mention here that our friends the Lady-birds are the most inveterate destroyers of aphid and almost all plant lice, so that their good services are nearly inestimable.

THE SPOTTED LADY-BIRD (*Hippodamia maculata*, De Geer).—Fig. 70 is a small pinkish beetle marked with large black blotches.



THE NINE-MARKED LADY-BIRD (*Coccinella 9 notata*, Herbet).—Fig. 71 is somewhat rounder than the last, its colour is brick red, and it has nine black spots; this insect is one of our most common beetles, and may be found in every part of Canada.



THE THIRTEEN-DOTTED LADY-BIRD (*Hippodamia 13 punctata*, Linn).—

Fig. 72. Fig. 72 is larger than either of the preceding. It has thirteen black spots on a brick red ground.

THE CONVERGENT LADY-BIRD (*Hippodamia convergens*, Guen.)—Fig. 73 is of a deep orange red colour, marked with black and white. It has, according to Mr. Riley, been of immense benefit in checking the ravages of the potato beetle. Its larva is blue, orange and black in colour, and in its pupal or inactive state it is of the exact colour of the larva of the Colorado beetle, and is doubtless quite often mistaken for that larva and ruthlessly destroyed. We see, therefore, that it is necessary to exercise some little discrimination, and not to destroy both friends and foes in one fell swoop. *a* shows the larva, *b* the pupa suspended by the tail from a stalk, and *c* the perfect beetle.



FIG. 73.

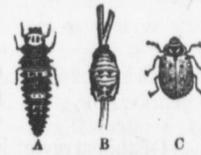


FIG. 74.



THE FIFTEEN-SPOTTED MYSIA (*Mysia*, 15 *punctata*, Oliv.)—Fig. 74. As this insect was discovered by us, attaching the Colorado larvæ, it may be of some interest to our readers to give a short sketch of its procedure, especially as all the Lady-birds already de-

scribed act in a similar manner in their attacks on the eggs and larvæ. It was sometime during the latter part of July, 1871, while wandering about the outskirts of a large potato patch, and examining the damage caused by the Colorado beetle, that we found on the vines the larva of a beetle belonging to the family of the Lady-birds. The insect was new to us, and, although there were no larvæ of the Colorado beetle in the immediate vicinity, yet we were in hope that we had discovered a new enemy of our abominable pest. To test the question more at leisure, we took our welcome treasure home, and placed it in a box, wherein were numerous specimens of Colorado larvæ in all stages, from the diabolical-looking little monster just hatched from the egg, to the full-grown, fat, and repulsive larva, dragging its bloated body slowly about in search of some convenient place in which to undergo the transformation into the pupal state. The box was roomy, and covered with a glass top, so that we had ample opportunities of observing what took place. After a little preliminary tour of observation, the Lady-bird caught sight of a small Colorado, and immediately commenced a fierce attack upon the unhappy little victim, seizing it in the powerful jaws, with which Dame Nature has provided most of these creatures, and, in the course of a very few minutes, sucking the juices completely out, and leaving only the dry and blackened-looking skin as a ghastly monument of its victory. It then commenced its attacks, after a short interval, on a full-grown specimen which, however, had strong objections to being devoured alive, and struggled viciously with its enemy, which was not nearly so large, although, of course, much more active. Its efforts at resistance were vain, and after the Lady-bird larva had got its jaws firmly fixed in its victim's broad and capacious back, the struggle soon ceased, and it became a question of the capacity of the Lady-bird to contain all the juices that were in the body of its corpulent victim. Nearly an hour was occupied in this little operation, and when it was over, our friend retired to rest on its laurels and digest its enormous meal at its leisure. For several days we watched, at different times, a repetition of the same thing, and the Lady-bird must have consumed some eight or nine Colorado larvæ. We regret that we neglected to make any description of this larva, and being called away from home just at this time, we found, on our return, that the larva had gone into the pupal state, and a few days afterwards the perfect beetle emerged, and proved to be a very light coloured specimen of *Mysia 15 punctata*, Olive., fig. 74. This beetle, as may be seen from the engraving, varies much in its perfect form, so much so, indeed, that a careless or unskilled observer would never imagine that these four insects belonged to one and the same species. The drawing is from the clever pencil of Mr. C. V. Riley. *a* shews the larva attacking a Colorado beetle larva, *b* the pupa, and *d, e, f, g* the various forms of the perfect beetle varying in colour from very light grey to deep chestnut brown.

FIG. 75.



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The next two insects belong to an order of beetles known as the *Carabidæ* or carnivorous ground beetles, they are predaceous both in the larval and perfect states, and they attack both colorado beetle and the larvæ probably on the ground, or whilst the larvæ are buried in the pupal state.

Calosoma calidum, (Fabr) Fig. 75. The glowing *Calosoma*, is a large handsome shining black beetle, with six rows of deep impressed coppery spots, which give the insect a most curious appearance. It is a very active beetle, and is of great service to the agriculturist or gardener being especially fond of cut worms, fortunately it is very common.

Harpalus caliginosus, (Say) Fig. 76. The murky ground beetle is of a dull black colour, it may be easily recognized from its figure.

Mr. C. V. Riley, states that it is a very formidable enemy to the

FIG. 76.



Color—Dull black.
rostrum or beak,

Agriculturists should learn to distinguish these carnivorous ground beetles and never destroy, them for they do an incalculable amount of benefit. We give at Fig. 77, an illustration of the larva of *Harpalus pennsylvanicus*, a congener of *H. caliginosus*, and as we showed in our report of last year a most inveterate foe to the plum curculio. The figure gives a very good idea of the general appearance of the larvæ of these ground beetles, which may often be met with under stones and stumps in slightly moist places.

The next six friendly insects belong to the true bug family *Hemiptera* or half wings, many of which emit a most disagreeable pungent odour. Many of these Hemiptera are plant feeders, deriving all their nourishment from the juices which they suck in their projecting rostrum or beak, others again have cannibal propensities and these are furnished with a more suitable beak.

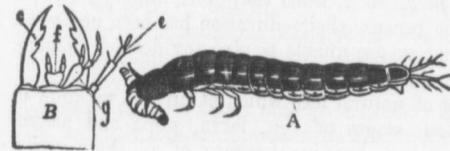


FIG. 77.

Arma Spinosa, (Dallas), Fig. 78. The spined soldier bug, is a smallish bug, of an ochre yellow colour. It has done much work in the Western States among the Colorado Potato Beetles. The figure *b* shows one wing extended, *a* gives a view of (much enlarged) of the rostrum or beak. It is a

true cannibal, and is found in Ontario.

FIG. 78.



Redwius raptatorius, (Say,) Fig. 79. The rapacious Soldier Bug, is of a light brown colour, and bears a good name for attacking the Colorado Beetle. It is also a cannibal and is found in Ontario.

Perillus circumcinctus, (Say) Fig. 80. This little friend was brought to us this last summer, having been caught in the act of killing a Colorado larva. It is a handsome beetle of a deep chocolate-brown colour, with broad margins and bands of creamy white, the figure gives a capital idea of its general appearance. We placed this insect also in our glass covered box, and watched

FIG. 79.



its operations, and mode of attack. It moved very quickly, and attacked the larva with a sudden dart of its sharp-pointed beak. The larva, of course, struggled with all its power, yet it never seemed at all to loosen the hold of the bug, which rather surprised us, for we were at a loss to see what enables the beak to be retained so firmly, for it is tolerably smooth and easy of withdrawal if the bug is willing. Yet when we at-

FIG. 80.



tempted to take the larva off the beak, we had to use some slight degree of force. The bug, moreover has a curious fashion of planting himself squarely and firmly on his feet, with the beak raised horizontal, and the victim poised or spitted on it, and writhing about quite clear of the ground. We had the curiosity to weigh the bug and also a larva which we saw it attacking, and the larva was very nearly as heavy as the bug, and yet it seemed no exertion to

the bug to raise its victim on the point of its beak and hold it suspended there while it sucked out the contents of the body.

Stiretrus fimbriatus, Say.—The Bordered Soldier-Bug is something like the preceding, but dark olive green, with cream-coloured markings.

Harpactor cinctus, Fabr.—The many-banded robber is a member of the same family as *Reduvius raptatorius*.

Coreus tristis, De Geer.—The common Squash Bug has been mentioned several times as an enemy of the Colorado Beetle, but we do not feel sure that this reputation is fairly earned. We intend, however, this coming season, to make experiments with this Bug, which is exceedingly common, and is usually productive of much damage among the squash, cucumbers and melons.

Phalangium.—The common Daddy Long-legs is said by people in Illinois to be a potato bug destroyer. To this long list of insect friends to man, we add a member of the mammalia, which is not usually regarded with very friendly eyes, and that is the Skunk. Mr. W. Le Baron, the State Entomologist of Illinois, thinks that there is some slight evidence of this little animal being a devourer of Colorado larva, especially as it is well known to destroy the May beetle, and its larva, the white grub, and some other of the larger sized insects. "That the skunk," writes Mr. Le Baron, "should eat potato bugs has no intrinsic improbability, and I think every one must be impressed with a feeling of the extreme appropriateness of the diet." Perhaps some fastidious people may think that the remedy in this case is worse than the disease and may exclaim with all due earnestness, "save us from our friends."

There is a great diversity of opinion as to whether poultry will or will not eat the larvæ of the Colorado Potato Beetle, and whether if they do eat them any injurious effects will follow. We have obtained much contradictory evidence on this point. A few people asserted that some of their poultry had suddenly sickened and died, after eating freely of the insect; while others stated that their turkeys, ducks and fowls, had eaten the larvæ greedily and with perfect impunity. One gentleman, in Illinois, states that he has taught his fowls to eat the bugs by throwing them down to them, like so much corn, when they were hungry; and he thinks that if all chickens do not eat them, it is because their education has been neglected. The evidence, however, is so evenly balanced that we are unable to give any decided opinion, but we hope to see some experiments made and a definite conclusion attained.

We have now arrived at the end of our list of natural foes which at present we know to attack the Colorado Potato Beetle in its various stages of egg, larva, pupa and perfect beetle. The question will be very naturally asked, how in the face of all these varied enemies the beetle continues to propagate its countless swarms apparently with undiminished numbers?

In answer to this question, we avail ourselves of the excellent report of Mr. Le Baron, the State Entomologist, of Illinois. "The best answer I can give, is that no one of these many enemies, if we except, perhaps, the parasitic *Lydella*, is exclusively appropriated to these insects like the *Tachina*, of the Tussock Moth, or the *Chalcis* of the Bark Louse. In other words, these various enemies depredate upon the potato bugs, when they happen to come in their way, but do not depend upon them for their subsistence. Besides, the predaceous insects above enumerated do not belong to the prolific class, and therefore, are too few in numbers to make much headway against such a multitudinous host as the Colorado Potato Bugs. I have repeatedly walked through potato fields, with the express intention of taking note of their destroyers, without seeing any creature seriously deserving of the name. Nature, if left to her own resources, often exhibits wonderful curative and recuperative powers, which are ordinarily sufficient to preserve the balance between the world of insects, and that of plants. If in any case, like the present, she seems to fail, it is because we have abruptly disturbed the balance, by supplying these prolific insects with a superabundance of congenial food. And now that we are overrun by them we stand aghast at the consequences. But nature often accommodates her economy to human wants, and rectifies our errors and follies. And I have no doubt that the Colorado Potato Beetle, like other noxious insects that have been equally prevalent, will in time disappear, especially in those localities where it is now most abundant, even though we leave the work wholly to nature. But we must give her time. Nature works more slowly but more surely than man, and her judgments take the course of an inevitable retribution. If we can have more patience and get along with fewer potatoes for a year or two, I doubt not that the time of our redemption will draw nigh. But as we

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do not know exactly when that time will come, and as patience without potatoes may seem to many, a tedious virtue, I opine there can be no sin in doing what we can to hasten the wished-for result."

A vast number of artificial remedies have been tried most of which, however, are utterly worthless. The only two practical and reliable ones are *hand picking*, and the use of *Paris Green*. In the summer of 1871, the attention of the Department of Agriculture, for Ontario, was called to the damage the Colorado Beetle was doing on the Western frontier. The Hon. John Carling, the energetic Minister of that Department, at once commissioned Mr. Wm. Saunders, and the writer of this report, to proceed to the West and thoroughly examine the district, and report to him as speedily as possible the result of their labours and also of all experiments they might make, so that the general public might have some reliable information. We accordingly made our investigation, and found that the beetle was to be seen in enormous numbers, and had been and still was doing a great deal of damage, in some cases destroying whole fields of potatoes. We made various experiments with different chemicals and mixtures, using *Arsenious Acid*, *Powdered Cobalt*, *Sulphate of Copper*, *Bichromate of Potash*, *Powdered Hellebore*, *Carbolate of Lime*, etc., but we found that the cheapest and most practical remedy was PARIS GREEN.

The many entomologists and agriculturists who have experimented on this insect, with various poisonous and other substances, in those portions of the United States where it has been so destructive for some years past, concur in recommending the use of *Paris Green*, diluted with flour, ashes, or air-slacked lime, as the best remedy known for destroying the insect, both in its larva and beetle state, without injuring the plant. The result of our experiments and investigations confirm this opinion, and this remedy is, no doubt, a reliable one, provided the *Paris Green* be of good quality. Our experience has also satisfied us that flour is a much better substance to mix with the green than either ashes or lime, as the insects eat it more readily, and, at the same time, it adheres more tenaciously to the surface of the plant, and hence is not so easily washed off by rain. We found good effects from a mixture of one part, by weight, of *Paris Green*, with 10 or 12 parts of flour, dusted lightly on the vines early in the morning, when the dew is on the foliage.

Where only a small patch is cultivated, the mixture can be readily applied by means of an ordinary flour dredger; but when larger quantities are grown, we would suggest the use of a round tin box, about nine or ten inches in diameter, and four or five inches in depth, with a tightly fitting lid, and with a bottom either perforated with small holes, or covered with fine wire gauze. This should be attached, by means of a hollow handle, to a stick of any convenient length. With such an instrument, which may be obtained at a very trifling cost, a large piece of ground can be gone over in a short time, and the mixture applied almost as fast as the operator can walk.

QUANTITIES REQUIRED, AND PROBABLE COST PER ACRE.

After a careful estimate, we consider that three pounds of the *Paris Green*, mixed with its due proportion of flour (30 to 36 pounds), will, if economically used, be found sufficient for one acre of potatoes. Assuming 50 cents to be the ordinary retail price per pound of *Paris Green*, every application of the mixture would cost from two to three dollars per acre, exclusive of the labour. If the insect is very abundant, two or more applications may be required, as exposure to wind and rain will eventually remove the powder entirely from the leaves, rendering them liable to further attacks. Some discretion should be exercised in selecting a suitable time for using the mixture, which should not be applied during high winds, or immediately before a rain storm.

As this mixture is of a poisonous character, ordinary care should be used in handling it, to avoid inhaling much of the dust when applying it, to wash the hands after each applica-

NOTE.—Seeing the importance of taking immediate action in carrying out the suggestions made in the report of Messrs. Saunders and Reed, the Department of Agriculture has effected such arrangements with a wholesale drug house in the City of Toronto as will enable farmers and others to obtain a reliable quality of *Paris Green* there at 30 cents per pound. It will be put up in one pound packages, as suggested, with full directions for use, and may be purchased in quantities of not less than ten pounds, by remitting the amount of cost to Messrs. Lyman Bros. & Co., of Toronto.

tion, to keep it out of the reach of children, and to exclude live stock of all kinds from fields where the poison is used. With these precautions no danger need be apprehended, it does not injure the leaves to any appreciable extent, unless very heavily applied, and cannot possibly affect the potato itself. We make these remarks because we have met with several individuals who entertain a foolish prejudice against the use of this mixture, for fear that it might injure the potatoes.

The use of Paris Green has also been strongly recommended, and we quote in its support from a recent article, by Mr. Riley, in the *American Entomologist*, addressed to "Our Canadian neighbours." "This substance has now become THE remedy for the Colorado potato beetle, and it is the best yet discovered. Having thoroughly tested it ourselves, and having seen it extensively used, we can freely say that, when applied judiciously, it is efficient and harmless. If used pure and too abundantly it will kill the vines as effectually as would the bugs, for it is nothing but arsenite of copper (often called *Scheele's green*, by druggists), and contains a varied proportion of arsenious acid according to its quality, often as much as 59 per cent., according to Brande and Taylor. But when used with six to twelve parts either of flour, ashes, plaster or slacked lime, it causes no serious injury to the foliage, and just as effectually kills the bugs. The varied success attending its use, as reported through our many agricultural papers, must be attributed to the difference in the quality of the drug. We hear many fears expressed that this poison may be washed into the soil, absorbed by the rootlets of the plant, and thus poison the tubers; but persons who entertain such fears forget that they themselves often apply to the ground, as nourishment for the vines, either animal, vegetable or mineral substances that are nauseous or even poisonous to us. Animal and vegetable substances, of whatever nature, must be essentially changed in character, and rendered harmless before they can be converted into healthy tubers, and a mineral poison could only do harm by being taken with the potatoes to the table. That any substance sprinkled either on the vines or on the ground would ever accompany to the table a vegetable which develops underground, and which is always well cooked before use, is rendered highly improbable. There can be no danger in the use of sound tubers. The poison may do harm, however, by being carelessly used, and it is most safely applied when attached to the end of a stick, several feet long, and should not be used where children are likely to play."

We learn also, that, at a recent horticultural meeting, in Missouri, of distinguished fruit-growers of that State and Illinois, the Entomologists of both these States being present, the conclusion of the whole matter was that Paris Green was the only practical antidote for the Colorado bug, and wheat flour the best vehicle in which to administer it.

Hand picking has been in Ontario until lately, the chief means employed in lessening the numbers of the beetle, and, where perseveringly followed, has proved very successful, but it needs to be almost daily repeated, and is therefore exceedingly troublesome, and quite impracticable where a large quantity of potatoes are under cultivation. In gardens, however, and small patches a great deal may be done by watching the early growth of the potato vines, and carefully destroying as many as possible of the first beetles that make their appearance, before they get time to pair, and also keeping a keen eye to the deposit of the first eggs. The usual method is to knock the insect off the plant with a piece of shingle into a dish or small pail containing a little water, as they readily fall when struck, both larvæ and beetles may thus be collected in large numbers.

As many stories are current relating to the supposed poisonous character of the Colorado potato beetle, we have made it a special aim to obtain all the information possible on this head, and we are unable to find the slightest evidence, in this country at any rate, to sustain this popular belief, although we have conversed with many persons who had handled and destroyed many thousands of the insects in their different stages, and also handled them freely ourselves with impunity. We do not know of any insect belonging to the family *Chrysomelidæ*, of which this beetle is a member, possessing poisonous properties, hence we deemed it highly improbable from the first that there was any truth in the stories so widely circulated, and which have created so much unnecessary alarm. There is, however, no necessity of using the hands or crushing the beetles therein, a piece of stick should be used, and answers far better for knocking off the beetles. In the State of Iowa a horse machine has been employed, which is worked between the rows and, by a revolving reel, knocks off the beetles and larvæ and throws them down between two rollers which effectually crush them. This, however, of course leaves the eggs undisturbed.

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During the course of the investigation above alluded to, we frequently met with gardens and fields containing two or more kinds of potatoes, and observed that in many instances one sort was very much more affected by the insects than the other. The *Meshannock* is particularly liable to attack, while the Early Rose and Peach Blow are less so; but where the latter are the only varieties planted, the insects do not hesitate to devour them. Mr. Riley also states that "he has known several instances where Meshannocks, raised side by side with Peach Blows, have been entirely destroyed, while the latter were untouched." From the *North-Western Farmer* we also glean that "a potato-grower, giving his experience with potatoes and bugs, names the White Rose, Peerless, White Peach Blow, Jersey Peach Blow, and the Buckeye, as the kinds least liable to be destroyed by the Colorado pest. He says that early planted potatoes escaped better than the same variety planted two or three weeks later. This is the universal experience, so far as we have heard."

We would strongly urge upon our farmers to plant their potatoes this year in such quantities only as they can well look after; one acre, carefully cultivated and watched over, will yield more gross results than four or five acres, if neglected. It is also desirable to isolate the potato patch as much as possible, and to avoid planting two years running in the same ground. Late ploughing or harrowing the ground, after removal of the crop, might also be beneficial in exposing the larvæ that have sought their winter quarters, and are then in the ground in their pupal state, to the rigours of our Canadian winter.

A suggestion has also been made that, as the beetle has a great preference for the egg-plant, which we have before shown is a member of the *Solanaceæ* family, it might be well to grow this plant on the outskirts of the potato patches, as a snare or decoy, to attract the beetles, and thus lead to their easier detection and destruction.

A peculiar feature in the history of the Colorado potato beetle, is the fact of its travelling from the West to the East, this being a remarkable exception to the ordinary rule that most noxious insects have invariably originated in the more densely populated and cultivated Eastern States, and have found their way thence gradually to the West.

We trust that the attention of our readers has been sufficiently awakened to the importance of exercising a strict vigilance over the course of this dreadful pest, for we can assure them on the authority of American sufferers that carelessness or negligence on their part will be sure to entail most serious consequences not on themselves only but also on their neighbours.

We give below for the benefit of our scientific readers a description of the larva of a Colorado Beetle, just after it has emerged from the egg. The notes were taken by Mr. Wm. Saunders, with the assistance of his beautiful microscope, and corroborated by the writer at the same time.

LENGTH $\frac{1}{2}$ of an inch, tapering posteriorly.

Head, very large, widest in front above, with a short projecting horn on each side, and covered with short black stiff looking hairs; colour, shiny black; mandibles black.

Body above, dull yellowish-orange, semi-transparent; 2nd segment with a black horny plate above, extending down the sides; 3rd segment, streaked with black down each side, the remaining segments dotted with brownish black tubercules, varying much in form and size, those along the sides near the under surface being largest and almost confluent, from each of these arises a single black hair or spine; terminal segments much smaller than the others and somewhat retractile, and furnished with two disks by which the larva is able to attach itself to any substance and to readily right itself when turned upside down.

Under surface very similar to the upper; legs black, each armed with a fine sharp curved claw by which the larva is enabled to adhere very tenaciously to any roughened surface.

3. THE STRIPED BLISTER BEETLE (*Epicauta vittata*, Fabr.)

Order—COLEOPTERA. Family—MELOIDÆ.

ATTACKING THE LEAVES ONLY OF THE POTATO.

This and the following beetle belong, as their name shows, to the same family as the famous Cantharides or Spanish flies, which are so much used for medicinal purposes, and which, in the South of Europe, form such an extensive article of commerce. Nearly all the beetles

of this family have the power of raising blisters when applied to the skin, a power which they retain even when dead and perfectly dry.

According to Dr. Harris, four of our native Cantharides have been thus successfully employed, and are found to be as powerful in their effects as the imported species.

THE STRIPED BLISTER BEETLE (*Epicauta vittata*, Fabr.)—Fig. 81 is of a dull tawny yellow above, with two black spots on the head, and two black stripes on the thorax or throat, while the wing cases have two or three black stripes. The head is tolerably broad and heart-shaped, and is fastened to the thorax by a very narrow neck; the antennæ are long and tapering, the thorax is narrower than the wing cases. These latter are usually long and narrow, and are very soft and flexible. The legs are long and slender. The body is soft, and emits when handled, a yellowish fluid from the joints, which gives a disagreeable smell. When alarmed the insect feigns death. The under side of the body and legs are black, covered with a greyish down. It is one of the insects to which the production of the *potato rot* has been ascribed. Mr. Riley states that, in Missouri, this and other blister beetles were more numerous and injurious in 1868 than the dreaded Colorado potato beetle. He also stated that a gentleman living in Illinois discovered that this striped blister beetle eats all other potato tops in preference to Peach Blows.



FIG. 81.
Colour—Black and yellow.

4. THE ASH GREY BLISTER BEETLE, (*Epicauta cinerea*, Fabr.)

Same order and family as preceding.

THE ASH GREY BLISTER BEETLE.—Fig. 82, *a* is far more common in Canada. Its

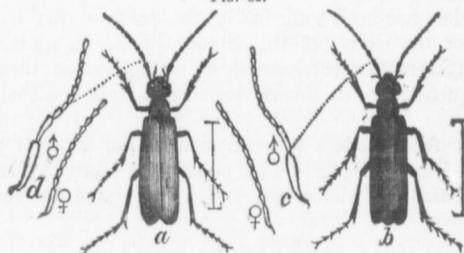


FIG. 82.
Colours—*a* Ash Grey. *b* Black.

body is covered with a very short ash grey down. Its general appearance and history is similar to that of the striped blister beetle. When handled the gray down comes off like the bloom of a plum, and leaves the insect quite black. It attacks not only potato leaves, but also English or Windsor beans, and honey locusts, and, according to Mr. Riley, the foliage of the apple tree, and the young fruit are also liable to its attacks.

5. THE BLACK BLISTER BEETLE, (*Epicauta atrata*, Fabr.) is totally black, and is about half an inch in length. It may be found very plentiful in the month of August on the potato vines, and on the leaves and blossom of the golden rods (*Solidago*.) Dr. Harris states that its ravages have often excited alarm.

Fig. 82, *b* gives a very good idea of the insect, although, in fact, the figure is that of *Epicauta murina*, a similar species, but not found in Ontario.

We are afraid that, on the whole, these Blister-beetles must be regarded and dealt with as enemies, although sometimes it may suit their purpose to feast upon the Colorado Beetle, and thus endeavour to earn the character of beneficial insects. These beetles may be knocked off the vines into a broad pan or pail of water, and destroyed, or driven into a windrow of hay or straw, and burnt; this latter plan Mr. Riley suggests as being the most practical and efficient remedy. As these insects are rather late in appearing, it would follow that the earlier planted potatoes would escape the best.



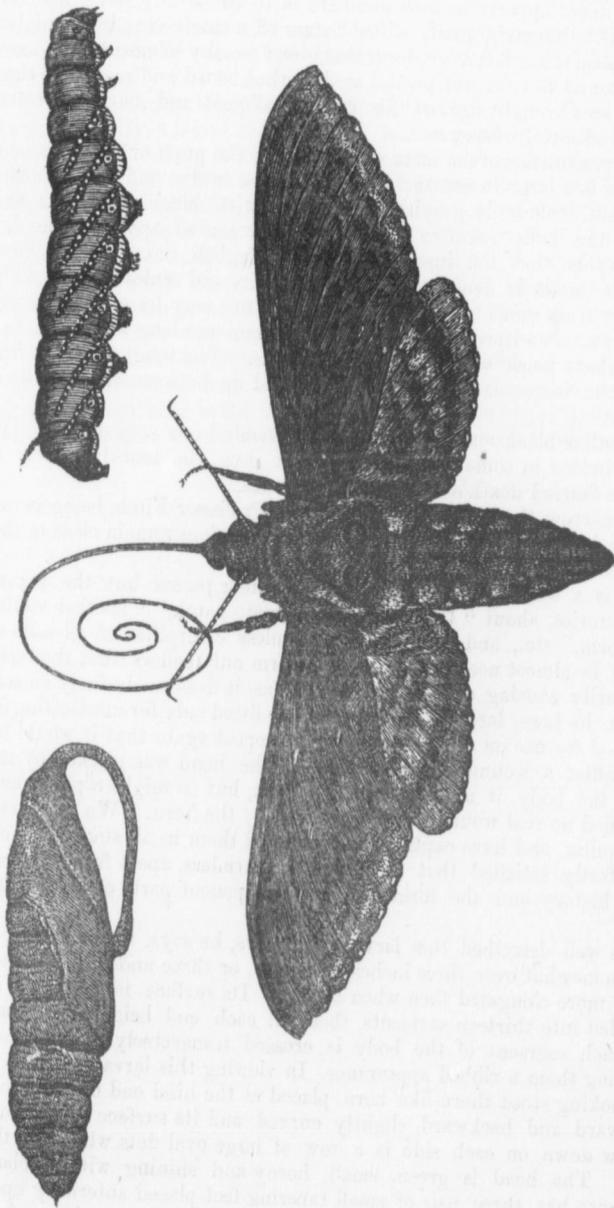
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5.—THE POTATO OR TOMATO WORM, (*Macrosila quinque maculata*, Hawthorn.)

Order—LEPIDOPTERA. Family—SPHINGIDÆ.

EATING THE LEAVES IN THE LARVAL STATE.

FIG. 83.



This common and well-known insect belongs to a family of moths called *Sphingidae* or "Hawk Moths," as they are more generally termed from their rapid mode of flight. The principal members of this family are large stout bodied moths with strong wide wings well adapted for swiftness. The larger ones are rarely seen during the day, but make their appearance at dusk or early evening, when they may be met with among the flower beds, darting about in search of food. The flight of one of these Hawk Moths has been so beautifully described by Mr. J. W. Douglas, the well-known English Entomologist, that we cannot refrain from quoting him: "Did you ever see a *Sphinx* fly? There is nothing to compare its motion to, except a flash of lightning. While you are looking at a flower in the twilight, between you and it glides a motion, a moving haziness, which is before you and yet conveys to your eye no definite image. Before you have half thought what it can be, you see the flower again distinctly, and rub your eyes, thinking there must have been some illusion, or possibly an unsteadiness of vision caused by the irritation of that gnat that was buzzing about your head; when, lo! the flower just beyond seems to shiver,—you move to see what is there, but there is a move before you, and a dim shadow flits away like a thought. Can it be anything real? Stand

still awhile; and now, in the increasing gloom, as you bend over the *Pelunias*, holding your breath, you see a darkness visible drop down before you, but its presence is better made

known by the humming caused by the rapid vibration of wings. Stir not, or this aerial body will float away. Now you see it deigns not to alight or touch the margin of the chalice, but, poising itself in air, stretches out its long tubular tongue, and quaffs the nectar at the bottom." The potato sphinx may be found in almost all parts of Ontario. The larva has a preference for tomato plants, if they are convenient, but in their absence will content itself with the leaves of the potato, which as we have already seen is a member of the same botanical family as the tomato. It never appears in such numbers as to cause any very material damage, although the larva will often strip nearly all the leaves off a single vine in one night; yet, from its great size and conspicuous form, we deem this insect worthy of notice, the more especially as we feel in duty bound to raise our protest against the absurd and malicious slanders that each recurring year sees brought against this much maligned and harmless caterpillar by ignorant persons and editorial wiseacres.

At Fig. 83 we give a representation of the larva or caterpillar, the pupa or chrysalis, and the perfect moth. The latter is a large insect measuring from five to five and a half inches across the wings. Its general colour is grayish, variegated with blackish streaks and bands, and on each side of the body are five round orange coloured spots surrounded with black, it is from these spots that the insect derives its English name of the "five spotted Sphinx." The whole moth is densely covered with hairs and scales which totally conceal the surface of the body from view. The head and thorax are very large, the eyes are especially remarkable for their size and prominence. The antennæ are long and thick, the extreme ends tapering into a sharp point which curves backwards. The tongue is some five or six inches long, and when the insect is at rest is kept coiled up between the two thick feelers or palpi.

The thorax has some peculiar black markings on it which remind one very much of the English Death's Head Moth, indeed in some specimens we have seen, the markings bear a most striking similarity to the fancied death's head and cross bones.

The wings are long and narrow, the hind ones, according to Professor Fitch, being twice, and the forward ones thrice as long as broad. When in repose, the wings remain close to the body, but slanting at somewhat sharp angles, like a house-roof.

The larva (see fig. 83) is a well known object; not a summer passes but the papers abound in most exaggerated stories, about "DEATH in the Tomato patch," "another victim POISONED by the Tomato worm," etc., and accusing this harmless caterpillar of all sorts of imaginary misdemeanors. It is almost needless for us to inform our readers that the larva is utterly incapable of voluntarily causing any harm; feeding as it does exclusively on soft leaves of the potato or tomato, its jaws, large as they appear, are fitted only for masticating its food, and are not at all adapted for use on a hard material, we repeat again that it would be impossible for the larva to inflict a wound with its jaws; if the hand was pricked by the spike on the anal segment of the body, it might pierce the flesh, but so might a pin or any sharp point, and we are satisfied no real wound could be caused by the horn. We have bred many specimens of this caterpillar, and have captured and handled them in all stages of their growth and are therefore perfectly satisfied that the insect is harmless, apart from the fact that our knowledge of their history and the formation and component parts of their body plainly corroborate our belief.

Professor Asa Fitch has well described this larva. It grows, he says, to the thickness of one's little finger, and is somewhat over three inches in length, or three and a half inches when crawling, it being then more elongated than when at rest. Its surface is destitute of hairs or bristles. It is divided into thirteen segments, those at each end being shorter and less distinct, the surface of each segment of the body is crossed transversely by impressed lines and elevated spaces giving them a ribbed appearance. In viewing this larva the eye first of all notices a formidable looking stout thorn-like horn placed at the hind end of the back, and projecting obliquely upward and backward, slightly curved and its surface rough from little projecting points. Low down on each side is a row of large oval dots which are the spiracles or breathing pores. The head is green, small, horny and shining with a black stripe on each side. The larva has three pair of small tapering feet placed anteriorly upon the breast, each having a sharp hook at its end, and four pairs of short, thick, fleshy pro-legs along the underside of the body with two similar ones at the tip. The colour of this worm is commonly bright green marked with white, along each side are seven straight oblique greenish yellow stripes, the last one of which is prolonged more or less distinctly to the base

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of the curved horn. The body is dotted with numerous greenish or yellowish white spots. This larva is liable to vary in its colours to a surprising extent. Many persons from noticing in their gardens or fields worms which are so totally dissimilar in their colours, imagine that there are two or three distinct species attacking their potatoes. The common colour is leek green; from this it varies to a lighter yellowish green, and on the other hand to various shades of darker brownish and blackish green. In other instances the green wholly vanishes and the worm is pale or deep amber brown, blackish brown, purplish black or pure black. In these brown and black varieties the head sometimes retains its normal green colour. The curved horn is, however, uniformly black. The larva grows rapidly and is a most voracious feeder, they usually reach their maturity during July and August. Their presence on the vines is generally first indicated to us by the large pellets of excrement which it drops, some of which frequently lodge in the forks of the stalks or adhere to the leaves. When fully matured the larva leaves the vines and buries itself in the ground, generally at the depth of several inches. Here it undergoes its transformation into the pupa or chrysalis form. This latter, see fig. 83, is of a bright, glossy, chestnut colour, and is particularly noticeable from its head or forward end being bent over and prolonged until it touches and firmly adheres to the breast, forming a loop somewhat after the fashion of the handle of a pitcher. This loop is merely the sheath of the tongue, whose length we have before alluded to. The pupa stays underground until the succeeding summer when being by the warmth of the sun fully matured the moth burst its pupa shell and forces its way upwards, and having reached the surface finds some convenient plant where it clings and remains until its wings are fully developed, and the twilight arouses it to fly in search of food. In the Southern States the tobacco suffers much from a very similar insect to the one we have just described. For both insects hand picking is the best remedy. The larva is particularly subject to the attacks of a small Ichneumon fly which helps to keep these insects in check.

INSECTS AFFECTING THE CABBAGE.

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

- | | |
|---|---|
| <p>1. The Rape Butterfly (<i>Pieris rapæ</i>, Linn).</p> <p>2. The Potherb Butterfly (<i>Pieris oleracea</i>, Harris).</p> <p>3. The Southern Cabbage Butterfly (<i>Pieris protodice</i>, Boisd).</p> | <p>4. The Zebra Caterpillar (<i>Mamestra picta</i>, Harris).</p> <p>5. The Cabbage Plusia (<i>Plusia brassicæ</i>, Riley).</p> <p>6. The Harlequin Cabbage-bug (<i>Strachia histrionica</i>, Hahn).</p> |
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1. THE RAPE BUTTERFLY (*Pieris rapæ*, Linn.).

LEPIDOPTERA—PIERIDÆ.

Though a considerable number of insects have long been known to affect the cabbage in this country, and have at times proved destructive in their ravages, yet it is only during the last few years that much alarm has been felt respecting their attacks, or that general attention has been directed towards them. This recent change in the amount of regard paid to cabbage insects has been occasioned by the arrival upon our shores of a European butterfly, whose ravages have long been a source of loss and annoyance to the gardeners of the mother land.

This new pest—the Rape Butterfly (*Pieris rapæ*)—was first observed by Mr. W. Couper at Quebec, in the year 1859; it had then, probably, been two or three years in the country. In 1863 Mr. G. J. Bowles, of Quebec, captured large numbers of specimens in the neighbourhood of that city, and the following year published an account of the occurrence of the insect in the *Canadian Naturalist and Geologist* (vol. i, new series, Aug. 1864, p. 258). Since then the new comer has increased and multiplied to a marvellous extent, spreading throughout the whole of the Province of Quebec, invading the eastern portion of Ontario, and extending into the neighbouring States and Provinces as far south as New Jersey. Everywhere it has proved excessively destructive to the cabbage crops, especially where they are cultivated in large quantities by market-gardeners, in the neighbourhood of cities and towns. So great, indeed, have been its ravages, that the Abbé Provancher, editor of *Le Naturaliste Canadien*,—an excellent magazine of natural history, published at Quebec,—has stated that it annually destroys more than \$240,000 worth of cabbages in and about that city. This is probably an over-estimate; yet even a fourth of the amount would be a very serious tax upon the gardening community of a single neighbourhood.

How this insect made its way across the Atlantic in safety, no one can positively say; but it may be reasonably conjectured that its eggs or larvæ were in some refuse cabbages or turnips thrown from an ocean steamship upon her arrival at Quebec, and that a supply of food chanced to be at hand for their sustenance. Once established, the species would soon spread, as it is very prolific, and its food is almost everywhere to be had in abundance. It feeds upon not only the leaves of different kinds of cabbages and cauliflower, but also upon those of turnips, nasturtium, mignonette, stocks, &c.



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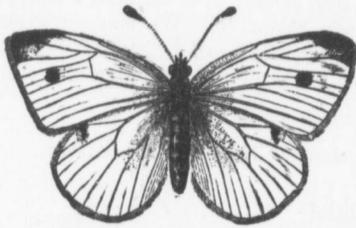
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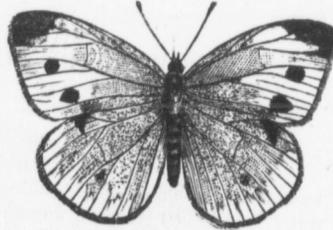
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FIG. 84.



The Rape Butterfly is a pretty black and white creature, measuring about two inches across its expanded wings. The male (Fig. 84) has only one black spot near the middle of each fore-wing, and a black dash at the tip; while the female (Fig. 85) has two black spots, and a similar black dash

FIG. 85.



at the tip of the fore-wings; both sexes have a black spot on the front margin of the hind wings. Occasionally specimens of the male are taken, of a pale yellow colour instead of white.

The butterfly, which emerges from the pupa state in early spring, lays its eggs shortly after its appearance, singly on the under-side of the leaves of the food-plant. From these are soon hatched out the larvæ,—tiny green caterpillars, which eat voraciously, and grow rapidly till they attain to a length of about an inch and a half. When full grown they are of a pale green colour, finely dotted with black, and have a yellowish stripe down the back, and another along each side (Fig. 86, *a*). Unlike the larvæ of several other species, this caterpillar attacks not only the comparatively worthless outer leaves, but bores down into the very heart of the plant, and thus renders the cabbages quite unfit for food. When ready to assume the pupa state, the creature leaves the plant upon which it has been feeding, and crawls away in search of some sheltered spot, such as the underside of a stone or plank, or projection of a fence or building. Here it suspends itself, with a silken girth around the middle, and a knot of silk at the tail, and turns into a yellowish or pale green chrysalis, speckled with black (Fig. 86, *b*). In this condition it remains for about a week, and then emerges as a perfect winged butterfly. A fresh batch of eggs is then laid, more caterpillars appear, and so the round of existence goes on. There are at least two broods in the year, and probably more; the last brood of the season spends the winter in the chrysalis state.

FIG. 86.



The remedies that may be employed for the purpose of keeping this pest in check, are very few in number, and by no means effectual. Paris green, that is employed with so much success against the Colorado Potato Beetle, and white hellebore, the specific for the Currant-worms, will destroy the Rape Caterpillars also, but with the decided disadvantage that the poison is sure to get inside the leaves of the cabbage-head, and to render the vegetable unfit for food. No one, certainly, would like to get rid of the caterpillars by providing "death in the pot" for himself and his family. There are other substances, however, such as the various compounds of cresylic acid, which are free from poisonous qualities, that may be used with advantage. The numbers of the foe may be further checked by catching and killing the butterflies as soon as they issue from the chrysalis, and before they lay their eggs for another brood. The chrysalis, also, should be searched for and destroyed. This is probably all that can be done in the way of artificial remedies.

When we can do so little ourselves to get rid of a pest, we turn anxiously to nature for a remedy. In Europe several parasites have long been known to attack this insect, and to keep it somewhat within bounds, but on this side of the Atlantic they were looked for by entomologist and gardener in vain. Very lately, however, the hoped-for friend made his appearance, in the shape of a tiny ichneumon—the *Pteromalus puparum*, of Linnæus—which has been observed in Vermont, at Boston, Mass., and Albany, N. Y. The credit of its first discovery in America is to be ascribed, we believe, to a young lad, son of a well known entomologist, Mr. P. S. Sprague, of Boston, Mass. He gathered, his father wrote us, about fifty chrysalids, every one of which was infested, as many as forty specimens of the parasite coming from a single one. This friendly insect is a tiny four-winged fly, about one-eighth of an inch long, with a golden-coloured body, and, in some cases, a brilliant green head. The female walks over the chrysalis, feeling with her antennæ for a suitable place for the insertion of her ovipositor, and when found, she drills a hole through which to lay her eggs; the process oc-

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cupies about a minute on an average. From the eggs soon emerge little maggots, which prey upon the substance of the chrysalis, and finally completely devour it. We may confidently expect now that the destructive powers of the Rape Caterpillar will soon be so much curtailed by this parasite that it will cease to be much dreaded by the growers of cabbage and cauliflower.

2. THE POTHERB BUTTERFLY (*Pieris oleracea*, Harris; *casta*, Kirby).

LEPIDOPTERA—PIERIDÆ.

Long before it was even imagined that the preceding destructive species would ever trouble us in this country, another member of the same genus of butterflies, the Potherb Pieris (*P. oleracea*, Harris), was known to Canadian entomologists as feeding upon the cabbage and other kindred plants. Though a native of this country, with plenty of its proper food within reach at all times, it is not at all an abundant species, and is not likely ever to prove a serious pest to the gardener. It is essentially a northern insect, seldom being found as far south as Pennsylvania, nor commonly anywhere in the United States south of Lake Ontario. It has been found in the Dominion, however, as far east as Nova Scotia, and west on Lake Superior; it has also been captured at Great Slave Lake in the far north-west. We have taken it ourselves occasionally, but rarely, at Cobourg, on Lake Ontario; on the shores of Lake Simcoe we have observed it in considerable numbers; at Collingwood, on Georgian Bay, both last summer and the previous one, we found it quite common; and we captured plenty of specimens of it at Sault Ste. Marie, and other points on Lake Huron.

This species may be at once distinguished from all our other butterflies by its pure white wings, free from all spots or markings on the upper surface; the under-side is also white, though occasionally tinged with yellow, and has the nervules more or less strongly marked with black scales. Some specimens are so entirely pure white, that they were considered by Kirby to be a distinct species, which he accordingly named *P. casta*; but there is now no doubt that his specimens were merely a variety of *P. oleracea*, which was first described by Dr. Harris in 1829. The wings of the insect expand about two inches; its legs and body are black.

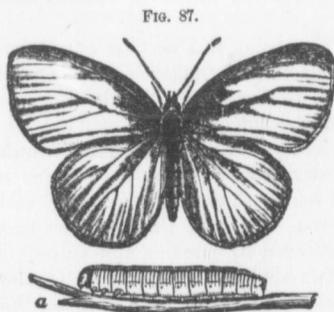


FIG. 87.

The annexed illustration (Fig. 87) represents the butterfly and the caterpillar (a). The latter is pale green, very minutely sprinkled with darker dots, and with a darker line along the back. When full grown, it measures about an inch and a quarter. From its colour it is not easily detected when feeding, being readily mistaken for one of the ribs of the leaf. When ready to assume the pupa state (Fig. 88), it leaves its food-plant, and crawls away to some retired spot; it suspends itself by the tail and a silken girth round the middle, in the same manner as the preceding species. The chrysalis is pale green or white, regularly and minutely spotted with black. In this condition it remains about ten days in summer, and then comes out as a butterfly; the autumn brood, however, remains in the pupa state all winter, there being two broods of caterpillars in each year. The original food-plant of the insect is unknown; it feeds, however, quite freely upon the leaves of cabbage, turnip, radish, mustard, and other plants of the same family.

As this species is so little troublesome, it is unnecessary to suggest any remedy. There is little doubt that its numbers are kept in check by some insect parasite.

3. THE SOUTHERN CABBAGE BUTTERFLY (*Pieris protodice*, Bois.)

LEPIDOPTERA—PIERIDÆ.

Besides the two species already described, we have yet another butterfly in Canada whose caterpillars feed upon the leaves of the cabbage and other kindred plants. It belongs to the

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same family and genus as the others, and resembles them in being a white insect with black markings. It is termed the Southern Cabbage Butterfly (*Pieris protodice*, Boisd.), because of its abundance and destructive powers in the more Southern States, while it is but seldom met with in the North. In this Province we sometimes capture specimens, but they are so rare that we look upon them as prizes, and eagerly add them to our collections.

The accompanying illustrations so well represent the insect in all its stages, that we need

FIG. 89.

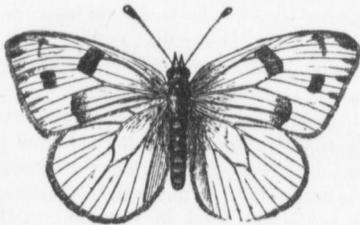
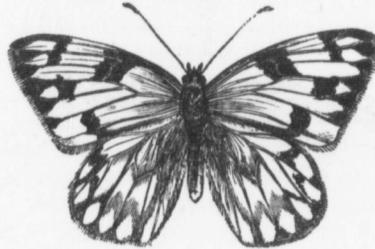
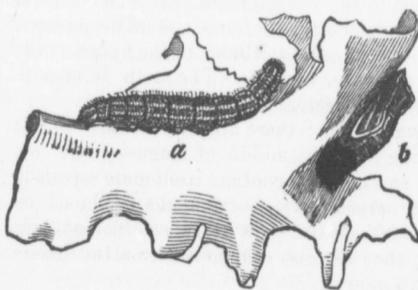


FIG. 90.



add but little by way of description. The colours of the butterflies, as above stated, are white and black. The male (Fig. 89) has but few black spots, while the female (Fig. 90) is very much darker from numerous black spots and markings.

FIG. 91.



The chrysalis (Fig. 91, b,) is of a light bluish-grey or green colour, speckled with black, and with its projecting parts edged with pale yellow or flesh-colour. The caterpillar (Fig. 91, a), varies in colour from deep indigo or purplish blue to pale blue and green. It has four longitudinal yellow stripes, and is covered with black dots. Like the other species, there are two broods in the year.

Though so rare, as we have stated, in Canada, it is yet frequently very destructive to the south of us. According to Mr. Riley, "it is the common white butterfly of Missouri, abounding in

many parts of the State, and sometimes fitting so thickly around the truck gardens near large cities, as to remind one at a distance of the falling of snow. It often proves exceedingly injurious, and I learn from a Mississippi exchange that 'there were last year thousands of dollars' worth of cabbages devastated and ruined by worms in the neighbourhood of Corinth.' I have often passed through cabbage-beds near St. Louis, and been unable to find a single perfect head, though few of the gardeners had any suspicion that the gay butterflies, which fitted so lazily from one plant to another, were the real parents of the mischievous worms which so riddled the leaves."

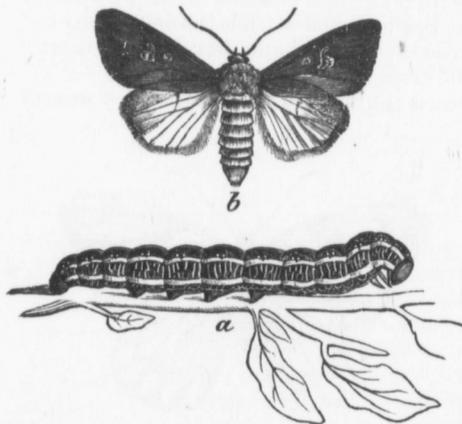
Mr. Scudder, of the Boston Society of Natural History, states that "this butterfly enjoys a wide geographical range, extending from Texas, on the south-west, Missouri on the west, and the mouth of the Red River of the North, on the north-west, as far as Connecticut and the Southern Atlantic States on the east."

4. THE ZEBRA CATERPILLAR (*Mamestra picta*, Harris.)

LEPIDOPTERA—APAMIDÆ.

Some of our readers have probably noticed upon their cabbages a very singularly marked, and, if they will acknowledge such a thing possible, beautiful caterpillar. It feeds openly upon the leaves, but when disturbed and rendered apprehensive of danger, it coils itself up

FIG. 92.



and remained in this condition till the following spring, when the perfect insect issued from the cocoon.

When changing to a chrysalis, it enters the ground, and forms a rough cocoon of particles of earth, united by silken threads; inside this the dark shiny brown chrysalis remains, hidden from view and sheltered from danger. The moth (Fig. 92, *b*), comes forth in early summer, and is quite a disappointing creature to those who have reared the gay, handsome caterpillar in expectation of something even more gorgeous in the winged state. It is not without beauty, however, though its colours are dull and inconspicuous; its forewings are deep brown, shaded with purple, and marked with paler spots in the middle, as shewn in the figure. The hind wings are white faintly edged with brown on the outer margin. The moth belongs to the nocturnal Lepidoptera, and is rarely seen except by collectors.

In the latitude of St. Louis Mo., Mr. Riley states that "there are two broods of this insect each year, the second brood of worms appearing from the middle of August along into October." He adds that he has noticed "that the spring brood confines itself more especially to young cruciferous plants, such as cabbages, beets, spinach, etc., but that the fall brood collects in hundreds on the heads and flower-buds of asters, on the snow-berry, on different kinds of honey-suckle, on mignonette, and on asparagus; they are also said to occur on the flowers of clover, and are quite partial to the common lamb's quarter."

These caterpillars are so bright and conspicuous that they can be easily detected on the plants, and destroyed by treading under foot. When quite young they herd together, and may be put an end to with ease; later on, they scatter and feed singly.

5. THE CABBAGE PLUSIA (*Plusia brassicae*, Riley.)

LEPIDOPTERA—PLUSIDÆ.

In the State of Missouri, and probably in many other localities, there occurs on the cabbage a voracious and destructive caterpillar, which has been reared and described by Mr. Riley (2nd Missouri Report, page 110,) under the name of the Cabbage Plusia (*P. brassicae*.) He gives the following account of it:—

"In the months of August and September the larva (Fig. 93 *a*) may be found quite abundant on the cabbage, gnawing large, irregular holes in the leaves. It is a pale green, translucent worm, marked longitudinally with still paler more opaque lines, and, like all the known larvæ of the family to which it belongs, it has but two pair of abdominal prolegs, the two anterior segments, which are usually furnished with such legs in ordinary caterpillars, not having the slightest trace of any. Consequently, they have to loop the body, as represented in the figure, and are true 'span-worms.' Their bodies are very soft and tender, and as they live exposed on the outside of the plants, and often rest motionless, with the body arched, for hours at a time, they are espied and devoured by many of their enemies, such as birds, toads

and drops to the ground. When full grown (Fig. 92, *a*), it is about two inches long, of a velvety black colour, with a red head and legs, and two yellow stripes along each side; between these stripes are numerous irregular cross lines of yellow, which are so striking as to have caused Dr. Melsheimer to give the creature the name of the Zebra Caterpillar (*Mamestra picta*). It feeds not only upon cabbage and cauliflower, but also upon spinach, beets, lettuce, and other garden vegetables. It is probable that in this country, as well as in the United States, there are two broods in the year. We have found the moth at different times during the summer, and the caterpillars we have taken on cabbages as late as the first week in October; in this case it very soon turned into the pupa state,

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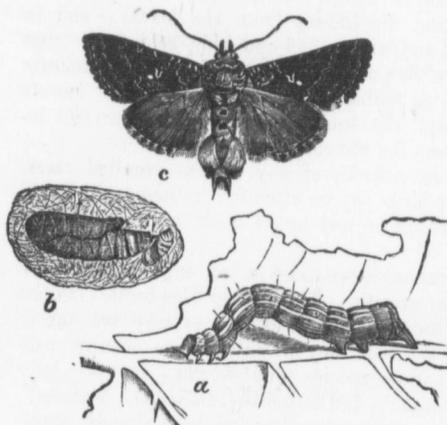
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FIG. 93.



bristles, by the aid of which it is enabled to cling to its cocoon.

"The moth is of a dark smoky-gray, inclining to brown, variegated with light grayish-brown, and marked in the middle of each front wing with a small oval spot and a somewhat U-shaped silvery white mark, as in the figure. The male (Fig. 10 c) is easily distinguished from the female by the large tuft of golden hairs, covering a few black ones, which springs from each side of his abdomen towards the tip."

Mr. Riley recommends drenching with a cresylic wash as an effectual remedy for this insect. We have not met with the species in Canada, but have thought it as well to give Mr. Riley's account of it to our readers.

6. THE HARLEQUIN CABBAGE-BUG (*Strachia Histrionica*, Hahn.)

HEMIPTERA—SCUTELLERIDÆ.

Though several of the cabbage insects that we have already described are bad enough as regards their destructive powers, the creature that we have now come to is said to exceed them all in its noxious qualities. Happily, it is a southern insect, and is not likely to trouble us very much in this Province. It is called the Harlequin Cabbage-Bug (*Strachia histrionica*, Hahn) from the gay appearance it presents with its bright black and yellow colours.

Dr. Lincecum, of Texas, has thus described its operations in the *Practical Entomologist* (vol. I. page 110):—

"The year before last (1865) they got into my garden, and utterly destroyed my cabbage, radishes, mustard, seed turnips, and every other cruciform plant. Last year I did not set any of that order of plants in my garden. But the present year, thinking they had probably left the premises, I planted my garden with radishes, mustard, and a variety of cabbages. By the first of April the mustard and radishes were large enough for use, and I discovered that the insect had commenced on them. I began picking them off by hand and tramping them under foot. By that means I have preserved my 434 cabbages, but I have visited every one of them daily now for four months, finding on them from thirty-five to sixty full-grown insects every day, some coupled and some in the act of depositing their eggs. Although many have been hatched in my garden the present season, I have suffered none to come to maturity; and the daily supplies of grown insects that I have been blessed with are immigrants from some other garden.

FIG. 94.



"The perfect insect [Fig. 94 represents it with wings closed; fig. 95 with wings expanded.] lives through the winter, and is ready to deposit its eggs as early as the 15th of March, or sooner, if it finds any cruciform plant large enough. They set their eggs on end in two rows, cemented together, mostly on the underside of the leaf, and generally from eleven to twelve in number. In about six days in April—four days in July—there hatches out from these eggs a brood of

FIG. 95.



etc. They are also subject to the attacks of at least two parasites, and die very often from disease, especially in wet weather; so that they are never likely to increase quite as badly as the butterflies.

"When full grown this worm weaves a very thin loose white cocoon, sometimes between the leaves of the plant on which it fed, but more often in some more sheltered situation, and changes to a chrysalis (Fig. 93 b) which varies from pale yellowish green to brown, and has a considerable protuberance at the end of the wing and leg cases, caused by the long proboscis of the enclosed moth being bent back at that point. This chrysalis is soft, the skin being very thin, and it is furnished at the extremity with an obtuse, roughened projection which emits two converging points, and several short curved

larvæ resembling the perfect insect, except in having no wings. This brood immediately begins the work of destruction by piercing and sucking the life-sap from the leaves; and in twelve days they have matured. They are timid, and will run off and hide behind the first leaf-stem, or any part of the plant that will answer the purpose. The leaf that they puncture immediately wilts, like the effects of poison, and soon withers. Half a dozen grown insects will kill a cabbage in a day. They continue through the summer, and sufficient perfect insects survive the winter to insure a full crop of them for the coming season.

"This tribe of insects do not seem liable to the attacks of any of the cannibal races, either in the egg state or at any other stage. Our birds pay no attention to them, neither will the domestic fowls touch them. I have, as yet, found no way to get clear of them, but to pick them off by hand."

Besides the foregoing insects, to which our cabbages are more or less exposed, there are others which attack them at various stages of their growth. The Turnip Flea-beetle (*Haltica striolata*), for instance, attacks the seed-leaves of the plant almost as soon as they are out of the ground; when a fair size, and planted out in the beds they are intended to occupy, cabbages are very frequently cut off in the night by various species of cut-worms (*Agrotis*); later on they are attacked at the root by wire-worms (*Elater*), and maggots (*Anthomyia brassicæ*); and on the leaves by plant-lice (*Aphides*), and the various caterpillars we have already enumerated. Taken altogether, we may be inclined to feel the same surprise that any of them ever grow up and attain to maturity, as some timorous old maids do with regard to mischief-loving, heedless boys! However, they do escape in sufficient numbers apparently to satisfy the requirements of the human race, and we may well "eat and be thankful."

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INSECTS ATTACKING THE CUCUMBER, MELON, PUMPKIN AND SQUASH.

By E. B. REED, LONDON ONT.

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| <p>1. The Squash-vine Borer (<i>Ægeria Cucurbitæ</i>, Harris.)</p> <p>2. The Squash Bug (<i>Coreus tristis</i>, De Geer.)</p> | <p>3. The Striped Cucumber Beetle (<i>Diabrotica vittata</i>, Olivier.)</p> <p>4. The Cucumber Flea Beetle (<i>Haltica cucumeris</i>, Harris.)</p> |
|---|--|

The plants above named, whose insect enemies we are about to describe, belong to a family known in Botany as the *Cucurbitaceæ* or Gourd family. It does not include in its limits a very large number of genera, but most of them being familiar to us in garden, or field, we trust that our readers will not object to learn some few facts regarding the natural history of the various insects that more commonly affect the growth of these vines, which, to almost every person in this country at any rate, are, in their respective seasons an object of interest, whether it be the pretty little *Mock-orange* ornamenting, with its climbing tendrils and bright-coloured fruit, our arbours and cottage walls; the esculent *Cucumber*, that mysterious emblem of coolness, but rightly surnamed the "Nemesis of vegetables"; the fragrant and delicious *Melon*; the thirst-assuaging *Water-melon*; the gigantic *Pumpkin*; or the mammoth *Squash*, the pride of the agriculturist and source of much joy and comfort to his cattle.

1. THE SQUASH-VINE BORER (*Ægeria Cucurbitæ*, Harris.)

Order, LEPIDOPTERA; family, ÆGERIADÆ.

The *Ægerians*, or "Clear-wings" as they are popularly termed, are a very curious tribe of moths. The greater part of their wings is devoid of scales, and is as transparent as the membranous wings of a bee or a fly. They are still futher remarkable for their extraordinary resemblance to insects of other orders—bees, wasps, hornets, etc. They are true lovers of flowers and sunshine, and flying only in the day-time they may frequently be seen reposing on some leaf enjoying the warmth of the sun's rays and expanding and contracting the curious little brush or fan of hairs at the end of their body. Their habits in the larval state are quite different from those of the *Sphingidæ*, the latter, as we have seen in the Potato and Plum *Sphinges*, living exposed upon the leaves of their food-plants, while the caterpillars of the *Ægerians* conceal themselves in the stems or roots of plants, and feed on the wood or pith.

During the summer our Squash and other similar vines often seem troubled with some disease which kills the plant. A little examination discloses the presence of a small borer, which has commenced its operations in the larval state, and has eaten out the interior of the stem close to the ground. This is the larva of the Squash-vine borer (*Ægeria Cucurbitæ*) Fig. 96. The full grown larva is about an inch in length. It is fleshy, soft, and of a transparent whitish colour, tapering at each extremity. The head is retractile, small, and of a brown colour. The larva has more the appearance of a maggot than a true caterpillar, the prolegs being wanting; but their loss is replaced by double rows of hooks beneath each segment, which enable the larva to proceed up and down its tunnels in the pith of the plant with the greatest ease and facility.



When fully matured the larva leaves the plant and seeks shelter beneath the earth, where

it forms an oblong oval cocoon of a gummy substance, covered with particles of earth and portions of the stalks of the vines, and here awaits transformation into a chrysalid. Fig. 97 gives a representation of one of these cocoons with the chrysalid inside it. According to Dr. Harris, the chrysalid is of a shining bay colour, and the edges of the abdominal segments are armed with transverse rows of short teeth. By means of these little teeth, the chrysalid

FIG 97.



just before it is about to be transformed to a winged insect, works its way out of the cocoon, and the shell of the chrysalis is left half emerging from the orifice after the moth has escaped from it. The perfect moth (Fig. 98) is a very pretty object. Its body,

FIG 98.



which is about half-an-inch in length, is orange coloured or tawny, with four or five black dorsal spots. The forewings are opaque olive brown, and expand about one inch and a quarter. The hind wings are quite transparent, except the margins. The hind legs are densely fringed with long orange-coloured and black hairs. The moth deposits its eggs on the vines, close to the roots. It should be caught and destroyed whenever practicable. Search should also be made for the eggs, or when any plant appears to droop, the larva should be sought for, and, if possible, killed.

2. THE SQUASH BUG (*Coreus tristis*, De Geer).

Order, HEMIPTERA; Family, CORISLÆ.

FIG. 99.



This common and well known insect is very destructive to squashes. Its habits have been so well described by the late Dr. T. D. Harris, that for the benefit of our Canadian agriculturists we have quoted him at some length. Fig. 99 represents the insect.

About the last of October squash-bugs desert the plants upon which they have lived during the summer, and conceal themselves in crevices of walls and fences, and other places of security, where they pass the winter in a torpid state. On the return of warm weather, they issue from their winter quarters, and when the vines of the squash have put forth a few rough leaves, the bugs meet beneath their shelter, pair, and immediately afterwards begin to lay their eggs. This usually happens about the last of June or the beginning of July, at which time, by carefully examining the vines, we shall find the insects on the ground, or on the stems of the vines close to the ground, from which they are hardly to be distinguished on account of their dusky colour. This is the place where they generally remain during the daytime, apparently to escape observation; but at night they leave the ground, get beneath the leaves, and lay their eggs in little patches, fastening them with a gummy substance to the under-side of the leaves. The eggs are round, and flattened on two sides, and are soon hatched. The young bugs are proportionally shorter and more rounded than the perfect insects, are of a pale ash colour, and have quite large antennæ, the joints of which are somewhat flattened. As they grow older and increase in size, after moulting their skins a few times, they become more oval in form, and the under-side of their bodies gradually acquires a dull ochre-yellow colour. They live together at first in little swarms or families beneath the leaves upon which they were hatched, and which, in consequence of the numerous punctures of the insects, and the quantity of sap imbibed by them, soon wither, and eventually become brown, dry and wrinkled, when the insects leave them for fresh leaves, which they exhaust in the same way.

As the eggs are not all laid at one time, so the bugs are hatched in successive broods, and consequently will be found in various stages of growth through the summer. They, however, attain their full size, pass through their last transformation, and appear in their perfect state, or furnished with wing-covers and wings, during the months of September and October. In this last state the squash-bug measures six-tenths of an inch in length. It is of a rusty black colour above, and of a dirty ochre-yellow colour beneath, and the sharp lateral edges of the abdomen, which project beyond the closed wing-covers, are spotted with ochre-yellow. The thin over-lapping portion of the wing-cover is black, the wings are transparent, but are dusky at their tips, and the upper side of the abdomen, upon which the wings rest when not in use, is of a deep black colour, and velvety appearance. On the back part of the head of this bug, and rather behind the eyes, are two little glassy elevated spots, which

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are called eyelets, and which are supposed to enable the insect to see distant objects above it, while the larger eyes at the sides of the head are for nearer objects around it. When handled, and still more when crushed, the squash-bug gives out an odour precisely similar to that of an over-ripe pear, but far too powerful to be agreeable. In order to prevent the ravages of these insects, they should be sought and killed when they are about to lay their eggs; and if any escape our observation at this time, their eggs may be easily found and crushed. With this view, the squash vines must be visited daily during the early part of their growth, and must be carefully examined for the bugs and their eggs. A very short time spent in this way every day, in the proper season, will save a good deal of vexation and disappointment afterwards. If this precaution be neglected or deferred until the vines have begun to spread, it will be exceedingly difficult to exterminate the insects, on account of their numbers; and if at this time dry weather should prevail, the vines will suffer so much from the bugs and the drought together as to produce but little if any fruit. Whatever contributes to bring forward the plants rapidly, and to promote the vigour and luxuriance of their foliage, renders them less liable to suffer by the exhausting punctures of the young bugs. Water drained from a cow-yard, and similar preparations, have been, with this intent, applied with benefit.

The pumpkin vines are also much affected by the squash-bug. Various remedies have been tried. For gardens and places adjacent to the house, the application of soap-suds has been tried with good effect. A very good plan is to leave chips or wilted leaves on the ground among the vines; the bugs retire under these after feeding at night, and may be gathered easily and destroyed in the daytime.

3. THE STRIPED CUCUMBER BEETLE (*Diabrotica vittata*, Olivier).

Order, COLEOPTERA; Family, CHRYSOMELIDÆ.

This beetle is very destructive to the cucumber, melon and squash, attacking the roots and boring the lower part of the stem in the larval or caterpillar state, while the perfect beetle feeds on the tender leaves of the young plants, and damages the buds and young shoots of later growth. It belongs to the leaf-eating beetles, like its congener, the 3-lined potato-beetle, whose history we have given in the earlier portion of this Report.

It is exceedingly common, both in Ontario and the United States; and in the latter country, Mr. C. V. Riley estimates that it destroys annually thousands of dollars' worth of cucurbitaceous vines.

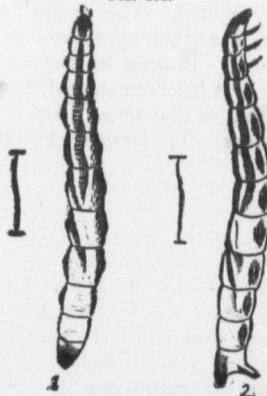
FIG. 100.



It is the only boring beetle that attacks these plants, and must not be confounded with a very similar insect of the same family, the 12-spotted *Diabrotica*, *Diabrotica 12-punctata*, Fabr (Fig. 100), which is often found feasting on the rind of melons, cucumbers and squashes.

The parent beetles of the "Striped Bug," as it is commonly called, make their appearance very early in the season, as soon as the young seed-leaves of the vines are above-ground, and even penetrate the earth in search of the sprouting seeds. After pairing, the female deposits her eggs near the roots of the vines. In due course of time these are hatched, and produce little whitish worms, which grow to about one-third of an inch in length, and as thick as a good-sized pin. Their heads and last segment of the body are dark and horny. The annexed cut (fig. 101) gives a highly magnified view of these larvæ,—No. 1 shewing the back, and No. 2 the side views; the hair lines at the side give the true dimensions of the larvæ. Dr. Henry Shimer, who has thoroughly worked up the history of this pest, states "that in June and July the grub eats the bark, and often perforates and hollows out the lower portion of the stem, which is beneath the ground, and the upper portion of the root, and occasionally, when the supply below fails, we find them in the vine, just above the ground." The larva arrives at maturity in about a month after the egg is laid." When full grown, the larvæ descend into the earth, and form little cavities, where they transform into the pupal state. The pupa is rather less

FIG. 101.



than a fifth of an inch in length, of a whitish colour, and the extremity of the abdomen ending

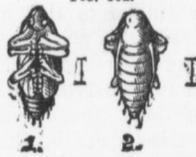


FIG. 102.

in two longish spines. Fig. 102 represents the front and back view of the pupa enlarged. After remaining in this condition about a fortnight, the perfect beetle is matured, and after a short period works its way out of the cell, and seeks the light of day.



FIG. 103.

Colours—Yellow and black.

The beetle (fig. 103) is about one quarter of an inch long. Its colour is a bright yellow, with a black head and broad stripes of black on the wing covers. The underside of the abdomen and the feet are black. There are, at least, three successive broods in each year. The last brood hibernates in the pupal state. Dr. Shimer has found the larvæ boring in the muskmelon and squash vines as late as October 1st. Dr. Harris states "that great numbers of these little beetles may be obtained in the autumn from the flowers of squash and pumpkin vines, the pollen and germs of which they are very fond of. They get into the blossoms as soon as the latter are opened, and are often caught there by the twisting and closing of the top of the flower, and when they want to escape they are obliged to gnaw a hole through the side of their temporary prison."

Various means have been suggested to prevent the ravages of these beetles, but the best remedy both for this and the cucumber flea beetle is to cover the young vines with boxes open at the bottom and covered on the top with millinet. Such boxes can be obtained at a very low cost. Sprinkling the vines with Paris green and flour, as for the potato bug, is also recommended.

4. THE CUCUMBER FLEA BEETLE (*Haltica cucumeris*, Harris).

Same order and family as the preceding.

This is another member of the leaf-eating family of beetles, and derives its popular name of Flea Beetle from its active jumps, for which it is peculiarly fitted by the great size of the hind thighs. Fig. 104 shews the perfect insect, the hair line at the side giving the true size.



Dr. Harris, who originally described it, says, "that it is only one-sixteenth of an inch long, of a black colour, with clay yellow antennæ and legs, except the hindmost thighs, which are brown. The upper side of the body is covered with punctures which are arranged in rows on the wing cases; and there is a deep transverse furrow across the hinder part of the thorax." These beetles do not confine their attacks to the cucumbers and melons, but feed on various other plants, including, as we have seen, the potato.

The larvæ burrow into the leaves, and eat out the soft, juicy pulp under the skin, making winding passages through the centre of the leaf, and thus causing considerable damage. They are little, slender grubs, tapering at each end. The perfect beetles nibble little holes in the leaf, which become thus materially affected in proportion to the extent of the attack. In some of the Western States whole fields of potatoes are often very badly injured. The beetles conceal themselves during the winter in some dry sheltered spot, and make their appearance early in the spring. There are several broods of them during the season. Bearing as they do a close relationship to the English Turnip Flea Beetle *H. nemorum*, it has been suggested that watering the leaves with a solution of lime might have a good effect, as that remedy has long ago been employed in England with great benefit to the turnip crops. The larvæ are believed to go underground to enter the pupal state.