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AND

PREPARED FOR

*President of the*

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*Head Master of*

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PRINTED

ANNUAL REPORT  
OF THE  
**ENTOMOLOGICAL SOCIETY**  
OF ONTARIO,

FOR THE YEAR 1875.

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

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

BY

**WILLIAM SAUNDERS,**

*President of the Entomological Society of Ontario; Editor of the Canadian Entomologist;*

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

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

AND

**R. V. ROGERS,**

*Barrister, &c., Kingston, Ontario.*

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Printed by Order of the Legislative Assembly.

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1876.

ENTOMOLOGICAL SOCIETY

Actias luna.....  
American Silkworm...  
Anisopteryx pometari  
    "    vernata  
Annual Address.....  
Annual Meeting.....  
Anthomyia ceparum...  
Apple Tree Blight....  
Army Worm.....

Bruchus pisi.....

Cabbage Butterfly.....  
Caloptenus spretus...  
Calosoma calidum....  
    "    scrutator.....  
Cambridge Entomologi  
    of.....  
Canker Worms, on....  
Clisiocampa Americana  
    "    sylvatica...  
Common Insects, on so

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Deilepoia bella.....  
Drasteria erichtea.....  
Doryphora decemlineata

**E**

Entomological Club of th  
    ciation.....  
Eudryas grata.....  
Eumenes fraterna.....  
Exorista leucania.....

**F**

Financial Statement.....

**G**

Gooseberry Saw-fly.....  
    "    Worm.....

**L**

Leucania unipuncta.....  
Locusts as an article of fr  
    "    in the Western S  
    "    Means for subdui  
London Branch, annual r  
    "    "    Report  
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ENTO

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PREPARED FOR

*President of the*

*Head Master of*

REPORT OF

*To the Honourable*

SIR,—I have the honour to acknowledge the receipt of your letter of the 10th inst. in relation to the report of the Committee on the subject of the receipts and expenditure of the office of the Head Master of the School of the University of Toronto. In accordance with the instructions of the Council of the University, I have the pleasure to forward to you herewith a copy of the report of the Committee, which will be found in the enclosed volume.

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REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO FOR THE  
YEAR 1875.

*To the Honourable the Commissioner of Agriculture.*

SIR,—I have the honour to submit for your consideration the Report of the Entomological Society of Ontario for the year 1875, in which you will find a detailed statement of the receipts and expenditures for the year, all of which have been duly audited. I also submit a list of the office-bearers elected for the year 1876.

In accordance with the provisions of the Statute, the annual meeting of the Society was

held at the City of Ottawa, at the time of the Exhibition of the Agricultural and Arts Association, when the Reports of the officers were presented and approved of.

With the view of carrying out the design of the Department in endeavouring to advance the knowledge of practical entomology, especially in its bearings on Agriculture and Horticulture, the members of the Entomological Society submit herewith the Annual Report on some of the noxious, beneficial and common insects found throughout this Province.

The organ of the Society, *The Canadian Entomologist*, is still issued regularly on or about the 15th of each month, each number containing twenty pages 8vo. It has now nearly reached the close of its seventh volume, and fully sustains its reputation as a valuable scientific journal. Being almost entirely filled with original matter, it has during the past seven years been the means of disseminating a vast amount of scientific knowledge relating to Entomology, and thus doing much towards furthering the interests of this important department of natural history.

The pages of this Report will be found illustrated with a number of excellent woodcuts and electrotypes, many of which are entirely new, some having been especially engraved for this Report. The expensive character of this work has prevented us from illustrating as profusely as we would have wished, for we are persuaded that such figures add greatly to the usefulness and attractiveness of our Reports.

I have the honour to remain, Sir,  
Your obedient servant,  
J. H. McMECHAN,

*Secretary-Treasurer Entomological Society of Ontario.*

London, Ontario, November, 1875.

### ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The fifth annual meeting of the above Society was held in the Court House, in the City of Ottawa, on the 22nd day of September, 1875, at 3 p.m. The reports of the officers were read, and a copy of the President's address promised to be placed at the disposal of the Printing Committee for publication.

The following officers for the ensuing year were then elected:—

*President.*—W. Saunders, London.

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

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

*Council.*—Wm. Couper, Montreal; R. V. Rogers, Kingston; J. Pettit, Grimsby; J. M. Denton and E. Baynes Reed, London.

*Editor of Entomologist.*—W. Saunders.

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

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

*Committee on Centennial Exhibition.*—W. Saunders, Rev. C. J. S. Bethune, J. H. McMechan.

*Auditors.*—G. Geddes, Chas. Chapman, London.

The Library Committee reported the purchase of a number of valuable books for the Society's Library during the past year.

### FINANCIAL STATEMENT OF THE SECRETARY-TREASURER.

#### *Receipts.*

To Balance from previous year.....	\$422 16
“ Government Grant towards Illustrations for Report.....	100 00
“ Annual Grant for 1875 .....	750 00
“ Members' Fees .....	127 05
“ Sales of cork, pins, &c., to members .....	46 34
	\$1,445 55

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*Disbursements.*

By CANADIAN ENTOMOLOGIST, printing and paper.....	\$533 91
“ Engravings for Report.....	134 64
“ Expenses of Report .....	120 00
“ Editor's salary .....	100 00
“ Secretary-Treasurer's salary.....	50 00
“ Expenses, sundry small .....	26 53
“ Rent .....	80 00
“ Insurance.....	10 63
“ Library.....	107 51
“ Advanced Centennial Fund .....	50 00
“ Balance on hand.....	232 33
	\$1,445 55

We certify the above as a correct statement of accounts for the year ending September 22nd, 1875, of the Treasurer of the Entomological Society of Ontario, as shown by the books and vouchers.

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

REPORT OF THE COUNCIL.

At the close of this the fifth year of the existence of our Society, it is our pleasing duty to bear testimony to the fact that it still sustains its well-earned reputation. A knowledge of insects and their habits, which it is the special object of our Society to advance, is now generally recognised as of great value to the farmer, fruit grower and others; and in view of the immense destruction insects entail, the money value of such knowledge, where it enables the cultivator of the soil to combat successfully the ravages of these formidable foes, is a matter of no small moment.

Branches of our Society are still in active existence in London, Kingston and Montreal, where they are doing much to advance the interests of our favourite study. The members of our Montreal branch have been particularly active during the past year, as will be seen from the Reports of their officers herewith submitted, and they have individually furnished many interesting papers for the Entomologist on the insects found in their district.

A request having been made that our Society should prepare a collection of Canadian Insects for the Centennial Exhibition to be held in Philadelphia during the coming year, and a grant sufficient to cover a portion of the expense having been recommended, we are gratified to know that our members have entered most heartily into the work, and many of them have placed their entire collections at the disposal of the Committee appointed to make the selection of specimens. We doubt not but that this collection will be a most interesting feature in the Canadian Department of the Exhibition, and will be in every way worthy of our Society and country.

During the past year death has deprived us of one of our esteemed honorary members, the first elected by this Society, and one who has generously donated to our Society's cabinets many objects of interest, and contributed to our Journal many valuable papers. We allude to the late Francis Walker, of the British Museum. One of our valued American contributors has also passed away, Mr. Philip L. Sprague, of Boston, Mass. Brief obituary notices of both will be found in the Report.

At the meeting of the Entomological Club of the American Association for the Advancement of Science, recently held at Detroit, our Society was represented by Mr. W. Saunders, Editor of the ENTOMOLOGIST. Many interesting facts in reference to insect life were elicited at the various meetings held by the Club, and some important conclusions arrived at affecting the welfare of Entomology. An account of these meetings will be given elsewhere.

The publication of the organ of the Society, the CANADIAN ENTOMOLOGIST, is still

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## ANNUAL MEETING OF THE MONTREAL BRANCH.

The second annual meeting of the Montreal Branch of the Entomological Society of Ontario was held on May 4th, 1875, when the following officers were elected for the ensuing year:—

G. J. Bowles, President; Alexander Gibb, Vice-President; C. W. Pearson, Secretary-Treasurer; G. B. Pearson, Curator; W. Couper, M. Kollmar, T. B. Caulfield, Council.

The Reports of the Council and Secretary-Treasurer were read and adopted. The Branch is progressing steadily, and our list of membership is increasing. During the past year working expenses have all been paid, leaving a balance on hand; a number of papers have been read, and the exhibitions of local and exotic rarities were exceedingly good. The Branch holds its meetings in the rooms of the Montreal Natural History Society, University Street. All business communications to be addressed to C. W. Pearson, the Burland Desbarats Company, Montreal, P. Q.

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

Your Council, in presenting their second Annual Report, have great pleasure in stating that the Branch has progressed steadily since its first meeting in August, 1873. During the past year eight new members were elected, making the total number of twenty, one of whom has since gone to Europe.

The papers read during the year are as follows:—

"Notes on the Larva of *Leucania pseudargyria* Gueneé," by F. B. Caulfield; "On a Dipterous Insect Destroying the Roots of Cabbage," by Wm. Couper; "Notes of Some Species of the Genus *Graptia*, found in the Vicinity of Montreal," by F. B. Caulfield; "On Tineidae," by Wm. Couper; "On Tineidae," by F. B. Caulfield; "A List of the Bombycidae of Quebec," by G. J. Bowles; "On the Catocalidae Occurring in the Vicinity of Montreal," by C. W. Pearson; "A List of the Diurnal Lepidoptera Occurring on the Island of Montreal," by F. B. Caulfield; "On the Usefulness of Spiders," by J. G. Jack; "A List of Spingidae Occurring on the Island of Montreal," by F. B. Caulfield.

The monthly meetings were fairly attended, and the exhibitions of Entomological material conspicuously illustrated the energy of the members in accumulating rare insects from various localities. The Branch having decided to hold their meetings in future in the rooms of the Montreal Natural History Society, it was found necessary to change the night of meeting from the first Wednesday to the first Tuesday in each month, and in order to meet the extra outlay for rental, it was decided to make the subscription twenty-five cents a month, which the Council presume will suffice for present emergencies. On the 1st of last July the members proceeded to Chateauguay Basin for a field day. The members were the guests of Mr. R. Jack, of Hillside, who treated them with true hospitality.

Your Council have ordered *Psyche*, a useful Entomological publication issued in Cambridge, Mass.

A suggestion made by your Council last year, that note books should be carried by members, has, in this instance, been fruitful in producing valuable lists and data of the occurrence of insects in our neighbourhood, and we trust that some of our members will devote their leisure this season to the much-neglected orders of Hemiptera, Neuroptera and Diptera.

All of which is respectfully submitted.

WM. COUPER, Chairman.

G. J. BOWLES.  
C. W. PEARSON.

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## ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1875.

*To the Members of the Entomological Society of Ontario:—*

GENTLEMEN,—For the fifth year in succession I find myself called upon, as your President, to address a few words to you on the condition of our Society, and on the subject of Entomology in general.

GEDDES,  
Secretary-Treasurer.

With regard to the Society, you have already learnt, from the satisfactory Reports of the parent organization and its various branches, that it continues to go on prospering in a quiet, unostentatious way. While there has been no marked increase to our list of members during the past year, and no performance of any work of unusual importance, yet it is a matter of congratulation that we have no falling off, either in numbers or resources, to deplore. Much of the inactivity in Entomological matters that has been apparent in this country during the past year may no doubt be ascribed to the prevalent "hardness of the times," which has occasioned—even to those least affected by it—much anxiety of mind, conjoined very often with increased absorption in the cares of business, or in the labours necessary for obtaining a livelihood. As you are well aware, we have in Canada but very few persons of assured wealth who are able, as in older and richer countries, to devote their abundant leisure to literature, art or science. Consequently, the condition of things in the world about us deprives most of our members of the leisure, if not also of the inclination, requisite for the successful pursuit of Entomology in any of its various phases. Before another season opens upon us, however, we have reason to believe that the worst of the present financial storm will be over, and that renewed confidence and prosperity throughout the country will remove the gloom and dulness now oppressing almost every department of work among us. With a revival of business, we may assuredly look for a restoration of activity in scientific pursuits, and hope that our Society, in common with others of a kindred character, may be distinguished by large accessions to its numbers, and by increased work in all its departments.

Last year, at our annual meeting, I took the opportunity of calling your attention to many fields of Entomological labour that are now all but unexplored in this country. May I repeat that there is ample scope for the exertions of all our members, whether they care only to form collections of specimens, or prefer to devote their labours to the unfolding of the life histories, or the study of the classification of insects? There is plenty of work remaining to be done, even in the favourite orders of Lepidoptera and Coleoptera, to say nothing of the others that are not so generally studied or collected. It would be a valuable contribution to our store of knowledge were lists of the Canadian species of all orders of insects to be formed and presented to the Society for publication, and at the same time a revision made of those published some years ago.

But not only is there scientific work of this kind to be performed, which will require generations for its complete achievement; there comes before us at the present moment an extraordinary object for accomplishment during the approaching winter. I allude to the representation of the Society by means of a collection of Canadian insects at the approaching Centennial Exhibition at Philadelphia. You will all, I think, agree with us in the belief that it is a matter of great importance to the Society that it should be brought in this way before the notice of the world, and that it cannot but be of some benefit to the Dominion that its natural history, as well as its industrial resources, should be fully exhibited. The Council of the Agricultural and Arts Association have already, on our behalf, brought the matter before the Commissioners appointed by the Government, and we understand that a sum of money will be provided to aid us in the satisfactory performance of the work. To gather together a fitting collection of insects, and to prepare them for exhibition, is a task that will strain to the utmost all the resources of the Society. We have commenced the work, relying upon the co-operation of you all, and now we trust that every one will help us by the loan of specimens, and any other aid that can be afforded. The Society is committed to the task; let us see to it that there be no failure.

Before turning from matters immediately affecting our Society, I may mention that our periodical, THE CANADIAN ENTOMOLOGIST, continues to be maintained with undiminished efficiency and interest, being largely supported and contributed to by our Entomological brethren of the United States; and that the last Annual Report presented by the Society to the Legislature has been received with more than usual marks of favour by the Press, scientific, agricultural and political, not only in Canada and the neighbouring States, but also in England. We have been naturally gratified to observe that, in many instances, copious extracts have been made from its pages, and even a whole article reprinted in an English scientific magazine.

Having referred thus far to our Society, and the things that especially concern it, let me now say a few words regarding Entomological matters in general. At the annual meeting of the American Association for the Advancement of Science, held in August last at Detroit,

Michigan, the general session. Its sessions, they were presided over by entomologists, and were very interesting. Our own Society I much regret that I could not attend, as I fully intended to do so. I have published in THE CANADIAN ENTOMOLOGIST here. Next year there will be an opportunity of access for Canadian entomologists to avail themselves of attending the session. From past experience, more valuable information can be obtained in your country.

During the season, the sea was very startling or unexpected, and was ravaged throughout the season. The assistance that his work has done in this Province and quality. The sea has been rapidly extending its neighbourhood of London, and its wake, that where it has wrought but a narrow path (Caloptenus spretus) has wrought a frightful scale of last year, occasioned by them which has been, upon the whole, during the past year, a great power for evil. Among the most noticeable wrought much damage to the United States and *Sylvatica*), which trees in many parts of the country fear may soon become a great agriculturalists. The But I need not detail the details, which are so familiar to you.

As I mentioned to you at the President for five years, and consideration so now make way for the interests of our Society, beg, therefore, to read at the same time, I Society at heart, and advance its best interests. Again offering:

Trinity College School  
Port Hope, S

Michigan, the general Entomological Club, organized last year at Hartford, met for the first time. Its sessions, held daily throughout the week of meeting, were remarkably interesting. They were presided over by Dr. Le Conte, undoubtedly the greatest of living American Entomologists, and were attended by a great majority of the noted Entomologists of this continent. Our own Society was most efficiently represented by our able Editor, Mr. Saunders. I much regret that the pressure of business matters at home prevented me from accompanying him, as I fully intended to have done. As a complete report of the proceedings is being published in THE CANADIAN ENTOMOLOGIST, I need not detain you by any account of them here. Next year the meeting is to be held at Buffalo, N. Y.—a place even more convenient of access for Canadians than Detroit. We trust that a large number of our members will avail themselves of the opportunity—which may not occur again for many years to come—of attending the sessions, and making the personal acquaintance of our American brethren. From past experience I can assure them of a hearty welcome, while no one can doubt that more valuable information can be acquired in a few days, in an assemblage of this kind, than can be obtained in years of solitary work.

During the season that is now all but brought to a close, there has occurred nothing of a very startling or unexpected character. The Colorado Beetle has continued to extend his ravages throughout our country, but he has been met by such a determined and universal resistance that his work of devastation has been hardly appreciable; certainly in the central portion of this Province we have never had a finer crop of potatoes, both as regards quantity and quality. The Cabbage Butterfly (*Pieris rapæ*), to which I also referred last year, has been rapidly extending to the west, and has already become a common object in the neighbourhood of London. So closely, however, does its parasite (*Pteromalus puparum*) follow in its wake, that where a year ago it was most destructive to all its food-plants, it has this season wrought but a moderate amount of damage. The Locusts, or Grasshoppers, of the west (*Caloptenus spretus*) have continued to commit much havoc, though not by any means on the frightful scale of last year; there is every prospect that the destitution and suffering then occasioned by them will not be repeated to any very great extent this year. While there has been, upon the whole, a decided diminution in the amount of loss occasioned by noxious insects during the past year, we have, nevertheless, to record an increase in the numbers and consequent power for evil of several common species that are always more or less abundant. Among the most notable I may mention the Army Worm (*Leucania unipuncta*), which has wrought much damage in the maritime Provinces of the Dominion, as well as in some portions of the United States; the two species of Tent Caterpillars (*Clisiocampa Americana* and *Sylvatica*), which have been excessively abundant and destructive to fruit and forest trees in many parts of this Province; and the Pea Weevil (*Bruchus pisi*), which we much fear may soon become—unless measures are taken to prevent it—a source of great loss to our agriculturists. These I mention as having had a more than usual manifestation this year. But I need not detain you with any account of the ordinary work of our insect friends and foes, which are so familiar to every one in this country.

As I mentioned at the outset, you have done me the great honour of electing me your President for five years in succession. While I thank you most cordially for your kindness and consideration so repeatedly shown to me, I feel that it is only reasonable that I should now make way for some one else, who may be able to devote more time and energy to the interests of our Society, and be of more real use to it than I have latterly been capable of. I beg, therefore, to resign into your hands the office that you have so long honoured me with; at the same time, I desire to say that I shall continue always to have the welfare of the Society at heart, and that I shall ever be ready and willing to do all that lies in my power to advance its best interests.

Again offering you my respectful thanks,

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

CHARLES J. S. BETHUNE.

Trinity College School,  
Port Hope, September, 1875.

ANNUAL ADDRESS OF THE PRESIDENT OF THE MONTREAL BRANCH  
OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

GENTLEMEN,—Members of a young Society, especially those who are verily sincere, when they learn that their institution is progressing indeed, become imbued with a sense of pleasure, and I am gratified to state that the Entomologists (the majority of whom are young beginners) who meet in this city have made a worthy advancement in their investigations during the last year. At its inception, I had a doubt with regard to the attention which persons joining us would give to the study of our local insects, but such a thought has been dispelled from my mind. During the past twelve months ten papers were read, the greater portion of which, being the production of tyros in the science, exhibit, at least, an energy on their part to promote Entomology to the position for which this Branch Society was instituted. Affiliated with the Entomological Society of Ontario, whose headquarters are at London, Ontario, we receive the same benefits of membership, &c., as our western brethren composing the parent body. Our by-laws are suitably framed to meet the general work of the Branch, and the only future requisite will be a mere effort to prevent our Financial Secretary from grumbling. By so doing, and with punctual attendance, we will be enabled to continue our regular monthly meetings, and have greater pleasure when we meet mutually together in the pursuit of our favourite study. Bear in mind, however, that during the next year our cabinet must be attended to—it will be necessary that it should contain at least the nucleus of a general local collection, presenting a fair number of specimens of the several Orders of Insects. I maintain that if we possess a good classified collection of native insects it would be a great inducement for young beginners to join us. Books on Entomology are generally expensive, and only a few can be consulted studiously in regard to the noxious and beneficial insects of this country. Valuable Entomological literature issues annually from the pens of co-labourers in the United States; the greater portion of these are in the form of State Agricultural Reports, which seldom come to our hands. Our branch is simply in the chrysalis state, and in consequence of the metamorphoses not being complete, we are unable at present to produce some tangible matter in exchange; but I trust the day is not distant when some of our young beginners will be proud of their productions—as worthy of being read by the old heads in the science. However, I have thought that, from time to time, duplicate papers on Entomology may be received by the Parent Society in exchange for THE CANADIAN ENTOMOLOGIST. These extra papers could be perused, and doubtless be of service to members of our branch, and the parent might, if it possesses such material, liberally share them between the three branches of its Society.

The Report of the Council informs you of the labour, &c., performed by members during the year. Possibly these labours will stand a fair criticism as emanating from a Society only in its second year, and the actual working members but young beginners. Old students should always bear leniently towards the tyro, especially when the latter seems anxious for information. He must be encouraged in this way. The low temperature which we experience in this latitude, during the greater portion of the year, may produce a kind of carelessness or lethargy in the young student of Entomology. This he should endeavour to avoid, and he can do so by devoting his leisure winter hours to the arrangement of his cabinet—that is to say, in reading, naming and classifying his specimens. He who admires the beauty and appreciates the value of Entomology will, with the return of lovely spring, refreshen his faculties as the objects of his research appear again before him.

We require more knowledge in connection with the distribution of insects, especially in regard to the Lepidoptera of Europe; I mean such species as are recorded as occurring in this portion of North America. Butterflies which are found distributed at this day throughout a great extent of this country, are recorded by the best of naturalists as having followed man from the Old World. Such species should be fully defined in order to prevent additional synonyma. "There is so great a similarity between our insect fauna and that of Southern Europe, that a knowledge of their species is often of great advantage in determining our own." The late Professor Agassiz states in his work on Lake Superior, that *Vanessa Antiopa*, "The Camberwell Beauty" of England, is one of these. That a few of the Diurnals are common to both continents I have no doubt, but in which of them did the species obtain their origin, or what is now termed their metropolis? My respected and talented friend Scudder, of Boston, in a late memoir on the genus *Pamphila*, says in his comments on *P. Manitoba*—a new but

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wide-spread species on this continent—that “the richness of this genus in America, and its extreme poverty in the Old World (where only a single species is known), lead to the presumption that the genus had its origin in our own country, and that temperate North America is its proper metropolis.” I have examined and compared specimens of *Pamphila comma* of Europe, and *P. Manitoba* of America, and cannot discern the slightest difference in their forms and markings. Even in the forms of abdominal appendages there is but slight differences in these two forms. It may be further stated, as it has been by others, that *P. comma* was introduced into this country from Europe. Moreover, like other introduced species, it had perhaps to feed on a different food-plant to that on which it fed in the Old World. This, in my opinion, produces at least external changes, and in connection with the wide spread of the form, we must as a natural result have varieties, the latter unfortunately being evidently considered species. The HESPERIDÆ intermix to some degree, and it is extremely difficult to trace the true form from its variety. Mr. Scudder is the chief authority on the HESPERIDÆ of the country, having made extensive research among this difficult class of butterflies; therefore he has greater facilities to prove differences between them, but I cannot look upon these two butterflies and discover the slightest deviation more than we find in the examination of a number of specimens of any particular species. A well-known European and American butterfly, *Vanessa Antiopa*, has a wide range and undoubtedly holds its metropolis on this continent. The colour of the wing-margins of this species has changed since its introduction into temperate America. All of us have seen the change which numbers of *Pieris rapæ* has gone through since its introduction into Canada, but after all it is nothing but the rape butterfly of Europe, slightly altered by change of food and climate, and it is just possible, by like influences, that the abdominal appendages of *P. rapæ* may in twenty years hence show differences in wide-spread varieties, as we have now shown to us in *Pamphila comma* of Europe, and *P. Manitoba* of Scudder. When *Pieris rapæ* came to us at Quebec, it changed and spread gradually, and although it lingers before the pressure of a parasite, yet it seems to hold against the enemy. This shows that there is something in this diversified climate favouring its spread which is southward and westward, and it is now a permanent insect of the United States. In these days there are so many ways by which insects are carried from place to place, that we cease to wonder when a strange species turns up in a locality wherein it was hitherto unknown.

It is a notorious fact, that almost all the insects which annoy our agriculturists and horticulturists came to us from the Old World. For instance, we have a saw-fly, which is found in our woodlands. It has lived there from time immemorial on wild gooseberries, and perhaps on the wild red currant, and we cannot find many instances of this species having attacked the domesticated gooseberry or currant to any extent. But the species introduced some twelve years ago from Europe has almost put a stop to the cultivation of the gooseberry and red currant throughout many parts of the United States and Canada. We have also a native onion-fly (*Ortalis arcuata*), which, although parasitic on the onion, does not appear to affect the crop generally, but the imported onion-fly (*Anthomyia ceparum*), an allied species, is a terrible pest to the onion-growers throughout the extent of the Dominion. Indeed, we have had an alarming number of insect foes imported into this country from the other side of the Atlantic. Another species of the latter genus has been destroying the cabbage in the neighbourhood of this city. This *Anthomyia* was also imported from Europe. The question may be asked, did these insects follow the introduction of certain plants from the same quarter? If *Antiopa* followed man to this country, its migration benefits the species, as the willows on which it feeds are far more abundant here than in Europe; but man has been instrumental in carrying noxious plants as well as insects, there being now distributed in America upwards of TWO HUNDRED AND THIRTY-THREE distinct species of plants from the Old World, all of which have run wild. It would seem that the climate of America is very conducive to the acclimatization and extension of European species. No doubt a number of North American insects have been, and will be from time to time, introduced into the Old World, but it appears that those already detected as coming from this country have not spread and become common there. These statements are made on the authority of British Entomologists and from the pen of C. V. Riley, the State Entomologist of Missouri, U.S., who accounts for the cause as follows:—“Since, then, it can be demonstrated by hard dry facts that American plants and insects do not become naturalized in the Old World with anything like the facility with which the plants and insects of the Old World are every day being naturalized in

America, there must be some cause or other for this singular state of things. What is that cause? It is, as we believe, a simple fact, which is pretty generally recognized now as true by modern naturalists, viz., that the plants and animals of America belong as a general rule to an old-fashioned creation, not so highly improved and developed as the more modernized creation which exists in Europe. In other words, although this is popularly known as the New World, it is in reality a much older world than that which we are accustomed to call the Old World. Consequently our plants and animals can no more stand their ground against European competitors imported from abroad, than the Red Indian has been able to stand his ground against the white Caucasian race. On the other hand, if by chance an American plant or an American animal finds its way into Europe, it can, as a general rule, no more stand its ground there against its European competitors than a colony of Red Indians could stand their ground in England, even if you gave them a whole county of land and an ample stock, tools and provisions to begin with. For throughout animated nature, as has been conclusively shown by Charles Darwin, there is a continual struggle for existence, the stronger and more favourably organized species overpowering and starving out from time to time their less vigorous and less favourably organized competitors. Hence it is as hopeless a task for a poor puny old-fashioned American bug to contend against a strong, energetic, highly developed European bug as it would be for a fleet of old-fashioned wooden ships to fight against a fleet of our modern iron-clads." Mr. Riley gives also another and perhaps the correct reason why the insects which are imported into this country multiply at a prodigious rate. . . . It is that "whenever an injurious insect is introduced in our midst, as a general rule the particular parasite or parasites which kept it in check abroad are not introduced with it. Now, if what I have read are facts, and doubtless they are, it is evident that the Colorado Potato Beetle, even if it does reach any part of the Old World, will have a poor chance of extension, believing that that law which governs the struggle for existence will be brought to bear against it, as has been the case in regard to other introduced species from this country."

A few years hence will prove these statements—that is to say, if the Colorado Potato Beetle reaches Europe within that time. It was introduced into Canada in 1869; during the latter year it was first noticed near Point Edward, at the extreme south of Lake Huron, and opposite Detroit, near Windsor, at the south-western corner of St. Clair. Since then it has been making its way towards the Province of Quebec. It was last noticed on the eastern confines of Ontario, so that at its present rate of spreading, we may expect this most destructive insect in our neighbourhood at no distant day.

I now beg to return thanks for your attention to the welfare of the Branch, as well as for the kindness shown me while presiding over you since it was formed.

WILLIAM COUPER,  
Montreal.

#### ADDRESS OF THE INCOMING PRESIDENT OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

GENTLEMEN,—On assuming the duties of the office which you have so kindly conferred upon me, I wish to make a few remarks in the hope and with the object of furthering the interests of our Society, and stimulating us in the study of our science. The excellent address given at our last meeting by our retiring President was, in the parts relating to our Society, mainly retrospective in character, as befitted the occasion; but as we are now beginning another year's studies, I intend my remarks to be prospective—looking forward to what we may do during the present season, and endeavouring to point out some things which, I think, will help us on individually, and advance our studies as a whole.

To the statement that Entomology is a pleasing, nay, a fascinating pursuit, you will all readily agree. That it is also the means of healthful and innocent recreation, is also a truth to which your assent will be cordially given. And it is not only a pleasing study and a healthful recreation, but also a science requiring close and deep research in order to properly understand its secrets. I believe that as time goes on, and the study of insects is more and more pursued in a philosophical manner, it will be of great value in solving many of the problems relating to animal life, which now claim the attention of naturalists. It may even aid in elucidating some of the mysteries of past conditions of life in this planet, and supply data

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relative to the phenomena of species and varieties, which may be applied to the solution of this question with regard to higher forms of life. I think that the importance of our science in these respects is not sufficiently recognized by us; that we are content with merely getting our insects properly named, and rejoicing over a rare or a new species, while the removing of the insect races, their habits, instincts and co-relations, which might help in solving the questions before referred to, are passed over too carelessly. Now, though from our position in life we can devote to Entomology only leisure time, I think we ought to try and give a little beneath the surface, and study the science, so far as our opportunities go, in a more thorough manner. Though we have not the time, nor the privilege of access to larger collections and libraries, which make us almost envy the position of many Entomologists in the United States, yet we may do something in our small way if we only set to work. The modern sciences have all been built up to their present high perfection on the inductive principle. Observation and experience have been the basis for advancement and theory, in contradistinction to the old system of theory first and observation afterwards. This inductive principle is the only solid foundation on which true knowledge can rest, and it is as applicable to Entomology as to any other science. In its economic aspect, or the study of insects and their hurtful or beneficial influence on cultivation, observation is of the first importance. And in the strictly scientific application of the pursuit, as in the study of species and varieties, the distribution of species, &c., all acquisitions to our knowledge must come from close and patient observation.

Now, I think we ought during the present season to pay more attention than we have hitherto done to the daily lives of our insect friends. A little thing, trifling though it may seem at the time, may give us a clue to something of greater importance, and the smallest insight into the habits, instincts or organization of an insect, when added to the observations of others, may lead at some future time to great results. Nothing is really little in the kingdom of nature; everything is under the wise and eternal laws of the Creator, and works for the end He designed, so that the smallest insect is worthy of our study, and may aid us in understanding something of the order, wisdom and skill which He has exerted in the creation and adaptation of the parts composing the wonderful system of life in which we find ourselves. Let us look then after little things, for as Smiles well observes, "Human knowledge itself is but an accumulation of little facts, made by successive generations of men; the little bits of knowledge and experience, carefully treasured up, growing at length into a mighty pyramid. Though many of these facts and observations may have seemed in the first instance to have but slight significance, they are all found to have their eventual uses, and to fit into their proper places. Indeed the close observation of little things is the secret of success in business, in art, in science, and in every pursuit in life."

I hope you will not think I am digressing, but I like to take and wish to give you an elevated ideal of our favourite study. If we consider any object we have in view a worthy and valuable one, we shall be the more likely to pursue it with assiduity and zeal; and while we regard Entomology as a pleasant recreation, let us not forget that it is a science bearing not only on the great interests of agriculture, but also, in conjunction with the other departments of Natural History, on questions at present causing agitation and discussion among the leading scientific men of the day.

Let our note-books then be kept ready, and whatever new thing we meet with during this year, in the life of our insect friends, be duly recorded. We shall at least be adding our little stone to build up the great Entomological pyramid.

Another thought which I wish to bring before you is, the advisability of extending our fields of operations. One of our principal objects is to learn something about the insects of the Island of Montreal. We cannot expect to learn *all* about them, or even to make a complete catalogue of their names, for some time to come, but we ought to remember that there are other orders represented here besides the Lepidoptera and Coleoptera. If we wish our Society to be symmetrical and well developed, we must study the other orders, otherwise we shall be a kind of monstrosity—an Entomological Society with a fair knowledge of the butterflies, moths and beetles of the Island, but utterly ignorant of its remaining and not less interesting insect inhabitants. To make a beginning, let us take all kinds, and then the possession of the specimens will incite us to find out their names and history. And if there was a good collection in the hands of the Society, say of Hymenoptera, I have no doubt, but that some member would be courageous enough to undertake the work and the pleasure of studying them up.



In the United States, the entomologists are doing good work in their different departments, and while the task of naming and describing is being rapidly prosecuted, some of them have leisure even to aim at changing the arrangement and nomenclature of the science. All honour to them for their industry and zeal, though some of their projects are too revolutionary, even for the present changeful age. Still I believe that even Mr. Scudder's system will be adopted at last, though, perhaps, very much modified in form. The great objection to it is the unearthing and bringing to the front of the names and classification of Hubner and other old authors who have been unnoticed if not forgotten for many years, and supplanting with these names those with which we have been familiar, and which have been given by entomologists who may be called the fathers of the science in America. The "law of priority," as it is called, is being enforced to its utmost limit—too far, in my estimation—and the result must be a discussion which will bring about a settlement of the question. Some years will doubtless pass before this end is gained; in the meantime I like to keep to the old familiar names, which seem to me like the names of old friends.

In the department of Physiological Entomology, Dr. Packard is carrying on investigations of great interest, into the nervous system of insects, which must result in the real advancement of the science, and a great increase in our knowledge of a most wonderful and attractive subject.

And now, gentlemen, I thank you for the honour you have done me in electing me your President. I hope and believe that this year will be a prosperous one in our history, and that we shall reap both mental and physical benefit from our studies.

G. J. BOWLES,  
Montreal.

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

According to previous announcement, the first meeting of this Club was held in the rooms of the Detroit Scientific Association, on the 10th of August, 1875, at 2.30 p.m., Dr. J. L. Leconte, President, in the chair; Prof. C. V. Riley, Secretary. The attendance was large, including S. H. Scudder, Esq., Cambridge, Mass., Vice-President, and Messrs. A. R. Grote, Buffalo, N.Y.; W. Saunders, London, Ont.; B. P. Mann and E. P. Austin, of Cambridge, Mass.; Prof. E. S. Morse, Salem, Mass.; J. A. Lintner, Albany, N.Y.; E. A. Schwarz, H. G. Hubbard, and B. Walker, of Detroit; Dr. A. E. Dalrymple and Dr. J. G. Morris, Baltimore, Md.; Prof. A. J. Cook, Lansing, Mich.; Dr. Hoy, Racine, Wisconsin; Clinton Roosevelt and Geo. Dimmock, Springfield, Mass.; B. D. Sanders, J. C. Holmes, and Wm. Provis, Detroit; J. T. Ison, Cleveland, Ohio; and others.

President Leconte, in a few opening remarks, stated the objects had in view in the formation of this Club. They were chiefly to cultivate closer personal relations among those interested in Entomological pursuits, many of whom were widely separated by distance, to exchange views and record observations, and to exhibit specimens of interest. He hoped that the meetings would not only be fruitful in these respects, but that, seeing the importance of Entomology in its relation to agriculture, some good to the country might flow from the deliberations.

Mr. Wm. Saunders mentioned the fact of the unusual scarcity of insects of the Saw-fly family (*Tenthredinidæ*) throughout western Ontario, especially those destructive to fruit, naming the Gooseberry Saw-fly (*Nematus ventricosus*) and the Pear Tree Slug (*Selandria cerasi*). Both these insects, although enormously abundant and destructive in 1874, had been quite scarce in 1875. He called for suggestions as to the cause, his own impression being that this diminution had been caused by the severity of the late winter and spring.

Prof. Cook, of Lansing, Mich., had not observed any remarkable scarcity of these species in his neighbourhood.

Prof. Riley had remarked their almost entire absence in some localities, and their comparative abundance in others.

Mr. A. R. Grote exhibited specimens of *Agrotis islandica* from the top of the White Mountains and from Labrador.

A lengthy discussion on nomenclature ensued, and was participated in by many of the members present, it being generally conceded that some action should be taken by the Club, looking to the adoption of some rules or suggestions which might guide the Entomologists of the country on this perplexing question. On motion, Messrs. Scudder, Riley and Saunders were appointed a committee to take the matter of nomenclature into consideration and present it at a future meeting in such form as to offer opportunity for more definite discussion.

Mr. Scudder spoke favourably of *Psyche*, the organ of the Cambridge Entomological Club, and urged that members subscribe for it on account of its excellent bibliographical record.

Mr. Mann called attention to the difficulty of getting hold of State Reports, and thought there should be some system adopted by which these Reports could be placed on sale, so that Entomologists who desired to do so might purchase them.

Mr. Saunders thought that if some plan could be devised whereby the valuable facts and suggestions contained in these various Reports could be brought together, condensed into one volume, and made available to agriculturists as well as entomologists, that much good would result from it.

The President suggested that such a work might well be done by the general government, and would be much more valuable than the volume it now sends out.

On motion, it was resolved that this Club request the American Association for the Advancement of Science to take such action as seems best calculated to secure the placing of State Reports upon scientific subjects in the library of the Association. The Secretary was instructed to bring this subject before the Association.

Dr. Morris referred to the scarcity of Sphingidae about Baltimore during the present season, an experience which was corroborated by other members present. Mr. Austin had found all insects unusually scarce about the White Mountains, where he had been collecting for the past two years. Mr. Riley thought the very severe and late winter and the unusually rainy summer in part explained the fact.

Mr. Scudder offered some remarks on the great abundance of the Army Worm (*Leucania unipuncta*) in portions of Massachusetts, as an exception to the general rule of scarcity of insect life; he had made a calculation from the number counted in a square foot, that in a field near Cambridge there must have been as many as two million worms to the acre. Other members offered similar experience in reference to this species. Mr. Riley stated that the Army Worm generally abounds during a very wet summer following a very dry year.

Mr. Lintner referred to the great scarcity of *Orgyia leucostigma* as in striking contrast to its abundance last year in Albany.

The election of officers then took place, resulting in the re-election of Dr. John L. Leconte as President, Samuel H. Scudder, Vice-President, and C. V. Riley, Secretary.

Mr. Riley read a paper on "Locusts as Food," in which he gave his own experience in cooking and eating them. On one occasion he ate nothing else for a whole day. He found them to have an agreeable nutty flavour, and especially recommended them deprived of their legs and wing cases, and fried in butter, and also spoke very highly of a soup made from them. He referred to John the Baptist, who had often been pitied for the scantiness of his fare, locusts and wild honey; Mr. Riley thought he had been well provided for. The writer regarded it as absurd that parties should actually die of starvation, as some had done in the districts where this locust plague had prevailed, while surrounded by such an abundance of nutritious and palatable food.

The meeting then adjourned, subject to the call of the President.

On Tuesday evening, the Cambridge Entomological Club held a meeting, when all interested in Entomology were invited to be present. W. Saunders, of London, Ont., was called to the chair. After the usual routine business had been disposed of, Mr. George Dimmock read a paper on the recent excursion of the Cambridge Club to the White Mountains, where the members had spent some two weeks in collecting. The experiences related were of a very interesting character, showing that the party, besides accomplishing much useful work, had thoroughly enjoyed their trip. Mr. Austin, who had been one of the party, ex-

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hibited a large collection of insects made during the past two years among the White Mountains, embracing many very interesting species, and offered some remarks on their habits.

Messrs. Cook, Lintner, Morris and Riley were elected members of the Club.

Mr. Grote presented some instructive facts in relation to the identity of some of the White Mountain moths with those of Labrador. Mr. Riley inquired whether many *Caloptenus* had been found on Mount Washington, and expressed an opinion that a race of *spretus* had been found there.

Mr. Saunders inquired of the Michigan friends whether *Pieris rapæ* had been found in the State. Prof. Cook stated that it had not yet appeared in Michigan; he remarked that *protodice* was much more numerous than *oleracea*. Mr. Riley stated that *protodice* was most abundant throughout Illinois and Missouri. Mr. Ison, of Cleveland, stated that *rapæ* appeared in his neighbourhood for the first time last spring; at first it was found along the lake shore, but before the season closed it was abundant throughout the greater part of the district over which his observation had extended. Mr. Ison said that with them the larva seemed to prefer mignonette to cabbage. In reply to a question as to the correctness of the views advanced by some Entomologists in regard to the colour of the imago being affected by this food plant, Mr. Lintner said that he had, from among 500 or 600 specimens fed on cabbage, found a number of the yellow variety. Mr. Riley stated that the larva of *protodice* was also partial to mignonette.

*Danais archippus* formed the next topic of discussion. Mr. Cook had found the larva this season peculiarly infested by several parasites. Mr. Riley had seen *Tachina* flies bred from *archippus*. Mr. Saunders had reared, on one occasion, a large number of small Hymenopterous parasites from a chrysalis. He also asked the members if any explanation could be given of the reason why this species assembled occasionally in immense swarms and migrated thus from place to place, and referred to instances of such swarming. Mr. Ison referred to an immense swarm which passed over Cleveland three years ago. In this instance it appeared as if they had crossed the lake from Canada; they were seen in immense numbers for three or four days. *Archippus* was said to occur in Australia, where it also occasionally swarms.

References were made by Mr. Grote to several rare captures of Lepidoptera in the vicinity of Buffalo. Among others he had taken *Thecla ocellifera*, which is also found in the West Indies. Mr. Saunders stated that he had again reared a specimen of *Thecla strigosa* from thorn, and referred to the capture of specimens of *P. thoas* and *P. marcellus* at North Ridge, Ont., by Mr. F. C. Lowe, of Dunnville. Mr. Cook said that *thoas* had been found this year at Lansing, that it occurred there to his knowledge some three years ago, and that last season it was quite common, the larva feeding on prickly ash. Mr. Riley stated that the larvæ of *philenor* feed on a creeping plant very closely allied to *Aristolochia*. Mr. Ison has found *philenor* scarce about Cleveland during the last five or six years, but *marcellus* rather common; the larva of the latter feeds on pawpaw. One of the Detroit members remarked that there were pawpaw bushes growing within a few miles of Detroit.

A discussion on sugaring for Noctuæ was next in order. Mr. Ison reported excellent success with this method at Cleveland; he preferred adding a little rum to the usual mixture of beer and molasses or coarse sugar. Mr. Lintner greatly interested the members in relating his wonderful success in sugaring. He produced a tabulated list of Noctuidæ captured or observed at sugar at Schenectady, N. Y., commencing with July 7th, giving the results of sixteen evenings in that month, and four evenings in August.

Seventy-eight species of Noctuæ are recorded, and opposite each species observed or collected is placed a check in a column bearing the day of the month at its head. Four species were observed on each evening, viz.:—*Hadena arctica*, *Hydroecia sera*, *Homopyralis tactus* and *Asopia costalis*. Of the first two, hundreds could have been collected on a single evening. *Hadena lignicolor* was not observed on only one evening; *Erastria carneola* on only two evenings; *Catocala ultronis* and *Hadena devastator* on only three evenings.

The following species were common:—*A. herbida*, *A. hauruspica*, *A. plecta*, *Orthodes infirma*, *Pseudothyatira expultrix*, *Hydroecia nictitans*, *Amphipyra pyramidoides* and *Erastria nigrifula*. Of *Catocala ultronis* about seventy examples in fine condition were captured; of *Catocala nuptata*, of which not a single example had ever before been taken by Mr. L., thirty-six were collected; and of *Catocala parta* sixteen examples had been secured, all in perfect condition. Specimens of *Catocala Meskei*, *C. serena*, *C. Briseis*, *C. Clintonii*, *C. polygona* and *C. similis* had also been obtained.

Mr. L. has become quite enthusiastic over the success which he has met thus far, in the number of rare species collected, and particularly in the perfect condition in which the larger portion of them are obtained. It is his purpose to continue his collecting in this method, and also the tabulation of the results. The table, when completed at the end of the season, will probably be published in the New York State Museum Report. We are sure that it will prove a valuable contribution to that part of the natural history of our moths which relates to the number and duration of their several broods.

Mr. Mann exhibited specimens of the wood of *Agave Americanum*, which, when cut of the proper thickness, may be used as a substitute for cork. This wood is remarkably light and porous, and pins may with great ease be firmly pushed into its substance. It grows in Brazil, and can be obtained from Mr. Mann at a lower price than cork. In proof of the suitability of this material for the purpose named, Mr. Mann stated that Wallace preserved all his specimens collected in the East Indies in boxes made with pieces of this wood pinned together with thorns.

At a late hour this most enjoyable meeting was brought to a close.

On Thursday afternoon a large proportion of the members of the Club joined in an excursion to some good collecting grounds in the neighbourhood of Fort Wayne, the party being under the direction of Mr. Hubbard, of Detroit. A very pleasant and profitable time was thus spent, and many interesting specimens captured. In addition to the advantage enjoyed of closer social intercourse between the "brethren of the net," this occasion afforded an opportunity for the mutual exchange of practical ideas in regard to collecting insects which no in-door meeting could have afforded. It seemed as if every member had some original idea of his own either in reference to capturing or carrying specimens, the advantages of which were freely urged and as freely discussed with much profit. After thoroughly enjoying themselves for several hours, the members returned at nightfall well satisfied with the afternoon's sport.

On Friday morning a second meeting of the Entomological Club was held at the rooms of the Detroit Scientific Association. In the absence of the President, Mr. Lintner was called to the chair.

The Committee on Nomenclature reported as follows:—

"The Committee appointed at the last meeting of the Entomological Club to consider whether any immediate action is advisable on the part of the Club to aid in establishing uniformity in zoological nomenclature, finding that the Committee of the General Association intends to report during the present session, and deeming it best to await this Report before making any definite proposition, would at the present time recommend that the Club appoint a committee of five to prepare and present to the Club at its next annual meeting a compendium of the views of the leading Entomologists of the country upon points which, in their judgment, require elucidation, and also to present a series of resolutions touching such points, in order that intelligent discussion may be had upon them, and some general agreement, if possible, arrived at.

(Signed)

"SAMUEL H. SCUDDER.

"C. V. RILEY.

"WM. SAUNDERS."

On motion, the Report was adopted, and the appointment of the Committee left with the President, who subsequently nominated the following gentlemen:—Messrs. Scudder, Saunders, Grote, Riley and Leconte.

An interesting discussion then took place in reference to the various methods of pronunciation followed by Entomologists when speaking of insect names, which culminated in the following resolution, which was carried unanimously:

"Resolved, That in view of the desirability of securing uniformity among Entomologists in the pronunciation of the names of insects, Mr. O. S. Westcott, of Chicago, be requested to prepare such an accentuated list for publication in the CANADIAN ENTOMOLOGIST."

Mr. Westcott very kindly promised to give his attention to this matter at an early date. We shall hail the advent of this list with much satisfaction; it is a work greatly needed, and coming from the hands of one who is in every way well fitted to do it justice, we feel sure that it will command general assent.

The next subject proposed for insects, in unanimously adopted

"Resolved, That insects which are requested to present so that the Club may

Some explanation Mr. George Dimmock from the wings of I mock had kindly suggested at his room the tical value of the di the working of the Entomological Club be a ready method of determining

This process of can Association, and It may thus be briefly rated aqueous solution of sulphuric acid to the solution of carbon added. After immediately disappears. This resolution and immersion of water, and then it be repeated as often may be safely and effectively

The denuded wings they had been gummed many of the general present.

In the compilation of the Club, we are greatly pleased his notes at our service.

During the course was read by Dr. J. L. of subduing insects in tance to the country general and finally it was resolved United States in reference learned author of this memorial, all of which were

## METHODS OF SUBDUING INSECTS

(Read before the American Entomological Society)

In accordance with immediate Mississippi distribution. It has due Middle States, and is particularly land, which will soon be

The next subject of discussion was on certain offensive names which have been proposed for insects, in which most of the members took part. The following resolution was unanimously adopted :—

“Resolved, That in view of the fact that certain names have of late been proposed for insects which are offensive and unwarrantable, that the Committee on Nomenclature be requested to present at the meeting next year a list of such names as should be ignored, so that the Club may take action in reference to them.”

Some explanations were then offered in regard to a valuable discovery lately made by Mr. George Dimmock, of Springfield, Mass., of a ready method of removing the scales from the wings of Lepidopterous insects, so as to display the vein structure. Mr. Dimmock had kindly shown the admirable working of his process to a number of Entomologists at his room the evening previous, when all present were struck with the great practical value of the discovery. After full explanations to those present who had not seen the working of the process, it was resolved, “That the thanks of the members of the Entomological Club be given to Mr. Dimmock for his valuable discovery in reference to a ready method of denuding the wings of insects.”

This process of Mr. Dimmock's formed the subject of a paper read before the American Association, and which will be published, we believe, in an early number of *Psyche*. It may thus be briefly explained: All the materials necessary are a little alcohol, a saturated aqueous solution of chloride of lime, a phial of pure muriatic acid and another of sulphuric acid. The wings are first moistened with alcohol, then transferred to the solution of chloride of lime, to which a little of the sulphuric acid has been added. After immersion for a few moments, the colouring matter of the scales rapidly disappears. This result may be hastened by taking the wings out of the chloride of lime solution and immersing for a moment in the muriatic acid, diluted with twice its weight of water, and then returning them again to the former solution. This alternation may be repeated as often as required. By this means any quantity of wings of Lepidoptera may be safely and entirely denuded with little or no trouble.

The denuded wings were neatly mounted by Mr. Dimmock on white cards, to which they had been gummed. An interesting collection, illustrating the nerve structure of many of the genera of moths, was exhibited by him, to the great gratification of all present.

In the compilation of these memoranda in regard to the meetings of the Entomological Club, we are greatly indebted to the Secretary, Prof. C. V. Riley, who very kindly placed his notes at our disposal; also to Mr. B. P. Mann, of Cambridge, who did us similar service.

During the course of the Sessions of the Association, a valuable and practical paper was read by Dr. J. L. Leconte, retiring President of the Association, on various methods of subduing insects injurious to agriculture. This question being one of immense importance to the country generally, and especially to the agriculturist, elicited much discussion, and finally it was resolved to memorialize the Senate and House of Representatives of the United States in reference to the carrying out of some of the suggestions made by the learned author of this paper. We append a copy of the paper, as well as one of the memorial, all of which we commend to the careful consideration of our readers.

#### METHODS OF SUBDUING INSECTS INJURIOUS TO AGRICULTURE.

BY JOHN L. LECONTE, M.D., PHILADELPHIA.

(Read before the American Association for the Advancement of Science, at Detroit, Aug. 10th.)

In accordance with the predictions made at the time of its first appearance in the immediate Mississippi Valley, the Colorado Potato Beetle continues to extend its area of distribution. It has during the last and present seasons reached the Atlantic coast of the Middle States, and is preparing an invasion in mass of the maritime parts of New England, which will soon be overrun with the same ease with which it has conquered the West-

ern and Middle States. Meanwhile the farmers are anxiously inquiring for means of destroying the invader. Materials destructive to the insects, and said not to be injurious to the plant or the soil, have been recommended almost without number; but, with the exception of Paris green, they have either been very insufficiently tried or found inoperative. That compound of arsenic and copper, therefore, remains naturally the favourite, notwithstanding its dangerous qualities and the possible deleterious effect it may produce on the fields after long use.

Entomologists and other scientific men are often asked: "Why do you not give us another remedy against this destructive insect? Are you baffled, with all your boasted progress in learning, by the invasion of a wretched little bug?" No, my friends, we are not baffled by the wretched little bug; but in our endeavours to teach you how to dispose of it in such a manner as to protect your crops, we are embarrassed by your own failure to grasp the magnitude of the problem which you have set us to solve. Had you indeed comprehended the warnings given by my lamented friend B. D. Walsh, on the first injurious appearance of the insect, and since repeated by many Entomologists, you would have insisted several years ago that the subject should be investigated with a power of inquiry proportioned to its importance, and you would have received such information as might, with proper and well-directed industry on your part, have prevented much loss.

However, I do not wish to speak of the past; it is gone, and its errors cannot be undone. Let us rather inquire what shall be done in the future.

The first thing, then, is to cease calling upon science for a remedy, when science and empiricism have probably already given you many remedies, concerning the application of which I will have a word to say by-and-by. Science can help you and will help you only when you have begun to help yourselves. How, then, can we begin to help ourselves? I hear you ask. First, then, there should be a Scientific Commission, selected by competent scientific authority for their merit and not for their political influence. Politicians have had too much control over our agricultural interests, as you all have reason to remember with regret. This Commission should be sufficiently large to subdivide the subjects committed to them in such manner as to thoroughly investigate the habits and times of appearance in different districts of the great agricultural pests, the effect upon them of all the cheaper materials which have been or may be judiciously suggested as destroying agents, and the proper times and manner of applying them. The members of the Commission should also receive sufficient compensation to warrant them in giving as much time and labour to this investigation as may be required, even to the temporary abandonment, if necessary, of their other scientific or secular pursuits. No such task can be properly performed and completed by the solitary labours of State Entomologists underpaid and overburdened with work. Only by association of several such careful observers and investigators can a worthy, useful result be obtained for the suppression of several of the most formidable pests.

2. This information being procured, should be tabulated as far as possible, or at least reduced to a compact form for easy reference, and widely published in newspapers and also in pamphlet form.

3. By the distribution of this information and by appeals through the newspapers and agricultural journals, as well as by addresses at meetings of farmers and others interested in agriculture, it must be impressed upon the public mind that all individual efforts for the suppression of these pests are frequently futile. Only combined and consentaneous action over large tracts of country will be effective.

Now, while I am prepared to believe that when these facts are made known to the farmers they will immediately see the importance of the suggestion for unanimous and simultaneous advance upon the enemy, yet without legislative aid it will be quite impossible to secure the organization requisite for an effective onslaught. It will therefore be necessary for the citizens interested to command their representatives, either in State Legislatures or in National Congress, to prepare proper laws for the destruction of these pests at stated times, to be determined and recommended by the Scientific Commission. These laws will be not only cheerfully obeyed by every intelligent farmer, but I know that the farmers as a class will be glad to have such laws enacted and enforced with penalties for their neglect. Those disposed to help themselves and each other can only thus be protected against an ignorant and indolent neighbour, whose thriftlessness would other

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wise make of his potato patch, his cotton field or his plum orchard a nuisance nursery from which no industry could protect the surrounding farms.

Thus, then, the organization necessary for a successful campaign against our insect enemies must be authoritatively demanded by you. Under less free forms of government the plan which I have suggested would probably have long ago been perfected by the rulers. Even the fear of the extension of the Colorado Potato Beetle to Europe has excited in several countries almost as much discussion and confusion of counsel as an apprehended revolution.

The fact is, that these incursions and ravages of hostile insects represent a condition of war. It is only by a quasi-military organization and appropriate weapons suited to the nature of the enemy that they can be conquered. Without recognition of this fact nothing can be done against them, and we must bow our heads and exclaim with the pious Mohammedan fatalist, "It is the will of God."

Three subjects yet remain to be considered—the materials to be used, the time of making the attack in force, and the weapons to be employed.

1. The materials may be either vegetable or mineral, or merely human labour intelligently and persistently applied. The latter is the only effective means of contending against some insects, but in all cases it is a necessary adjunct to the remedies used. These remedies are very numerous, and until a careful investigation is made of the large number already suggested, no proper indications can be given except that those least injurious to man should be preferred, even at greater cost of money and labour; and that those which kill the insect by contact with its body are likely to prove more effectual than those which destroy by poisoning its food. It may be here observed that the form of apparatus in these two cases must be quite different. In the latter, any contrivance which will sprinkle a fluid or dust a powder on the exposed or upper surface of the leaves will be sufficient; in the former, in which the poison kills by contact with the insect, it must be able to reach the enemy wherever sheltered.

2. The time of attack must naturally be when the enemy is least able to resist. To quote again from the excellent memoir of Motschulsky, "the most effective and at the same time the easiest mode of opposing the development of the locusts is the crushing out of the young broods when collected in swarms in the place where they are hatched. Consequently the most important thing is to know the nesting place of these destructive pests. In order to discover them and to point out the course to be pursued, \* \* \* it might be well to send skilful persons \* \* \* to make the necessary researches, and these, with the assistance of the local authorities, might seek out the places where the insects abound, and establish the necessary regulations for their destruction." (l. c. p. 228.) In the case of the cotton moth it is plain that the attack should be made upon the earliest broods, which are said to appear in the extreme southern part of the country, and from which the migratory swarms which travel northward are supposed to be developed; also, that the attack must be directed against the caterpillars rather than the perfect insects.

The Colorado Potato Beetle may also be attacked with greatest success in the larval state. The integuments are then soft, and the appetite more voracious, so that whether the poison by contact or the poison by food be used, it will have a more certain effect than upon the perfect insect, which is protected against the former by the hard chitinous surface, and against the latter by preoccupation in reproductive duties.

You will be prepared to admit the importance of the recommendation above made, that the times for making the attack should be directed by the Scientific Commission after full examination of the habits of the insects and the dates of their appearance in their various stages of development. These dates will vary in different districts, and without a carefully tabulated calendar of the necessary facts, no system of combined effort, such as I believe to be essential, can be planned.

The apparatus to be used must of course vary greatly with the habits of the insects to be attacked. In the case of the plum curculio, canvas frames propelled on a kind of wheelbarrow, with a ram to concuss the trunk of the tree, is probably the best instrument yet devised. The insect will fall into the net when the tree is struck, and may be easily destroyed when a sufficient mass has been collected. For the cotton moth and the potato beetle the apparatus for poisoning the leaves upon which they feed may be any simple sprinkler or dusting box, according as liquid or solid poison is employed. But for

direct application to the insect itself, we must use means by which a fine spray will be driven with force sufficient to envelop the whole plant, or the surface of the ground upon which the insects are assembled, in a mist of poisonous liquid. Such an instrument is the atomizer, which has the additional advantage over the sprinkler that it consumes less liquid. The first application of the atomizer for the destruction of insects was made by me several years ago; and in the *American Naturalist* for August, 1869, I published a short paper recommending its use with certain poisonous liquids for the disinfection and preservation of insect cabinets. I have seen its frequent use with great success.

When the question of locusts became of importance last year, and the Colorado potato beetle began to be very troublesome in the Atlantic States, I spoke with several commercial friends and others about the propriety of making atomizers of large size for the destruction of these pests. In consequence of delay in the measures they thought necessary to command the attention and security of a manufacturer, no progress has yet been made for introducing such a contrivance into general use. Meanwhile a small apparatus, consisting of an atomizer, a tank of fluid supported on the back, and a pair of bellows fixed at the side of the operator, has been independently introduced by a manufacturing establishment in Philadelphia, and I have been told is somewhat of a favourite. It will doubtless be useful to a limited extent, and is not patented, I believe.

For small arms, this or a somewhat larger and more complete instrument will answer, but in the war against insect pests in which I have endeavoured to interest you, we must have heavy ordnance as well as weapons for hand use. Large compound atomizer tubes, with five, ten, twenty, or, in fact, an indefinite number of orifices for producing the spray, can be made, connected with large tanks of fluid, and worked by a powerful current of air from a revolving fan, driven by man, horse or steam power, according to the size of the instrument. When of sufficiently large size, the machine can be mounted on wheels and transported wherever it would be required for use. Before such instruments as these an invading army of caterpillars, or even a recently hatched swarm of locusts, would be annihilated. A comparatively small number of men would be required to work a battery of this kind of field artillery, and it would be found immensely effective.

The organization recommended can be effected only by the strong appeal of the people where agricultural interests dominate, for proper instruction from the Government and proper protection by legislative power. We have game laws to protect our useful wild animals; thistle laws to guard against extension of noxious weeds. Why not have insect laws for destruction of agricultural pests?

Farmers of the West, are you willing to exert yourselves to procure this result? The prize is a rich one—it is no less than immunity from an annual destruction of property quadruple or sextuple that of the great Chicago conflagration.

#### COPY OF MEMORIAL.

*To the Honourable the Senate and the House of Representatives of the United States.*

The subscribers to this Memorial respectfully represent to your Honourable bodies:

That they recognize in the invasion of grasshoppers, or more properly locusts, which during the past season have reduced to starvation many thousands of the inhabitants of the Western States and Territories, and especially of Minnesota, Nebraska, and Kansas, a great national calamity, calling for more efficient measures than those now available to prevent a recurrence of similar disasters.

They have reason to believe, from the reiterated cautions given by men of science, that a more careful study of the habits, rapidity of extension, and injuries caused by the few species of insects most destructive to agriculture would lead to useful suggestions by which proper means can be devised for the repression of these pests.

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The agricultural industries are shown by all statistics to be greater in importance and value than all the other interests of the nation combined.

The labour required for the full investigation of the complex problems involved in the protection against natural enemies of these vast interests can only be had by the employment of the best men of science, who are usually not found in the service of the Government, but who for a great national purpose would give their closest attention to any subject which might be committed to them.

Such objects as the locust, which has caused recently a destruction of food estimated at from \$40,000,000 to \$50,000,000; the Colorado potato-beetle, which, in accordance with the predictions of Entomologists of repute, has extended from the Rocky Mountains to the Atlantic, and has invaded the neighbouring Dominion; the Chinche bug, so destructive to cereals in the Valley of the Mississippi; the army worm and the cotton worms which destroy whole crops, certainly require the strongest measures that can be adopted by the Government for their suppression.

It was estimated by Mr. B. D. Walsh, that in 1861 the injury caused by insects in the State of Illinois alone amounted to \$20,000,000. The destruction must be now much greater.

By the same authority it was stated that "the annual damage done by insects in the United States cannot be less than \$300,000,000.

The appropriations made by a State, however liberal, must ever fail to procure such investigations as your memorialists pray for: the enemies are national, and must be dealt with by national authority, as much as an invading army of foreigners, hostile to our civilization. Unless repressed by intelligent means applied over its whole area of distribution, the insect, with its free powers of movement in its adult state, is not controlled.

Your Memorialists would be glad to believe that the information needed upon these most important subjects could be afforded by the Department of Agriculture. Unfortunately such is not the case, nor can it be until the Department is under scientific advice. There remain, therefore, but two modes of procuring for the Government and the people proper counsel for defence against agricultural pests.

The first is the reorganization of the Department upon a scientific basis, under the control of men whose learning and fitness for the position are acknowledged both abroad and at home. The second alternative is the appointment of a Commission of five persons,—to wit, three entomologists, one chemist, and one botanist, eminent in their respective branches of science—to be chosen by the Council of the National Academy of Science, and approved by the Secretary of the Treasury, with such salaries as your Honourable bodies would consider adequate for the responsible work required of them, and with such additional appropriation as might be needed for clerical assistance. The duty of this Commission would be to investigate the causes which affect injuriously agricultural interests, and to suggest the best means of diminishing the losses.

The results of such investigations should be embodied in brief Reports containing practical instructions and made accessible at a small price, or by personal education to every farmer in the country.

It is believed by your Memorialists that the granting of their prayer by the creation of such a Commission would do more for advancing Agriculture than can ever be expected from the Department, and be in the end most economical. If such a Commission were appointed for a definite term (say five or seven years), it would at the end of that time save in part, or perhaps wholly, the annual expenses of the Department of Agriculture, and would lessen greatly the destruction of agricultural products, by tending to the rapid extermination of all these great pests.

It could be safely promised that the work of such a Commission would be of equal value and dignity with that of other Scientific Commissions of the Government; such as the Coast Survey, Geological Survey, Commission of Fisheries, and Signal Bureau, and would be as strictly practical as either.

And your Memorialists, as in duty bound, will ever pray, &c.

## OUR DECEASED MEMBERS.

FRANCIS WALKER.

The sad intelligence of the death of that distinguished Entomologist, Francis Walker, of London, England, will, we know, bring grief to the hearts of all those who have been favoured with the acquaintance or correspondence of that genial-hearted man. His continued and disinterested kindness towards all those with whom he had to do has endeared him to many. Although we never had the pleasure of a personal acquaintance with the deceased, yet to ourselves personally, as well as to our Society, he has always been among the truest and kindest friends we have had, ever ready to do us any service in his power. His death leaves a void in our circle which it will be hard to fill. The following brief sketch of his career and his unceasing labours, written by one who knew him well, will be read with interest:

It has become my painful duty to record that Francis Walker, the most voluminous and most industrious writer on Entomology this country has ever produced, expired at his residence, Elm Hall, Wanstead, on the 5th of October, 1874, sincerely lamented by all who enjoyed the pleasure and advantage of his friendship. He was the seventh son, and the tenth and youngest child of Mr. John Walker, a gentleman of independent fortune, residing at Arno's Grove, Southgate, where the subject of this memoir was born on the 31st of July, 1809. Mr. Walker—the father—had a decided taste for science, especially Natural History; he was a fellow of the Royal and Horticultural Societies, and vice-president of the Linnean, so that his son's almost boyish propensity for studies, in which he afterwards became so eminent, seems to have been inherited rather than acquired.

Mr. Walker's decided talent for observing noteworthy facts in Entomology was first exhibited at home, when as a mere child his attention was attracted by the butterflies, which, in the fruit season, came to feed on the ripe plums and apricots in his father's gardens; *Vanessa C-Album* is especially mentioned; and *Limenitis Sibylla*, another species no longer found in the vicinity of London, was then common at Southgate.

In 1816 Mr. Walker's parents were staying with their family at Geneva, then the centre of a literary *coterie*, in which they met, among other celebrities, Lord Byron, Madame de Stael, and the naturalists De Saussure and Vernet. They spent more than a year at Geneva and Vevey, and in 1818 proceeded to Lucerne, from which place Francis, then a boy nine years of age, made the ascent of Mont Pilatus, in company with his elder brother Henry; their object, in addition to the ever delightful one of mountain-climbing, being the collecting of butterflies. The family afterwards visited Neuwied, and returned to Arno's Grove in 1820.

In 1830 the two brothers, Henry and Francis, again visited the Continent, and now it was purely an Entomological tour, the late Mr. Curtis, the well-known author of "British Entomology," being their companion. This party collected most assiduously in the island of Jersey, and afterwards at Fontainebleau, Montpellier, Lyons, Nantes, Vaucluse, &c., the French Satyridæ, of which they formed very fine collections, being their principal object.

Mr. Walker's career as an author commenced in 1832. He contributed to the first number of the "Entomological Magazine," the introductory chapter of his "Monographia Chalciditum," a work on the minute parasitic Hymenoptera—a tribe of insects which he ever afterwards studied with the most assiduous attention, and one on which he immediately became the leading authority. He was then only twenty-three years of age; but his writings exhibited a depth of research and maturity of judgment which have rarely been excelled, and which abundantly evince the time and talent he had already devoted to these insects. It is worthy of notice that he now descended from the largest and most showy to the smallest and least conspicuous of insects, doubtless feeling that whereas among the magnificent butterflies there was but little opportunity for the discovery of novelties, among the Chalcidites everything was new—everything required that minute, patient and laborious investigation in which he seemed so especially to delight. Only two authors, Dalman and Spinola, had preceded him in devoting their attention to the structure

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of these atoms of creation ; and even these two had described comparatively a very small number of species.

In 1834 Mr. Walker, somewhat reluctantly, consented to undertake the editorial management of the "Entomological Magazine," and resigned the office the following year, yet continued a constant contributor to its pages. The same year he visited Lapland, in company with two of our most distinguished botanists ; and in this extreme north of Europe, and especially at Alten and Hammerfest, he assiduously collected insects, more particularly the northern Diptera, the Satyridæ among Lepidoptera, and the Chalcididæ amongst Hymenoptera. During this journey we have the first and only notice of his prowess as a sportsman ; he shot wild grouse and ptarmigan ; and on one solitary occasion was accessory to the death of a reindeer ; but as other rifles besides his own were simultaneously discharged, it is difficult to say whose was the effective bullet. I am glad to be able to record that Mr. Walker declined to give the poor creature the *coup de grâce*, and, for this especial purpose, resigned to another his *couteau de chasse*.

In May, 1840, he married Mary Elizabeth, the eldest daughter of Mr. Ford, of Ellell Hall, near Lancaster, and spent the summer on the Continent, again collecting in Switzerland with his customary assiduity.

In 1848 he explored the Isle of Thanet, the following year the Isle of Wight, and succeeding years, 1850 and 1851, he visited Geneva and Interlachen ; and during the former year commenced his great work on Diptera. This formed part of a projected series of works on British insects, to be called "Insecta Britannica," a project in which the late Mr. Spence took a deep interest.

During the year 1851 was published the first volume of the "Diptera." This work is printed in 8vo., and contained 314 pages ; the second volume appeared in 1853, and contained 298 pages ; and the third volume in 1856, and contained 352 pages. Thus the entire work comprised nearly 1,000 pages of closely-printed descriptions.

Another tour on the Continent occupied a considerable portion of 1857, Mr. Walker visiting Calais, Rouen, Paris, Strasbourg, Baden-Baden, Heidelberg, Wiesbaden, Frankfurt, Mayence, Cologne, Brussels, Aix-la-Chapelle and Antwerp. During the journey he collected in the Black Forest ; and this is the only scene of his scientific labours, during the tour, of which I have any intelligence.

The summer of 1860 was devoted to a thorough exploration of the Channel Islands. Dr. Bowerbank was his companion during a portion of the time, and, as a consequence, the sponges of these islands were a main object of research—the Gouliot caves in Sark, so celebrated for their marine productions, were a great attraction to both naturalists.

In 1861 Mr. Walker's excursions were chiefly confined to North Devon ; he visited Linton, Clovelly, Ilfracombe, Bideford, and Barnstaple ; and now his attention seems to have been again chiefly occupied with Lepidoptera, at the scarcity of which he was greatly disappointed, having expected, from the extensive woods, to have found moths particularly abundant.

In 1863 he toured the English lakes ; and, in the spring of 1865, North Wales and Ireland ; and in the autumn he again visited Paris, Geneva, Lucerne, Interlachen, and Altdorf, ascending the Righi, Mont Pilatus and the Mürren, and proceeding to Kandersteg, the Oeschinen See, and the Gemmi Pass.

In 1867 we find him again in France and Switzerland, ascending the Col de Voza, and examining the Jardin of the Mer de Glace ; thence over the Tête Noir to Martigny, Sion, and the Great St. Bernard ; returning by St. Maurice and the Villeneuve to Geneva.

In 1869 he made the tour of the Isle of Man, and returned by Holyhead ; in 1870 he paid another visit to Llanberis, as well as to all the more beautiful scenery in North Wales, crossing over to Ireland, and touring that island from south to north ; and in 1871, he examined entomologically the Scilly Islands, and the districts of the Lizard and the Land's End.

In 1872 he turned his attention to Italy, visiting Rome, Piza, Lucca, Florence, Naples, Sorrento, Capri, Milan, and Venice, as well as the Lakes of Como and Maggiore.

And, finally, in the present year, he had again proceeded as far as Aberystwith, on his way to Ireland, when his intention was frustrated by illness, which terminated fatally

on the 5th of October. He died in the most perfect peace of body and of mind. For many years Mr. Walker was a member of the Linnæan and Entomological Societies of London, but resigned his membership in both some time before the close of his life.

It might be excusable in a man of such incessant bodily activity—so locomotive by inclination, so devoted to the study of Nature in all her aspects, so diligent a collector of the objects of his favourite study—had he allowed his pen to rest while his hands were engaged in forming and arranging his collections. But this was not the case with Mr. Walker, as his Catalogues of the National Collection abundantly testify. Of the Lepidoptera Heterocera, alone, Mr. Walker catalogued and described upwards of twenty-three thousand species; in addition to which he prepared similar catalogues, although perhaps not to the same extent, of the Diptera, Orthoptera, Homoptera, Neuroptera, and part of the Hymenoptera: such an amount of labour, as is testified by these catalogues, has seldom, if ever, been accomplished by one individual. But this statement by no means represents the whole of his literary labours. He contributed shorter or longer papers to the Transactions of learned societies, and to the periodicals of the day, especially to the "Zoologist" and "Entomologist;" by the indexes of the latter I find he sent thirteen communications to the first volume, three to the second, one to the fourth, thirteen to the fifth, and forty-three to the sixth; during the present year his writings appear in every number. I intended to catalogue these and his other labours, to give some idea of the number of pages, number of species and dates of each; but I can scarcely now venture to look forward to the accomplishment of this labour of love.

A word remains to be spoken of the man, apart from the scientific and accomplished naturalist. Throughout my long life I have never met with any one who possessed more correct, more diversified, or more general information, or who imparted that information to others with greater readiness and kindness; I have never met with any one more unassuming, more utterly unselfish, more uniformly kind and considerate to all with whom he came in contact. It is no ordinary happiness to have enjoyed the friendship of such a man for nearly half a century.—*Edward Newman, in The Entomologist.*

#### PHILIP L. SPRAGUE.

Mr. Philip L. Sprague died at Montpelier, Vermont, his native place, on the 6th day of August last, in the forty-fifth year of his age. He was elected a member of our Society in 1860.

About 1862 he commenced the study of Entomology in the Vermont State Cabinet of Natural History, displaying a marked taste for the Lepidoptera, and during the intervals of his business made considerable progress in biological investigations, as well as in the technology of the science. Circumstances soon induced him to direct his attention chiefly to the Coleoptera, and here his assiduity in making collections, his accuracy in the determination of species, and his studies in the microscopic anatomy of this order, gave his opinions weight among naturalists. His keen appreciation of the labours of his predecessors, and his love of neatness and method, evinced themselves in all he did.

At the time of his death he had been for some months a valuable assistant and member of the Boston Society of Natural History, where many of his works remain to speak for themselves. Among his associates there he was distinguished for his geniality of manner and never-failing readiness to assist younger students. At the time of his death his fame and foreign correspondence were somewhat extended, and he was actively engaged in the preparation of materials for an illustrative cabinet of the Natural History of his native State. He had published from time to time in the *Canadian Entomologist* and the *Proceedings of the Natural History Society* carefully elaborated results of his work, and contributed to various other periodicals devoted to his favourite branch of investigation. His fine private cabinet of insects, principally of the Coleopterous Order, in accordance with his expressed determination, form a part of the Museum of the Society to which he was attached, and is in itself no mean monument to his memory.

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## ON CANKER WORMS.

BY W. SAUNDERS, LONDON, ONT.

Late in the fall, when many of the leaves have fallen and severe frosts have cut everything tender, and all nature begins to look bleak and cheerless, a walk in the woods on a sunny afternoon is not without its charms. Here and there slender, delicate, silky-winged moths may be seen flitting about, apparently in a somewhat aimless manner, enjoying the genial sunshine. On capturing one, and examining it closely, we find it to be a very handsome and delicately-marked moth, with wing structure so thin as to be almost transparent, and one is naturally led to inquire how it is that so frail a creature should select so frosty and bleak a season in which to appear among us. In reply to this reasonable inquiry it may be said that appearances are deceptive; that delicate as the structure of this moth appears to be, it is nevertheless one of the hardiest of its race, requiring, indeed, some considerable degree of cold for its perfection. These moths are the product of the Canker Worm, and the winged specimens are all males.

During the last few years several valuable papers have been published on the insects known as Canker Worms, in which has been detailed much hitherto unknown in connection with their life history. Prominent among these is a paper by C. V. Riley, St. Louis, Mo., in his Second Report on the Noxious Insects of the State of Missouri, and a recent paper of his in the Transactions of the St. Louis Academy of Science; also an article by B. P. Mann, in the Proceedings of the Boston Society of Natural History, and another by H. K. Morrison, in the 6th volume of the *Canadian Entomologist*. In the following summary of what is known respecting these insects we shall make free use of these, as well as previous writings, without further acknowledgment.

In 1795, Prof. W. D. Peck wrote his "Natural History of the Canker Worm." This paper was awarded a prize by the Massachusetts Society for Promoting Agriculture, and was published in their Proceedings. At this early period all the insects passing under this name were supposed to be one and the same species; but later and more careful observation has led to a modification of this view, and it is now universally admitted that there are two distinct species possessing similar habits, and having many points of resemblance—one producing the perfect insect in the fall, the other partly in the fall and partly in the spring, the former species being known under the name of *Anisopteryx pometaria*, the latter as a *Vernata*. The latter species will first claim our attention.

### *Anisopteryx Vernata.*



At *b* fig. 1 we have a representation of the egg of this species on an enlarged scale, the natural size being shown in the small cluster adjoining. In form it is not unlike a miniature hen's egg, but is of a very delicate texture and pearly lustre, with irregular impressions on its surface. The eggs are laid in masses, without any regularity or order in their arrangement, often as many as a hundred together, and secreted in the crevices of the bark of the trees infested. The eggs are usually hatched between the first and middle of May, about the time when the young leaves of the apple tree begin to push from the bud. The little canker worms, on making their escape from the egg, cluster upon and consume the tender leaves, and on the approach of cold or wet weather creep for shelter into the bosom of the expanding bud or into the opening flowers. The newly-hatched caterpillar is of a dark olive green or brown colour, with a black shining head, and a horny plate of the same colour on the second segment. When full grown they measure

about an inch in length, and present the appearance shown at *a*, fig. 1: in the same figure *c* represents a side view, and *d* a back view of one of the joints or segments of the body, enlarged so as to show their markings. These caterpillars are called "loopers," because they loop their bodies when in motion.

The colour of the body of the larva varies from greenish yellow to dusky or even dark brown. The head is mottled and spotted, and has two pale transverse lines in front; the body is longitudinally striped with many narrow pale lines; along the sides the body becomes deeper in colour, and down the middle of the back are some blackish spots. When not eating they remain stretched out at full length, and resting on their fore and hind legs under the leaves.

When full grown they leave the trees, either by creeping down the trunk or by letting themselves down by silken threads from the branches. When thus suspended in great numbers, as is frequently the case, under the limbs of trees overhanging roads and sidewalks, they become a great annoyance, especially to over-sensitive pedestrians, and are also often swept off by passing vehicles, and in this manner conveyed to other places. Having reached the ground, they soon begin to burrow into it, and having penetrated from two to six inches, a simple earthen cell is formed by compressing the earth, and lining it with a few silken threads; this makes but a fragile home for the chrysalis, and is easily broken to pieces.

The chrysalis, which is about five lines long, and one-and-a-half in diameter, is of a pale, greyish-brown colour, with a greenish tint on the wing-sheaths in the male; that of the female is more robust than the male, and both are sparingly pitted with shallow dots over their surface. Sometimes the chrysalis produces the perfect insect late in the autumn; in other cases it remains quiescent during the fall and winter months, emerging during the first warm days of early spring.

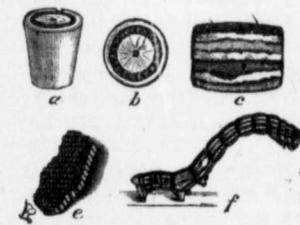
The female moths of both species of canker worm are wingless, and present a very odd, spider-like appearance (see *b*, fig. 2, and *b*, fig. 4), but with none of the activity of that predacious race with a body distended with eggs, she drags her weary way along in a most ungainly manner, until she reaches the base of a suitable tree, up which she climbs, and there awaits the arrival of the male. The abdomen of the female as well as that of the male of this species *vernata*, *b* fig. 2, have upon the hinder margin of each of the seven rings of the abdomen two transverse rows of stiff, reddish spines, pointing backwards. At *d* fig. 2, we have represented a joint of the abdomen showing these spines. *c* represents a portion of the antenna of the female, and *e* her retractile ovipositor.

The male, *a* fig. 2, is active, although a delicate and slender-looking creature. Its fore wings are ash-coloured or brownish grey, of a silky, semi-transparent appearance, with a broken whitish band crossing the wings near the outer margin, and three interrupted brownish lines between that and the base. There is an oblique black dash near the tip of the fore wings, and a nearly continuous black line before the fringe. The hind wings are plain, pale ash-coloured, or very light gray, with a dusky dot about the middle of each.

#### *Anisopteryx pomataria*.

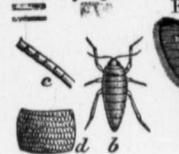
This species, although, as already remarked, closely resembling the preceding species, has many points of difference. The eggs—see *a* and *b*, fig. 3—are flattened above, have a central puncture and a brown circle near the border, and are laid side by side in regular and compact masses, *c* fig. 3, and are usually deposited in exposed situations.

The newly hatched caterpillar is pale olive green, with the head, and horny covering of the upper part of the second segment of a very pale hue. The full grown caterpillar, *f* fig. 3, is also differently marked; *c* represents a



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side view of a single joint of the mature caterpillar enlarged; the longitudinal lines are fewer in number, but broader and more distinct.

The chrysalis is much tougher than that of the former species, being formed of densely spun silk of a buff colour, interwoven on the outside with particles of earth.

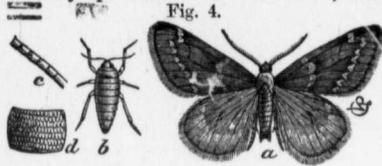


Fig. 4.

In the male moth, *a* fig. 4, the antennæ have a greater number of joints, there being fifty or more in this species, whereas in *vernata* there are not quite forty. The wings are less transparent but more glossy, the fore wings brownish gray but of a darker hue than in the other species, and are crossed by two more regular whitish bands, the

outer one enlarging near the apex, where it forms a large pale spot. The hind wings are grayish brown, with a faint central blackish dot, and usually a more or less distinct white band crossing them.

The female, also, has a correspondingly greater number of joints in her antennæ; the abdomen in both sexes is without spines, and that of the female terminates bluntly and is without an ovipositor. In fig. 4 *b* represents the female moth, *d* a segment of her abdomen, and *c* a portion of one of the antennæ.

Where the canker worms are numerous they are very destructive to apple trees, but are by no means confined in their operations to this particular tree; they also attack the plum, the cherry the elm and a variety of other trees. In most localities where they occur they multiply rapidly, often enormously, and do an amount of damage corresponding with their numbers. The very young worms on the trees are seldom noticed, but as they acquire age and increasing voracity the riddled and seared appearance of the foliage speaks unmistakably of their presence. In the New England States they have been a terrible pest for many years, and are now becoming plentiful in portions of Ontario particularly in some parts of the Niagara district.

#### REMEDIES.

In order to attack an enemy with success it is very essential that we know his vulnerable points. In the case of these insects, since the females are without wings, if they can be prevented from crawling up the trees to deposit their eggs a great point will be gained. Various measures have been recommended and employed to secure this end, and these remedies usually belong to one of two classes: first, those which prevent the ascension of the moth by entangling her feet and holding her there or by drowning her; and second, those which endeavour to accomplish the same end by preventing her from getting a foothold, and causing her repeatedly to fall to the ground until she becomes exhausted and dies.

The first class of remedies are probably the most effectual, and tar, applied either directly around the body of the tree or on strips of old canvas or stiff paper, is probably one of the cheapest and best of these. Refuse sorghum molasses, printers' ink or slow drying varnishes have also been recommended for use in the same manner. Tin, lead and rubber troughs to contain oil, belts of cotton wool, &c., also belong to this class of remedies, and have all been used with more or less success. In the use of any of the first named sticky substances it should be borne in mind that they must be kept sticky by frequent renewal of the surface in all mild weather or the application will be useless; they should also be applied as early as the latter part of October and kept on until the leaves are well expanded in the following spring. It must also be remembered that some of the moths, defeated in their attempts to climb the tree, will deposit their eggs near the ground or anywhere, in fact, below the application, and that the tiny young worms hatched from them will pass without difficulty through a very slight crevice; hence, whether troughs or bandages are used, precautions must be taken to fill up all the irregularities of surface in the rough bark of the trees, so that no openings be left through which they may pass. Cotton wool answers well in many cases for this purpose.

The second class of remedies consist of various ingenious designs for collars of metal, wood or glass fastened around the tree, and sloping downwards like an inverted funnel. These, although they prevent the moths from ascending the trees, offer little or no ob-

stacle to the ascension of the young caterpillar ; hence they often fail of success. The remedies belonging to the first class are then the surest and best ; and although it must be admitted that it involves much time and labour to renew from time to time, for so long a period, the tar or other sticky application, so as to make it an effectual bar to the ascent of the insect, as well as a trap for its unwary feet, still it will doubtless pay well wherever the canker worm abounds, to give this matter the attention requisite to make it a success. The limited powers of motion possessed by the female necessarily restrict it within a narrow circle ; hence it is very local in its attacks, sometimes abounding in one orchard and scarcely known in another a short distance off ; it follows that when once it has obtained a footing and is neglected it must multiply prodigiously.

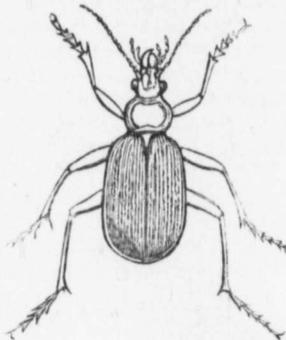
Fig. 5.



the golden green wing cases and beautiful varied hued body (*Calosoma scrutator*) (fig. 6). These active beetles may often be seen mounting the trunks of the trees and carrying off such soft-bodied worms. A species of wasp (*Eumenes fraterna*) is also said by Harris to store her cells with canker worms as food for her young, often gathering 18 or 20 of them for a single cell.

The canker worms moreover have natural enemies which prey upon them. A small mite (*Nothrus ovivorus*) has been observed devouring its eggs, and doubtless some of the active little birds which winter

Fig. 6.



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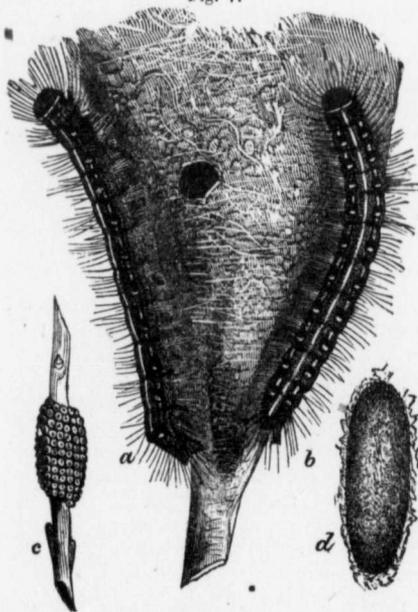
## NOTES OF THE YEAR.

BY W. SAUNDERS, LONDON, ONT.

During the past summer there has been an unusual scarcity of insect life. Whether this is to be attributed to the extreme severity of the winter, or to the very dry summer which preceded it, we are unable to determine; possibly both may have had something to do with the result. Our usually common butterflies were seldom seen during the summer, and those nocturnal visitors, the moths, as compared with the abundance of average years, were "few and far between." The same scarcity has been noted among our insect pests—the plagues of the gardener and fruit-grower. Some, which have been abundant for many years past, were notably scarce, viz.:

### THE TENT CATERPILLAR (*Clisiocampa Americana*), HARRIS.

Fig. 7.



Some years ago, the caterpillars of this species were enormously abundant. They were to be seen in almost every orchard, stripping the apple, cherry and plum trees of their foliage, and playing similar pranks among our thorn bushes, wild cherry trees, and other trees and shrubs in our woods and along our roadsides. Everyone must be familiar with the white web-nests of this caterpillar. They have, however, been lessening in numbers in the western portion of Ontario for several years past, until now their presence is scarcely felt as an annoyance. The lessening of this evil is doubtless due partly to the vigilance of our farmers and fruit-growers; for while with us this insect has been decreasing, in many parts of Lower Canada, where the cold of winter is much more intense than with us, the destruction of trees by this tent caterpillar is bitterly complained of, and they remain as abundant or more abundant than ever; and the same remarks will apply to some of the eastern sections of our own Province. We trust, also, that some portion of the credit of our almost exemption from this pest may be

due to the information scattered broadcast from year to year in our Annual Reports, by which our farmers and fruit-growers have been instructed how to contend with this and various other insect enemies in the most advantageous manner.

A cluster of the eggs from which these caterpillars hatch are shown at *c*, fig. 7. They are generally deposited during the month of July upon the smaller twigs of our fruit trees, each one containing upwards of 200 eggs, sometimes more, all enclosed in an oval ring-like cluster, firmly cemented together and coated with a varnish which is alike uninjured by sun or rain. About the time when the buds begin to burst, these caterpillars hatch, and at once begin to spin for themselves a web or covering, in which they can take

refuge from their enemies, or shelter from inclement weather. The web is spun in concert, each one doing his own part in the construction of this convenient home for the little community.

They have their regular times for feeding, issuing from the orifice of their tent in processional order, usually once in the forenoon and once in the afternoon. In about six weeks they become full grown, and then present the appearance shown at *a* and *b*, fig. 7; *a* shows a side view and *b* a back view of the same caterpillar. The body is black, about two inches long, with a white stripe down the back. On each side of this central stripe there are a number of short irregular longitudinal yellow lines. On the sides are paler lines, with spots and streaks of pale blue. The under side of the body is nearly black.

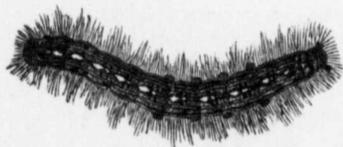
As these caterpillars approach maturity, they lose their social habits, and, leaving their friends and kindred, they wander about singly in all directions. The main object of this dispersion seems to be the finding of separate and secure retreats, in which to pass the chrysalis stage of their existence—in crevices in the rough bark of trees, on the lower edges of boards where they are nailed to the posts of fences, in holes in the posts, and in a variety of other situations of a similar character, where they will be sheltered from the weather. Here their cocoons are spun, and within the enclosure the larva changes to a chrysalis. The cocoon is oval, of a pale yellow colour (see *d*, fig. 7), and in its construction the silk is mixed with a pasty substance which, when dry, becomes powdery, and is partly removed from the surface of the cocoons by handling. The chrysalis, which lies within the cocoon, is about three-fourths of an inch long, and of a pale brown colour.

At the expiration of two or three weeks the moths escape from the cocoons. They are of a dull reddish colour, varying in depth of shade, with two straight whitish stripes, which extend across the fore wings obliquely, dividing the wing into three nearly equal portions. The females sometimes have the two stripes closer together; in the males they are less variable. The hind wings are nearly of the same colour as the front ones, but without any stripes. In both, the under surface is very similar to the upper, and the wings when expanded measure from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches or more.

The moths usually appear early in July, when, on sultry evenings, they come thumping against the lighted windows of our houses, and if they gain access, they fly about the lights in the room with great rapidity, and in the wildest and most bewildered manner, striking violently against any and every object which opposes their progress. A few days after their appearance on the wing they pair, and then the females begin to deposit their eggs on the twigs of our fruit trees, in the belt-like masses we have already referred to.

Another and a very similar species is known as the "Forest Tent Caterpillar" (*Clisiocampa sylvatica*), so called because it is frequently found on forest trees, although it is also very destructive to the apple. The eggs are laid in the same manner as the last species named, and in masses about the same size; the caterpillars, too, resemble each other, but may be at once distinguished by the peculiar markings down the back. In the former

Fig. 8.



species the white forms a continuous and prominent stripe; in this one the stripe is replaced by a row of white spots (see fig. 8). There are other minor points of difference, but this one character is invariable, and will enable any one to separate the species without difficulty. Some few years ago the western section of Ontario was overrun by this caterpillar, whole orchards having been completely defoliated as if a fire had passed over them, and the trees greatly damaged thereby; but the vigilance of our farmers, aided by the natural enemies of these insects, has been successful in reducing their numbers so considerably that they have ceased to be a source of much anxiety. These caterpillars usually select the side of a tree on which to spin their web, rather than a fork of one of the limbs, and when nearly full grown scatter as in the case of the other species, and wander about singly in search of suitable locations in which to spin their cocoons. These latter are scarcely distinguishable from that already described; the moths also may easily be confounded with those of *Americana*, but they are usually somewhat smaller in size and paler in colour, while the oblique lines on the anterior wings are dark in place of nearly white.

This insect is described in the species of parasitism; agency is concerned fully over one's tent they should be removed made in spring, they have escaped observation their small web s

This destructive appeared for the first western limits of this insect was given now within reach summary of the life its existence.

It was brought leaves, about the Quebec, in 1859, very abundant about 50 miles east and of 1866 we found Saguenay River, Hampshire, and Every year since rection, until now Md.; and west as it has been gradually and early this summer recorded captures

The cabbage spot on the front



the middle of the side of the fore wing the upper side in sides, except that specimens are four butterfly (*Colias pi*) The eggs of tenters of two or three very small that and under a sufficient sculptured. When tinge, and in about

This insect in the larva state is attacked by the same species of ground beetles as are described in the article on canker worms; they are also subject to the attacks of several species of parasites, which thin the ranks of the enemy most thoroughly. As far as man's agency is concerned, they are most effectually fought in the egg state; by looking carefully over one's trees during the winter season, the egg masses are readily detected, when they should be removed and destroyed. A second examination of the trees should be made in spring, when the young foliage begins to push forth; then any clusters which have escaped observation will be found to have hatched, when the young larvæ in their small web should be carefully collected and destroyed.

#### THE ENGLISH CABBAGE BUTTERFLY (*Pieris Rapæ*).

This destructive pest is rapidly spreading westward. During the past season it has appeared for the first time in London and the neighbourhood, and will probably reach the western limits of the Province before the end of the summer of 1876. A description of this insect was given in our Society's Report for the year 1871; but since that Report is not now within reach of many of our members, for their benefit we will again give a brief summary of the history of this insect, describing its appearance in the various stages of its existence.

It was brought to Quebec from Europe most probably in the egg state on cabbage leaves, about the year 1857 or 1858, its advent being chronicled by an entomologist in Quebec, in 1859, when the first specimens were captured. In 1863 the insect had become very abundant about Quebec, and was supposed at that time to have extended some 40 or 50 miles east and west of the city, but probably it had spread further, for in the summer of 1866 we found it very common about Chicoutimi, at the head of navigation on the Saguenay River, and during that same year the butterfly was taken in Vermont and New Hampshire, and by the end of 1870 had overspread a large portion of the middle States. Every year since its introduction the area occupied by it has been extended in every direction, until now it has spread as far east as Halifax, N. S.; farther south than Baltimore, Md.; and west as far as the western portion of Ohio. In Canada, during the same period, it has been gradually spreading westward. Last year it was common about Hamilton, and early this summer had extended as far as Paris, and later in the season the first recorded captures were made in London.

The cabbage butterfly is white, with a black dash at the tip of the fore wings, a black spot on the front margin of the hind wings, and in the male (see fig. 9) one black spot in

Fig. 9.

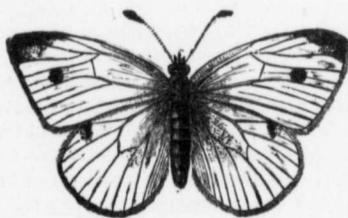
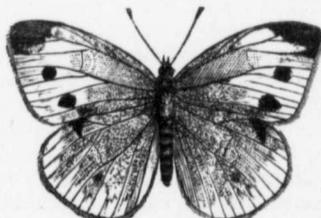


Fig. 10.



the middle of the fore wings, but in the female (see fig. 10) there are two. The under side of the fore wings in both sexes is marked by two spots, corresponding to those on the upper side in the female; in other respects the wings are very much alike on both sides, except that beneath there is a tint of yellow at the base and tip. Occasionally male specimens are found of a bright yellow colour, almost like our common sulphur yellow butterfly (*Colias philodice*).

The eggs of this insect are laid on the under side of cabbage leaves, singly or in clusters of two or three, where they are attached by some adhesive substance. They are so very small that they easily escape observation; in shape they resemble a sugar loaf, and under a sufficient magnifying power their surface appears beautifully ribbed and sculptured. When newly deposited the eggs are white, but they soon acquire a yellow tinge, and in about a week they hatch, the enclosed worm escaping by gnawing a hole

through the egg shell, after which it devours the remainder of the egg shell, and then sets to work with an insatiable appetite on the cabbage leaves.

Fig. 11.



In about a fortnight after hatching, the caterpillar (*a*, fig. 11) has acquired its full growth. It is then about an inch and a quarter long, of a pale green colour, finely dotted with black, with a yellowish stripe down the back, and a number of small yellowish spots forming a broken stripe along each side. When fully fed and about to transform, it leaves its food plant, and taking shelter under the coping of some wall or fence, or other convenient hiding place, there changes to a chrysalis. The chrysalis (*b*, fig. 11), which is somewhat variable in colour, is usually pale green, sprinkled with very small black dots. The period passed in the chrysalis state varies at different portions of the season. In the summer the chrysalis usually becomes a butterfly within a fortnight; later in the season it remains unchanged until the following spring. There are at least two, perhaps three broods during the year, and the ratio of increase of the insect is enormous.

The caterpillar is dreaded by cooks in every country where it prevails; it is not content with riddling the outside leaves, but prefers to secrete itself in the heart, so that every cabbage has to be torn apart and carefully examined before being cooked; and even after it has been dished up, one needs a watchful eye to avoid an undesirable admixture of animal with vegetable food.

#### REMEDIES.

One method suggested is to search for the eggs at the proper season and destroy them; another, to employ children with nets to catch the butterflies, and as these latter are rather slow and heavy flyers, this is not a difficult task; while a third method recommended is to lay boards between the rows of cabbages, supporting them two or three inches above the ground, with the view of luring the worms to select such places in which to pass the chrysalis stage of their existence, and so secure their destruction. Objections can be readily found to all these methods, but they are the best which man's experience has yet enabled him to devise. The use of poisons such as Paris Green and Hellebore is not admissible in this case on account of the difficulty of freeing the plant from such substances before cooking.

Nature has, however, provided a remedy; a small parasitic fly (*Pteromalus puparum*) attacks the chrysalis of this species in Europe, and, strange to say, has in some unknown manner also found its way to this country. This is a little four-winged fly about one-eighth of an inch long, with a yellowish body. The female flies about in search of the chrysalids, which she punctures with her ovipositor, inserting a number of eggs in each; in a short time these hatch into tiny grubs, which consume the substance of the chrysalis; as many as forty or fifty of these have been found in a single case. This little friend is now quite common in the State of New York, as well as in the eastern parts of Canada. It is probable that gardeners will suffer much from the depredations of the caterpillar for several years, until the parasite reaches us, and has multiplied to a sufficient extent to keep the depredator within moderate bounds. In the meantime it may be expected to extend its march westward and northward through our own country, and over the fertile plains of the neighbouring States away out to the far west.

#### THE PEAR TREE SLUG (*Selandria cerasi*).

In our Report last year we referred to this insect at some length, and detailed to some extent its ravages in our own neighbourhood. The havoc this disgusting little slug made among the pear trees was terrible, consuming the leaves so thoroughly that the trees looked as if they had been scorched by fire—in many instances every leaf dropped from the trees, leaving them for a time as bare as in midwinter; fully a thousand trees in the young pear orchard of the writer suffered severely. Following on the heels of this destructive pest we experienced a winter of unusual severity, when, as might be expected, a large number of these trees, thus weakened, perished from the cold. The extreme winter, however, was not an unmitigated evil. The low temperature which killed the en-

feebled trees opera has been that the scarcely any could be necessary to subdue th

Fig. 12.



watchfulness was re- bare. In 1875 little

Fig.



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Very different is the worm, (*Abraxis ribes* state, and hence did enduring the most sev- erant and destructive, not so easily destroyed should be made about sprinkle the bushes operator taking prop-

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Fig. 12.

pest, a small, black, four-winged fly, and fig. 13 the larva, or slug, in various stages of its growth. For the benefit of those who may not have the Report of last year to refer to, we would say that to shower the infested leaves from the rose of a watering-pot with powdered hellebore and water, in the proportion of one pound to a barrel of water, is so effectual that it leaves nothing further to be desired.



Fig. 13

#### THE GOOSEBERRY WORM (*Nematus ventricosus*).

This insect also was mentioned in our last Report as having been extremely abundant and very destructive; this summer, on the contrary, it has been unusually scarce. In past seasons constant

watchfulness was required to prevent the currant and gooseberry bushes from being eaten bare. In 1875 little or no effort has been needed to keep it within bounds. This insect

Fig. 14.



Fig. 15.

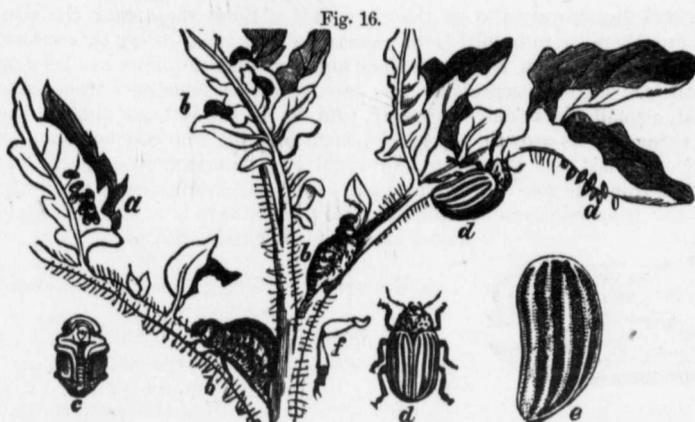


also passes the winter in the ground in the chrysalis state, and has probably suffered from the same causes which proved so fatal to the pear tree slug. To avoid misapprehension, we introduce again the figure of the larva (see fig. 14).

Very different is our experience with the other currant worm, known as the measuring worm, (*Abraxia ribearia*), shown at fig. 15. This creature passes the winter in the egg state, and hence did not seem to suffer at all, the eggs of insects being capable usually of enduring the most severe cold without injuring their vitality. This larva has been very abundant and destructive, probably more so in Western Ontario than ever before; they are not so easily destroyed by hellebore as the other species is. If used in the liquid state it should be made about double strength; probably the better plan in this case is to first sprinkle the bushes with water, and then dust the powdered hellebore lightly on, the operator taking proper care to avoid the inhalation of the dust.

#### THE POTATO BEETLE (*Doryphora decemlineata*).

This insect (see fig. 16) continues its progress eastward and southward. During



weeks without a particle of food, and could easily endure the abstinence which a voyage across the Atlantic would entail. Already many of the European Governments have taken measures of precaution against their introduction, and we sincerely hope that these measures may be successful. Throughout Ontario this insect has not proved so great a scourge as was anticipated, and notwithstanding the immense numbers in which they have appeared, they have scarcely influenced the price of that valuable esculent, the potato, not even in the worst affected districts. We can only attribute this result to the persistent application by our farmers of that valuable remedy, Paris green. Notwithstanding the outcries which some have made against its use, general experience has decided immensely in its favour, and it is almost universally used. During the past summer a series of interesting experiments have been carried on by the chemist of the Department of Agriculture in Washington, with the view of ascertaining how far the soil could be impregnated with Paris green without operating disastrously on vegetable growth. The results of these experiments have shown that any reasonable amount of Paris green required for the destruction of the potato beetle may be used without influencing the soil to the detriment of plant life to any perceptible extent.

It is nevertheless true that in many cases larger quantities of this poisonous substance have been used than there was need for, and some cases of irritation, arising from carelessly inhaling the dust of the powder while applying it, have been reported to us. The use of the Paris green with water is becoming much more general, and is highly approved of by those who have used it in that manner. If the Paris green be of good quality, from one to two teaspoonfuls will be sufficient for a pailful of water. This mixture is occasionally agitated so as to keep the powder suspended in the liquid, and applied with a whisk or small broom, which is first dipped in the liquid and then shaken over the vines. At first sight this seems a laborious process, but most of those who have tried concur in the opinion that it involves no more labour than is required for an application of the powder; that it takes much less Paris green to the acre, and has the additional advantage that it can be applied at any time during the day and in all weathers.

#### THE APPLE TREE BLIGHT.

This mysterious disease, which was first referred to in our last Report, if not on the increase throughout our Province, is in some districts manifesting an intensity which at first was not expected. This has been especially the case with the trees in the orchards and nursery of Mr. James Dougall, of Windsor. These were visited by the writer on the 10th of August last, in company with some friends, including Thos. Meehan, Editor of the *Gardener's Monthly*, Philadelphia, and Professors Beal and Cook, of the Agricultural College of Lansing, Michigan.

We found that, in addition to the ordinary form of this tree-blight affecting the twig

the past season it reached as far as Ottawa, and in some of the New England States has approached the sea shore. It is quite possible that before long it may cross the Atlantic secreted among the merchandise carried thither by vessels. During the summer they will survive many

of the current year some of the large limbs blighted the base of the blighted to the point of jointed into the woiness of the suggest what distinctive, its presence and developing features which close study to determine

The twig blight much as to give the circumference, and dis had also injured to these the injury spread downwards. Evidences of the of the outer bark, small trees the twigs remained apparently similar to that given had been smitten by of these, cutting away in most instances they had extended in their external appearance

of the current year's growth only, that there was a blight causing the entire destruction of some of the large limbs of several of the trees. Many of the twigs on these limbs had been blighted the previous year or years, and it is possible that this more serious blight of the limbs is but an extension and further development of the twig blight. On examining the base of the blighted twigs and fruit spurs it was found that where these were killed to the point of junction with the wood that the discolouration arising from the disease extended into the wood of the branch, which seems to point to the probability of the correctness of the suggestion just made. On the other hand, seeing that its character is somewhat distinctive, it may be inferred that it is an entirely different form, resulting from the presence and development of a different species of fungus; so obscure are the distinguishing features which separate these lower forms of vegetable life, that it would require much close study to determine this point.

The twig blight had affected many of the older trees in Mr. Dougall's orchards so much as to give them a decidedly withered and browned aspect, pervading the entire circumference, and distributed with much apparent regularity over their many branches. It had also injured to a very great extent the young apple trees in his nursery rows: in these the injury appeared to begin in the tips of the upper branches, and from thence spread downwards, extending in many instances half way down the trunk of the tree. Evidences of the extension of the blight were to be seen sometimes in the discolouration of the outer bark, in patches below apparently uninjured portions. In some of these small trees the twigs were blighted down the trunk to near its base, while the trunk remained apparently sound. The odour of the affected twigs, when broken, was very similar to that given off from pear blight. Many of the young trees in the nursery rows had been smitten by the disease early in the summer, and Mr. Dougall had pruned many of these, cutting away the whole of the diseased portion down to the healthy growth, but in most instances the blight attacked the remaining portions, and extending downwards involved more or less of the trunk to its base, indicating probably that the fungoid germs had extended in the sap through the adjoining tissues, without producing as yet any external appearance by which their presence might be recognised.

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## ON SOME OF OUR COMMON INSECTS.

BY W. SAUNDERS, LONDON, ONTARIO.

In accordance with the plan pursued in our Reports for several years past, we present our readers with a chapter on some of our common insects; and although in this instance we include some which are more or less injurious, still we think they claim attention more from the frequency of their occurrence than from the amount of injury they do. They also in some instances excite curiosity, and elicit admiration on account of their great beauty, or in consequence of their peculiarities.

### THE BEAUTIFUL DEIOPEIA (*Deiopeia bella*).

This lovely moth, represented in fig. 17 (after Riley), may well claim a place among the most elegant and beautiful of the Lepidoptera. Although rare in some parts of our Province, they are quite common in other localities. We have found them common in the neighbourhood of Port Stanley, on the shores of Lake Erie, and they are usually common and sometimes abundant about Grimsby, Ont. We have also seen them in insect collections from various parts of Canada.



Fig. 17.

This moth measures when its wings are expanded about one and a half inches. Its fore wings vary in colour from lemon yellow to orange, and are crossed by six white bands, each containing a row of black dots. The hind wings vary in colour from pink to scarlet red, with an irregular border of black behind. The fringes of the wings are white.

The under surface of both pairs of wings is of a deep red colour, with the front edge of the fore wings yellowish; the white bands on the upper surface of the fore wings are not reproduced, but the black dots are more prominent, and being more or less confluent, appear as broken bands. The hind wings are marked nearly as above.

The head is white, spotted with black; the shoulder covers white, with some yellow at the base, and two black dots on each; the thorax and abdomen whitish, the former with six black dots, the latter banded with black beneath.

### \* *Drasteria Erichtea* (CRAM.)

In fig. 18 we have this insect in the perfect state well represented. Although it is one of our commonest moths, a day-flier, abundant almost everywhere, yet we have never heard of its having had a common name bestowed upon it. We are not going to christen it, for we are no admirer of common names where they can be avoided, and we think they can in this instance. *Drasteria erichtea* is not harsh and unpronounceable, as is the case with many, especially of our more recent names, as well as some that have been resur-



Fig. 18.

rected, and those who do not care to burden their memories with both names, may drop the latter, and will still be understood if they speak of the moth as "the common *Drasteria*."

The female is 1 1/2 inches; the male a little less. The wings are marked with bands and dots from the base, and midway between the front edge of the wings black dots similarly also widely margin.

The inner part of the hind wing half is crossed by a pale line, which latter is very much faint.

The under surface of the wings is partially buff. *Drasteria erichtea* is common in the chrysalis stage in open fields and woods. Its flight is sudden.

The caterpillar is green, with longitudinal lines. The under surface of the wings is marked with stripes of a darker shade of the darker shade of the darker shade. The spaces between the stripes are of a feature only seen, and the attitude when disturbed.

The under surface of the wings is a still deeper shade, and extends its body into the segments. The feet are marked with darker dots. This is a common moth, and extends its body into the segments.

The specimens are common in the third week in September, and until early the following month.

This moth (see with a glossy surface) is common in the third week in September.

Fig. 19.



Colours, creamy white and purple.

The hind wings are marked with a few whitish pearly spots produced more prominently on the outer margin, extending to the tip.

The female moth, when its wings are spread, will measure about one and a half inches; the male about a quarter of an inch less. The fore wings are grayish brown, with bands and dots of dark brown; one band crosses the wing about an eighth of an inch from the base, and a second—which sometimes does not extend entirely across—is placed midway between the first and the outer margin. There is a dull patch of brown near the front edge of the wing, between the first and second bands, and two or three prominent black dots similarly situated between the second band and the apex; the outer edge is also widely margined with brown.

The inner portion of the hind wings is similar in colour to the front pair; the outer half is crossed by two darker bands irregular in outline, the space between them being occupied by a paler hue, as also is the space between the outside band and the hind margin, which latter is narrowly bordered with the darker shade. The markings on both wings vary much in intensity, being sometimes almost black, in other instances very faint.

The under surfaces of both wings are much paler, with the markings of the upper surface partially but indistinctly produced.

*Drasteria erichtea* appears among our earliest insects in spring, having passed the winter in the chrysalis state; it is also found up to quite a late period in the autumn. It frequents fields and meadows, and open grassy spots along the sides of our railroad tracks. Its flight is sudden, and after a short but rapid course, it as suddenly alights.

The caterpillar feeds on clover, and when full grown measures one and a quarter inches in length or more. It has a medium sized head, rather flat in front, with darker longitudinal lines. The body above is reddish brown, with many longitudinal lines and stripes of a darker shade. There is a double whitish line down the back, with a stripe of the darker shade of brown on each side, and lower down, close to the spiracles, is another stripe of the same dark hue, while between these two are faint longitudinal lines. The spaces between the segments, from fifth to eighth inclusive, are nearly black above, a feature only seen, however, when the body is coiled up; the larva readily assumes this attitude when disturbed.

The under surface is a little darker than the upper, with many longitudinal lines of a still deeper shade, and a central stripe of blackish green from the sixth to the ninth segments. The feet and prolegs are greenish and semi-transparent, with faint lines and darker dots. This larva has but three pairs of prolegs, and hence it alternately arches and extends its body in progression.

The specimens from which the above description was taken were full grown by the third week in September, when they became chrysalids, and remained in that condition until early the following spring.

#### THE BEAUTIFUL WOOD NYMPH (*Eudryas grata*).

This moth (see fig. 19) is truly a beautiful creature. Its fore wings are creamy white, with a glossy surface, with a wide brownish purple stripe along the anterior edge, reaching from the base to a little beyond the middle of the wing.

Fig. 19.



Colours, creamy white and brownish purple.

On the outer margin is a broad band of the same hue, widening posteriorly, with a wavy white line running through it, composed of minute pearly dots or scales. It is bordered internally with dull deep green. The brownish purple band is continued along the hinder edge, but it is much narrower here, and terminates a little before it reaches the base. There are also two brown spots, one round, the other reniform, near the middle of the wing, often so suffused with pearly white scales as to be indistinct above, but clear and striking on the under side.

The hind wings are reddish yellow, with a broad brownish purple band along the outer margin, extending nearly to the outer angle, and powdered here and there with a few whitish pearly scales; there is also a faint dot on the middle of the wing, which is reproduced more prominently on the under side. The under surface of both wings is red-

dish yellow. The head is black, and there is a wide black stripe down the back, merging into a series of spots of the same, which extend nearly the whole remaining length of body. The sides of the body are reddish yellow, with a row of blackish dots close to the under surface. The fore legs are beautifully tufted with white, the shoulder covers also are white, and so is the under surface of the body.

When this moth is at rest—that is, during the day time—its wings are closed like a roof over its back, and its tufted fore legs are stretched out.

The insect passes the winter in the chrysalis state, emerging as a moth from the middle of June to the middle of July. The earliest recorded date we have of the appearance of the moth is June 25th. It is usually common during the last week in June and the first in July, when it may often be found in the day time fast asleep on the leaves of the grape vine.

Soon after the moths appear they begin to deposit their eggs. These are among the prettiest and most beautiful of insect eggs; at *e*, fig. 20 (after Riley), we have a view of the upper surface, and at *f* a side view of this charming object. It is round and very flat; its colour is yellowish or greenish yellow, with an enclosed ring of black placed a little beyond the middle, and sometimes nearer to the outer margin. In the centre of the egg is a large, nearly round dot, and at a little distance from this a circle of smaller dots, from which arise a series of from 24 to 27 raised striae, diverging equally as they approach the outer edge, and crossed by many gracefully curving lines which interlace also the spaces between.

When mature, the young caterpillar escapes from the upper part of the egg, lifting the centre and rupturing the portion placed over the black ring. In some cases we have observed the eggshell to be eaten by the newly hatched larva; in others it remains almost untouched. The young larvæ have a strange habit of twisting their hinder segments and throwing them forward, resting on the anterior segments in a curious manner. At this age they eat small holes all over the vine leaves in different parts; they are often solitary, but sometimes two or three may be found on a single leaf.

When mature, the full grown larva appears as at *a*, fig. 20; it is then nearly one and a-half inches long, tapering towards the head, thickening towards the posterior extremity. The head is of an orange colour, with a few round black dots and pale brownish hairs.

The body above is pale bluish, crossed by bands of orange and many lines of black. Each segment, excepting the terminal one, is crossed by an orange band, all of which are nearly uniform in width, excepting that on the 12th segment, which is much wider. These are all more or less dotted with round black dots, from each one of which arises a single short brown hair. There are also crossing each segment six black lines, placed nearly at equal distances along each side, but with a wider space in the middle, where the orange band occurs. The twelfth segment is much raised, and the terminal one suddenly sloped. The under side is very like the upper, and also marked with orange and black; feet and prolegs orange, spotted with black.

The larvæ feed on Virginia Creeper (*Ampelopsis quinquefolia*) as well as on the grape-vine, and Mr. Bowles, of Montreal, has found them feeding on the hop.

When full grown, they descend to seek some secure retreat in which to pass the chrysalis, or inactive stage of their existence. They are fond of boring into old pieces of wood, and in the chambers thus formed they find secure lodgment; they will also bore into corn cobs. When rearing them we have supplied pieces of cork for this purpose, and have had as many as twenty-one chrysalids enclosed within two small bungs about  $1\frac{1}{2}$  inches in diameter, and one inch thick. The excavation is but little larger than the chrysalis which is to rest in it; it is not lined with silk, but is made moderately smooth, and is furnished with a cap or cover composed of minute fragments of cork, formed into a sort of membrane by means of a glutinous secretion mixed with threads of silk. When nicely finished, the surface of this cover is slightly glossy, the glossiness extending a little beyond the actual orifice, indicating that the glutinous matter has been of a thin consistency and has spread a little during its application. When the lid is lifted the head of the chrysalis is usually found quite close to it.

Fig. 21.



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Fig. 22.



cially pine stumps, a resembles the larva. This latter, however into and feeding on Apple, Pear, and es; the sudden death of

In our Report cecropia moth; the n

Fig. 21.



The chrysalis is about seven-tenths of an inch long, of a nearly uniform dark brown colour, and roughened with small blackish points or granulations.

This insect is subject to the attacks of a parasite, a two-winged fly—a Tachina—probably the species known as the red-tailed Tachina fly, *Exorista leucania* (see fig. 21, after Riley). It is not much unlike the common house fly in appearance, is about a quarter of an inch long, with a white face, large reddish eyes, a dark hairy body with four, more or less,

distinct lines down the thorax, and patches of a greyish shade along the sides of the abdomen. The parent fly deposits her eggs on the back of the caterpillar, usually a short distance behind the head, where they are cemented firmly by means of a peculiar secretion with which the insect is furnished. Three or four of these eggs are usually placed upon a single caterpillar, where, after a few days, they hatch, when the tiny worms eat their way through the skin into the interior of the body, where they feed upon the fatty matters, instinctively avoiding the vital organs. When the caterpillar is about full grown it dies, and from its body emerge these three or four full-grown whitish grubs, which soon after their exit change to chrysalids. These are nearly one-fifth of an inch long, oval, smooth and of a dark brown colour, from which in due time the perfect flies escape.

#### THE CYLINDRICAL ORTHOSOMA (*Orthosoma cylindricum*, FABR.)

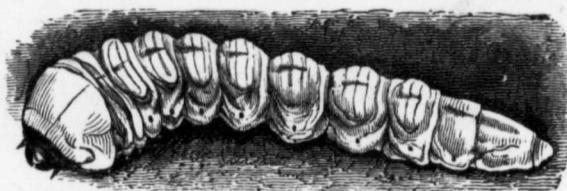
This formidable-looking, long-horned beetle, fig. 22, is very common in most portions of Ontario during the month of July. It flies at night with a rapid and noisy flight, entering the open windows of lighted rooms during the evenings, often to the great alarm of nervous inmates. This beetle measures an inch and a quarter, or even more in length, and is about one-third of an inch in width. Its body is long and narrow, and of a light brown colour, which assumes a darker shade on the head and antennæ. The thorax is furnished with three sharp teeth on each side, and each wing case has three slightly raised ribs or lines.

The larva of this insect inhabits decaying pine wood, espe-

Fig. 22.



Fig. 23.

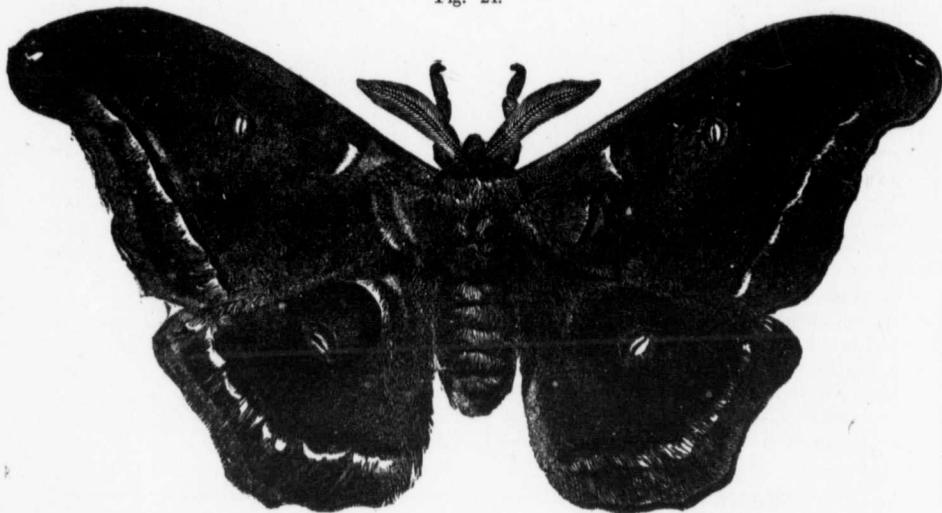


cially pine stumps, and is supposed to be several years in completing its growth; it closely resembles the larva of its near relative, *Prionus laticollis*, shown in fig. 23 (after Riley). This latter, however, differs somewhat in its habits and appetite, seeming to prefer boring into and feeding on living roots, such as those of the Lombardy Poplar, Balm of Gilead, Apple, Pear, and especially roots of the Grape-vine; in the latter case frequently causing the sudden death of the vines attacked.

#### THE AMERICAN SILKWORM (*Telea polyphemus*).

In our Report last year we gave our readers a sketch of the life history of our regal cecropia moth; the magnificent moth to which we now propose to refer is a fitting sequel

Fig. 24.



to that. It is, we think, one of the handsomest creatures in existence, with an expanse of wing of from five to six inches. In fig. 24 we have a representation of the male moth; fig. 25 shows that of the female.

Fig. 25.



The moth is usually of a rich buff or ochre yellow colour; sometimes inclining to pale grey or cream colour; at others assuming a deeper, almost brown, colour. Towards the base of the wings they are crossed by an irregular pale white band, margined with red; towards the outer margin is a stripe of pale purplish white, bordered within by one of rich deep brown. Near the middle of each wing is a transparent eye-like spot, with a slender line across the middle; those on the front wings are largest, nearly round, margined with yellow, which is edged outside with black. On the hinder wings the spots are more eye-like in shape, are margined with yellow, with a line of black margined with blue above, and the whole set in a large oval patch of deep rich brownish black, the widest portion of the patch being above the eye spot, where also it is sprinkled with bluish

atoms. The front or toothed, those than in the female lovely creature flies mistaken in the body, like those of showa. Early in throughout that n eggs, usually on t rally placed singly.

The egg is at convex portions w Boston, who has on the silk obtain the first volume o the day they are shells weigh only about one ounce. they weigh ten ti 620 times; forty weight, having co ing three-quarters



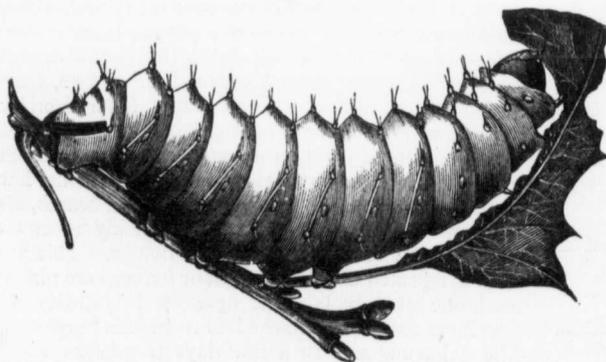
with six tubercles with a silvery spot and two on each uniting the lower longitudinally str colour, and the angular line simil

Having reach the branches for made, "it now," leaves to which to suitable, it begins near by, and by t leaf is made to ap three leaves are d directions, and so the most difficult chanical, the coc The silk is distri

atoms. The front edge of the fore wings is grey. The antennæ in both sexes are pectinate or toothed, those of the male (which are very beautiful) being much more deeply toothed than in the female—a character by which the sexes may be readily distinguished. This lovely creature flies only at night, and when on the wing is of such a size that it is often mistaken in the dusk for a bat. When at rest, the wings are held elevated above the body, like those of a butterfly; but, if disturbed, they are spread out flat, both pairs being shown. Early in June the moths first make their appearance, and they may be found throughout that month. In a few days they pair, after which the female deposits her eggs, usually on the under side of the leaves of the oak, maple or hazel; they are generally placed singly, but occasionally two or three may be found on the same leaf.

The egg is about one-tenth of an inch in diameter, convex above and below, with the convex portions whitish and the nearly cylindrical sides brown. Mr. L. Trouvelot, of Boston, who has reared great numbers of these insects for the purpose of experimenting on the silk obtained from their cocoons, gives the result of his valuable observations in the first volume of the *American Naturalist*. He says that one hundred of the eggs, on the day they are laid, will weigh eight grains; that one hundred and ten of the empty shells weigh only one grain, and that six thousand of the newly hatched worms will weigh about one ounce. They are not long, however, in increasing their weight; in ten days they weigh ten times their weight at birth; in twenty days, sixty times; thirty days, 620 times; forty days, 1,800 times; and in fifty-six days, 4,140 times their original weight, having consumed in this period about one hundred and twenty oak leaves, weighing three-quarters of a pound.

Fig. 26.



The larva when fully grown appears as represented in fig. 26; it then measures over three inches in length, with a very thick body. Mr. Trouvelot thus describes its appearance: "The head is of a light chestnut brown colour; the body of a handsome transparent light yellowish green, with seven oblique lines of a pale yellowish colour on each side of the body; the segments are each adorned

with six tubercles, giving rise to a few hairs, which are tinted sometimes with orange, with a silvery spot on the middle; there are six rows of protuberances, two on the back and two on each side, and the oblique lines run between the two rows of lateral tubercles, uniting the lower one to the upper one by a yellowish line. The under side of the body is longitudinally striped with a faint yellowish band; the spiracles are of a pale orange colour, and the feet are brown. The posterior part is bordered by a purplish brown angular line similar to the letter V."

Having reached maturity the larva begins to search about with a restless air among the branches for a suitable place in which to construct its cocoon. The selection being made, "it now," says Mr. Trouvelot, "feels with its head in all directions to discover any leaves to which to attach the fibres that are to give form to the cocoon. If it finds the place suitable, it begins to wind a layer of silk around a twig, then a fibre is attached to a leaf near by, and by many times doubling this fibre and making it shorter every time, the leaf is made to approach the twig at the distance necessary to build the cocoon; two or three leaves are disposed like this one, and then fibres are spread between them in all directions, and soon the ovoid form of the cocoon distinctly appears. This seems to be the most difficult feat for the worm to accomplish, as after this the work is simply mechanical, the cocoon being made of regular layers of silk united by a gummy substance. The silk is distributed in zigzag lines of about one-eighth of an inch long. When the co-

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coo is made, the worm will have moved his head to and fro, in order to distribute the silk, about two hundred and fifty-four thousand times."

"After about half a day's work, the cocoon is so far completed that the worm can hardly be distinguished through the fine texture of the wall; then a gummy resinous substance, sometimes of a light brown colour, is spread over all the inside of the cocoon. The larva continues to work for four or five days, hardly taking a few minutes of rest, and finally another coating is spun in the interior, when the cocoon is all finished and completely air-tight." The finished cocoon is shown in fig. 27.

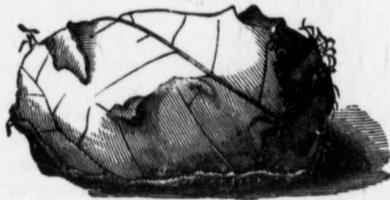


Fig. 27.

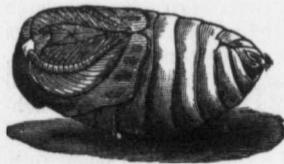


Fig. 28.

During this process of spinning, the larva, as might be expected, diminishes in size, which is due mainly to the enormous quantity of silk it has produced. Within two or three days after the completion of the cocoon, the worm sheds its larva skin and enters upon the chrysalis stage of its existence. The chrysalis (see fig. 28) is of a dark chestnut brown colour, its hind segment being armed with a small brush-like cluster of hooks. Through the anterior segments the antennæ, and —on a diminutive scale—the wings of the future moth may be clearly seen. In this condition the insect passes the winter, emerging as a moth in the following June.

This insect, especially in the larval state, is subject to the attack of many foes. It has been estimated that ninety per cent. and upwards of the larva fall a prey to insectivorous birds; the thrushes, catbirds and orioles are said to be especially active in this department. They also have their insect enemies. Besides the ordinary run of spiders, bugs, wasps, &c., they have a special and

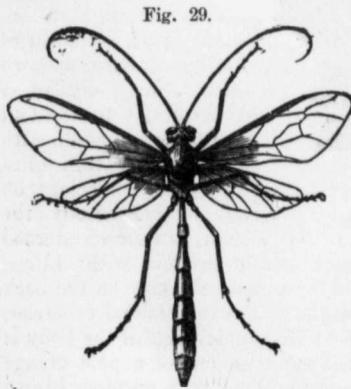


Fig. 29.

most dangerous foe in a species of Ichneumon fly, known as *Ophion macrurum* (fig. 29). This active creature may often be seen in summer flying about, searching among the leaves of shrubs and trees for her lawful prey; having found the object of her search, she watches her opportunity to place quickly upon the skin of her victim a small oval white egg. This process is repeated until some eight or ten eggs are placed, each one securely fastened by a small quantity of a glutinous substance attached to it for this purpose by the Ichneumon. In a few days these eggs hatch, when the tiny worms pierce through the skin of the caterpillar, and commence to feed on the fatty portions within. The caterpillar continues to grow, and usually lives long enough to make its cocoon, when it dies; and in the following summer, in place of the moth there issues its enemy, the Ichneumon parasite.

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## ON SOME OF OUR COMMON INSECTS.

BY R. V. ROGERS, KINGSTON, ONT.

### THE LUNA MOTH (*Actias luna*, LINN.)

If any of the insect host is a proof of high art in nature, and of the beauty of the Creator's thoughts, it is most assuredly the fair creature whose name is mentioned above. Allied to families whose members are among the greatest of the insect world, and having cousins and connections surpassing in size and beauty all others of their kingdom in this Dominion, still this moth is as pre-eminent above its fellows as is its namesake—the fair empress of the sky—above the lesser lights that rule the night.

So conspicuous is the Luna in her royal robes that she has a right to feel slighted at being thus long almost unnoticed in the pages of the ENTOMOLOGIST, and now it is hard upon her to be described among "Some of our Common Insects;" but blue blood always tells, and queenly grace and beauty will ever distinguish the Luna from among the *profanum vulgus* of the Articulata.

And now for a biographical sketch of this beauty from the cradle to the grave, and beyond that, after it assumes the resurrection attire, to that day when, its work accomplished, it lays itself down that its body may mingle again with its parent dust.

The eggs, which are more than one hundred in number, are of a dark brown or chocolate colour, smooth and .005 of an inch in length; the sides are flattened and of a lighter shade. In a fortnight the little larvæ begin to appear, making their escape into the outer world by eating an oval opening in the end of the shell. Now one can see that the inner surface of the egg is perfectly white. The little wriggling caterpillars, when they first emerge, are about .02 of an inch in length, and exhibit a black head, greenish on top and yellowish in front; a body black, adorned with two yellow spots on each segment, and decorated with numerous yellow hairs; the under part of the body and feet are of a light yellow. Some crawl about with the empty shell on their tails, others carry it as an umbrella over their heads, but the majority seem to discard it at once, as their human superiors do a friend from whom nothing more is to be expected. Some that I attempted to bring up by the hand, without the assistance of that most careful of mothers, Dame Nature, had in a week grown over a third of an inch in length, and showed the warts crowned with little hairs on each segment. In ten days they began to change their skin, having eaten so much that their first clothes had become too tight for them. Now they showed a head and body of light green, with yellow knobs on each segment: the hairy appendages were not so numerous or distinct as before, and a few of those on the front segments were dark. In a fortnight from its birth the largest one was nearly half an inch long, and when they had been in the land of the living for a month they were nearly an inch in length. When fully grown the head of the caterpillar is nearly elliptical in shape, and of a pearl colour; the rest is of a delicate pale and very clear bluish-green colour. A very pale yellow stripe extends along each side of the body, from the first to the tenth segment, just below the line of the spiracles; and the back is crossed, between the rings, by narrow transverse lines of the same colour. After the manner of its kith and kin, each segment is adorned with small pearly warts—tinged with purple—five or six in number, each furnished with a few little hairs. At the end of the tail are three brown spots, edged above with yellow.

When at rest, this magnificent caterpillar (which, by the way, is very similar to that of its congener, *Telea polyphemus*, save that the latter is destitute of the lateral yellow stripe, and the bands between the segments, the tail being bordered by a brown V-shaped mark) is nearly as thick as a man's thumb; its rings being bunched and body shortened, the length is only about two inches, but when it sets out on its travels, it stretches itself

to about three inches. In the CANADIAN ENTOMOLOGIST (vol. vi., p. 86) Mr. Gentry describes an interesting variety in which the general colour is a dull reddish brown; the lateral and transverse stripes of yellow have vanished, the abdominal spots shine conspicuously, but without the yellow edging; the pearl-coloured warts with their purple edge have, however, assumed a richer hue, and blaze like a coronet of rubies.

When the larva has passed its allotted days in eating the leaves of the hickory, beech, oak or walnut, and is thinking seriously of preparing its silken shroud and the casket in which it is to lie until its resurrection morn, it casts about and draws together two or three leaves of a tree, and within this hollow spins an oval and very close and strong cocoon of whitish silk. It is about  $1\frac{3}{4}$  inches in length, of a chestnut brown on the outside; very thin, and frequently rough on the surface; covered with warts and excrescences, but seldom showing the print of leaves. Harris says that the cocoons are formed on the trees, and that they fall to earth with the leaves shaken off by autumnal gales; but other observers assert that the larva crawls to the ground just before its change, and there prepares for its future transformations.

In this state, too, the Luna greatly resembles the Polyphemus, and many a collector having—after careful searching—got together a fair supply of what he deems Luna chrysalids, is greatly chagrined by finding dusky, one-eyed giant Polyphemi issue from the silken tombs, instead of a bright throng of empresses of the night in their delicate bridal attire. The Polyphemus cocoons are, however, white or dirty white; rather smaller than the Lunas, with rounded ends; sometimes angular, because of leaves moulded unevenly into the surface, and generally coated with a white powder.

About the month of June the Lunas awake from their long and death-like sleep, burst asunder their cerements—having first loosened the compact threads by ejecting a liquid—and issue forth in all their glory, no more to be mistaken for the sober one-eyed Cyclopeans, but resplendent in gay attire. The wings, which expand from  $4\frac{3}{4}$  to  $5\frac{1}{2}$  inches, are of a delicate light green colour, and the hinder ones are each prolonged into a tail of an inch and a half or more in length—longer, indeed, than those of the day-flying Papilios. Along the front edge of the fore wings is a broad purple-brown stripe, extending also across the thorax, and sending backwards a little branch to a glittering, eye-like spot near the middle of the wing. These eyes (of which there is one on each of the wings) are transparent in the centre, and encircled by rings of white, yellow, blue and black. The hinder borders are more or less edged with purple brown. All the nervures are very distinct and pale brown. Near the body the wings are densely covered with hairs. The under sides are similar to the upper, except that an indistinct undulating line runs along the margin of both wings.

As for the body that bears these lovely appendages, the thorax is white, sometimes yellowish or greenish, crossed by the purple-brown stripe that traverses the whole length of the upper edge of the front wings; the abdomen is of the same colour as the thorax, and covered with white hairs like wool. The head is white and small, and adorned with wide, flat and strongly pectinated antennæ of a brownish tinge. The legs are purple-brown.

Such is Luna in her various transformations to outward appearance; notwithstanding her size and loveliness, her habits and peculiar instincts are not very noteworthy. The gift of superior beauty, as among the highest of animals so in the insect world, is not frequently accompanied by remarkable intelligence or superior sense; and the most gaudy butterfly or moth is a fool in comparison with the dingy-coloured bee. The caterpillars of butterflies and moths have some various instincts—chiefly in the direction of silk spinning and sepulchre building—but the perfect insects only live “to increase and multiply their race, and embellish nature. Their existence in the perfect state is usually very brief; it is one of the prettiest of honeymoons, and often love subdues and destroys every other passion. The gourmandizing caterpillar is never troubled by the ardent flame which consumes even the thought of sipping the nectar of the flowers that rival in beauty the wings of the perfect representation of elegance and love. The early insect lives and eats, and the perfect form lives and dies.”

## THE

In our last Ann  
account of the Locust



gleaned from various

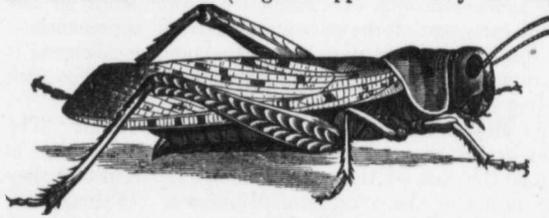
During the present season has been very much injured from the devastation of the locust, where very few localities where the crop (October 30, 1875) was lately harvested at Pembina, and in the drained land. Effort for the few hours in which the garden with a ditch have been successful “Many of the farmers to eat, as they had at the Penitentiary, in the effects of the ravage. With regard to the future will be felt for some time, cal facts as to its percentage examined, and the future where nature has determined means and labour in of this Province will losses from this plague and lessened, by unit will be, with industry.

Another writer in 1875 gives the following and the southern shore chiefly settled and in spite of the grasshopper Ontario. Instead of Baie St. Paul and French sown, as did most of appeared, turned out

## THE WESTERN LOCUSTS.

BY THE REV. C. J. S. BETHUNE.

In our last Annual Report (1874) we devoted a considerable portion of our space to an account of the Locusts (or grasshoppers as they are improperly termed), which were so



destructive that year throughout large tracts of country in Manitoba and the neighbouring regions of British America, and in many of the States between the Rocky Mountains and the Mississippi River. We now propose to supplement that account by information that we have

gleaned from various sources, and that, we trust, will prove interesting to the reader.

During the present year (1875) it is cheering to find that the extent of the plague has been very much diminished, and that many portions of the West are rapidly recovering from the devastation and suffering of the previous year. In the Province of Manitoba, where very serious havoc has been committed by the insect, there are this year many localities where the injury is but trifling. To quote a correspondent of the *Toronto Globe* (October 30, 1875)—“No better wheat and potatoes can anywhere be found than were lately harvested at Portage La Prairie and along the Red River between Fort Garry and Pembina, and in the neighbourhood of St. John. All this is spring-sown, in rich, well-drained land. Efforts in the infested regions, made by settlers and their families during the few hours in which the locust rested, such as building fires, surrounding the field or garden with a ditch into which the insects fall and drown, beating them with bushes, &c., have been successful in saving large parts of the crops.” On the other hand, he states: “Many of the farmers this year let their fields go waste rather than plant for the locusts to eat, as they had done for two years. In the gardens of Government House and of the Penitentiary, in the old field at Kildonan, and along the banks of both rivers, we saw the effects of the ravages. The garden of Deer Lodge was destroyed in a few hours.” With regard to the future he adds: “It is generally hoped that but little of this plague will be felt for some years in Manitoba. The grounds for such confidence are the historical facts as to its periodicity, the great numbers of the parasites found on the specimens examined, and the fact that the locusts flew off without depositing their eggs. In lands where nature has dealt with less lavish hand the farmer might well hesitate to embark his means and labour in tillage; but the great returns which the marvellously rich, deep soil of this Province will yearly produce, will doubtless allow an ample margin for periodical losses from this plague, and these losses too may be anticipated, and to a great extent met and lessened, by united skilful effort when the lands become settled, as no doubt they soon will be, with industrious farmers using all modern means of agriculture.”

Another writer in the same newspaper (Mr. J. M. Machar—*Daily Globe*, Dec. 18, 1875) gives the following information respecting Manitoba:—“Between the Assiniboine and the southern shore of Lake Manitoba there lies a district of about ten miles square, chiefly settled and farmed by emigrants from Ontario. These farmers have harvested, in spite of the grasshoppers, a two-thirds crop, which is better than an average crop in Ontario. Instead of sowing nothing, as did many of their neighbours in the parishes of Baie St. Paul and Francois Xavier, or watching the grasshoppers devour what they had sown, as did most of the others, these brave men sowed in hope, and when the enemy appeared, turned out and fought him. I saw a forty-acre field of splendid wheat at Port-

age Creek, which had been saved by spreading a swathe of straw across the middle of the field; then the whole family armed themselves with boughs, and forming line drove the grasshoppers before them into the straw. When evening came a match was applied, and in five minutes nothing was left of the invaders but their horny coverings, which, at the time of my visit in August, still littered the ground in millions."

#### THE LOCUSTS IN THE WESTERN STATES.

Throughout the Western States that lie beyond the Mississippi River, where last year fully one hundred thousand people were estimated to have been seriously affected by the plague of locusts—many being reduced to poverty and starvation—this year the actual suffering has been comparatively slight. From the official reports of the Department of Agriculture at Washington, we gather that the dreaded locust "seems to be perishing from the assaults of parasites; its demonstrations of destructive power were far less formidable than last year." In the early part of the season very serious apprehensions were felt as to the safety of the crops in many localities, but as the summer advanced it was found that though much injury was inflicted in particular places, there was no such wide-spread havoc as in the preceding year.

In the "Monthly Report" for May and June, for instance, it is stated that "The destructive locust, *Caloptenus spretus*, has recommenced its depredations west of the line of the Missouri, and in some counties to the east of that river. It was reported that they were hatching in immense numbers in five of the counties of Minnesota. In some cases they were burned in great numbers in piles of straw. In Missouri they were very destructive in the north-western part of Vernon County; in Platte they swept all the grain and grass crops; they were also a terrible scourge in five other counties. (All of these suffered severely last year—they lie along the western boundary of the State.) In Kansas they had eaten all the stacked tame-grass hay and all the old meadows, twenty-five per cent. of the wheat, and most of the growing corn-plants; in Marshall County they destroyed wheat, oats and gardens; Leavenworth records the most terrible visitation yet known—the popular dismay is indescribable. Similar reports come from seventeen other counties. In some villages the streets are covered with these insects. Fruit-trees have in many cases failed to bear, from the fact that they were last year deprived of all their foliage and young-wood growth by these pests. From some counties come bitter complaints of the falsehoods of newspaper writers and others, palliating or denying the real extent of the disasters. These false representations are made in the interest of speculative property-holders, who fear a depreciation of their investments. In a few counties the injuries have as yet been small, but all such places are yet liable to destructive visitation. The cotton-plant was especially relished by these insects. In Nebraska they had destroyed twenty per cent. of the small grain, and were still at work. In Colorado they were numerous and destructive in three counties."

In the *Prairie Farmer* of the 29th of May it is stated that "the reports from the grasshopper regions of Missouri, Kansas and Nebraska are somewhat conflicting, yet on the whole a little more cheerful from many localities than they were last week. From Sedalia, Missouri, comes an account of three deaths from starvation. At a meeting held at Jefferson City, it was stated that suffering in many parts of the State was imminent, and it was resolved that the Governor should appoint commissioners in every county of the State to solicit relief, and that collections for the sufferers should be taken up in all the churches on the Fast Day, June 3rd." This 'Fast Day' was appointed by proclamation of the Governor of the State of Missouri, as a day of fasting and prayer to Almighty God for deliverance from the plague of locusts, and was, on the whole, very religiously observed throughout the State.

The same paper quoted above relates further that the ravages still continue in the neighbourhood of St. Joseph. "The feeling regarding them varies with localities; some are despondent, while others think the damage will be light. The people of Nebraska generally are reported to be very hopeful; they believe that the entire corn crop at least will be saved. They have developed in patches, but are doing less harm than was anticipated."

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In the next issue of the *Prairie Farmer* (June 5th) a further account is given of the locust ravages, as follows:—

"Though in many localities the locusts have begun to try their wings, they do not yet seem ready for a prolonged or general flight. They seem to fly short distances in all directions, though we hear little of encroachments on new ground to the eastward. A few days more will settle the question as to direction and probable damage. All we know now is that in Missouri there is already considerable suffering among the people. A meeting was held at Independence on the 31st. From all portions of the county there came sad accounts of suffering. A relief committee was appointed. From Lexington we hear that the locusts are still at work, with no immediate prospect of leaving. A committee for relief purposes has been appointed. At Fort Scott, Kansas, the pests are reported as on the wing for the north-west. At Olathe they are moving northward. We have few particulars from Nebraska, but from what we do hear, conclude that there is little cause for alarm. The same may be said of Minnesota. In Nebraska, however, there is developing disease among the people, resulting from the privations of the past few months. Scurvy prevails to a considerable extent."

The July "Monthly Report of the Department of Agriculture" at Washington gives a record of the plague of locusts, from which we gather the following:—

"They appeared in several counties of Minnesota. Blue earth offered a bounty for their destruction. About 20,000 bushels were collected and destroyed at a cost of \$32,000, without perceptibly diminishing their numbers." They were very destructive in three other counties, but were comparatively innocuous in the rest from which reports had come. In Iowa, Montgomery County had a very destructive visitation in the western part, the greatest injury being to the corn crop. They are also noted in eight other counties. In Missouri they did serious damage in several of the counties mentioned in the preceding month's report. "They swept away all the crops in Clay County; in Carroll they chewed tobacco." In Texas they were injurious to the cotton-plant. In Kansas they inflicted a very serious amount of damage; in three counties, three-fourths of the crops were destroyed; they were "very bad" in fourteen more counties; while lighter visitations were reported from six others. In Nebraska they are reported as more or less injurious in thirteen counties.

After this the various records show a brighter state of things, the numerous ravages already referred to proving, in many instances, much less serious than was at first apprehended. A correspondent of the *Prairie Farmer*, writing from Johnson County, Nebraska, on the 29th of July, states that "the grasshoppers hatched and commenced eating the wheat on April 28th, and stayed with us until June 13th. They commenced flying when the wind was north-west, and continued to fly up to the 27th of June—some days partly in clouds that could be seen when three miles off, but they did not light much in our county. As to wheat, there may be one-third of a crop of inferior quality, but potatoes and grass never looked better. If nothing happens to the corn, it will be the largest crop raised in the county." Another correspondent from the same State, writing a fortnight later, says: "We have splendid prospects for crops of all kinds planted since the grasshoppers left. Most of our small grain has been harvested, threshed and marketed by the grasshoppers, and so far we have not received any returns; but we have the best prairie grass I ever saw. If the frost holds off as late as usual, we shall have a large quantity of corn and buckwheat." The "Monthly Report" from Washington, for August and September, mentions locust ravages in a few counties of the States of Minnesota, Iowa, Missouri, Kansas and Nebraska, but notices a great decrease in the reported devastations. "The pest," it states, "is evidently declining very fast, and the earnest hopes of a cessation of their ravages expressed by our correspondents appear to have a solid foundation in facts." The very perceptible reduction in the extent of the plague is attributed to the immense development of parasites upon the bodies of the locusts. The reports for the three remaining months of the year all show that "the plague was stayed" before it caused the utter ruin that was so widespread during the previous year. To give a few instances out of many:—A writer from Minnesota says, "I cannot report in comparison with last year, as we then produced nothing of any account, owing to destruction by grasshoppers. This year all kinds of crops raised here are generally good. The end of the season finds the farmers in better condition than for three or four years." Another from Clay County,

Missouri, writes: "Since the destruction by the grasshoppers, crops of all kinds have grown beyond precedent as to quantity and quality. Food for stock is abundant, and pastures abound with rye instead of blue-grass." A third, from Kansas, the State that has suffered most of all from the locusts, states that "the failure of wheat, oats, timothy, clover, flax, &c., by ravages of the grasshopper, caused the planting of an extraordinary breadth of corn, potatoes, beans, buckwheat and vines of all kinds. Then the finest season for the growth of these crops has brought our farmers bountiful harvests of them." Others from different parts of the same State write: "Last year we had almost nothing; this year we have great abundance." "All our crops were destroyed last year, while this year they are all good." "Last season we had nothing worth noting; this season our crops are large beyond any precedent." From Nebraska, it is reported that "neither corn nor potatoes were raised last year; the whole crops were destroyed by grasshoppers; this season we have the best crops ever raised."

From the foregoing Reports it is evident that the locust visitation of this year, though very alarming in the earlier portion of the season, has proved to be of only moderate importance. No doubt there have been here and there, in the infested region, individual cases of extreme suffering, but the general population have escaped without any serious hardship. Where the invading horde of locusts makes but one attack, there is no doubt that it can be repelled and got rid of by vigorous efforts, especially if the population is sufficiently dense to admit of concerted action over a considerable area; but, on the whole, it is apparent that natural causes alone have operated in the reduction of the great army, and that no human measures have had any appreciable effect in averting a repetition of the frightful sufferings of the ever memorable "Locust Year," 1874.

#### MEANS OF REDUCING THE RAVAGES OF THE LOCUSTS.

In our Report of last year we gave an account of various methods that may be employed in the reduction of the ravages of the locusts; since its publication much has been said and written in different quarters upon the same subject, as, from the vast amount of devastation caused by the insect, it had become a matter of supreme importance to the people of the whole continent, whether personally affected or not. Naturally, therefore, the subject came up for discussion at the meeting of the American Association for the Advancement of Science, held at Detroit in August last. Papers were there read by Dr. LeConte, of Philadelphia, retiring President of the Association, the most eminent of American Entomologists, and Professor Riley, the State Entomologist of Missouri, who has made the locusts a subject of personal study since their appearance in his State. As Dr. LeConte's paper has already been quoted by Mr. Saunders in the earlier portion of this Report, we need only desire the reader to refer to it there.

From Professor Riley's paper, which was of considerable length, we make the following quotations, which the reader will observe set forth for the most part similar modes of prevention to those briefly suggested by us in our last Report (pages 40 and 41):—

"The means to be employed against the ravages of the locust in the more fertile country subject to its periodical visitations, but in which it is not indigenous, may be classed under five heads:—1. Natural agencies. 2. Artificial means of destroying the eggs. 3. Means of destroying the unfledged young. 4. Remedies against the mature or winged insects. 5. Prevention.

"1. *Natural Agencies.*—These are, 1st., climatic conditions which induce disease and prevent the insect's continued multiplication in much of the country it invades. 2nd. Natural enemies, consisting of birds, reptiles and mammals which devour, or in other ways destroy it, and of predaceous and parasitic species of its own class. The agencies in the first and last categories are beyond man's control, and will do their appointed work uninfluenced by his action; but the others are more within his control. Almost all birds inhabiting the western plains feed upon the locust and its eggs, and the prairie chicken and quail are untiring in this good work. The States subject to locust ravages should pass more stringent laws for the better protection of these game birds, with which the markets of the East are annually glutted. Many of the harmless reptiles—toads, snakes and lizards—should be spared from the ruthless war which most persons, ignorant of their habits, wage against them.

"2. *Artificial means.*—In his warfare against the locust, the European and Asiatic Government has just beneath the surface, and high, dry ground completely filled with them, and out exposing them, and quite whitish as the numbers will be destroyed more exposed to the sun and desiccating in the plough, many of them late the next year to bring the eggs to the surface, the eggs, and they may be stock can be confined by the trampling. All the eggs are too often should be collected and destruction in the way destroyed is equivalent amount of destitution and that in many sections, words, the earth was: Legislatures of those liberal price per bush treasury for this purpose most in need of assistance.

"3. *Destruction of the young.*—to, heavy rolling, when of them, but is most a drive almost as readily windrows or piles of brush, me that by far the most young locust armies—straw to burn—is by the sides, offers an effectual and die at the bottom necessitates the covering is best to dig pits or to mulch, and may be by mighty locust plague; thorough and effectual such evil as that which tempts at ditching by often divert the encroachment you may rest assured he refers to such slow where a ditch, such as around a field about half and by that time the should hatch within the of the field.

"There are various them into converging at each end, and then cross rags and dipped in coal

"2. *Artificial means of destroying the Eggs.*—The fact that man can accomplish most in his warfare against locusts by destroying the eggs, has long been recognised by European and Asiatic Governments liable to suffer from the insects. The eggs are laid in masses, just beneath the surface of the ground, seldom to a greater depth than an inch; and high, dry ground is preferred for the purpose. Very often the ground is so completely filled with these egg-masses, that not a spoonful of the soil can be turned up without exposing them, and a harrowing, or shallow ploughing, will cause the surface to look quite whitish as the masses break up and bleach from exposure to the atmosphere. Great numbers will be destroyed by such harrowing or ploughing, as they are not only thereby more exposed to the attacks of natural enemies, but they lose vitality through the bleaching and desiccating influence of the dew, and rain and sun. If deeply turned under by the plough, many of them will rot, and the young that chance to hatch will come forth too late the next year to do much harm—providing the same ground be not re-turned so as to bring the eggs to the surface in the spring. Excess of moisture for a few days is fatal to the eggs, and they may very easily be destroyed where irrigation is practicable. Where stock can be confined and fed on soil filled with such eggs, many of these will be destroyed by the trampling. All these means are obviously insufficient, however, for the reason that the eggs are too often placed where none of them can be employed. In such cases they should be collected and destroyed by the inhabitants, and the State should offer some inducement in the way of bounty for such collection and destruction. Every bushel of eggs destroyed is equivalent to a hundred acres of corn saved, and when we consider the amount of destitution caused in some of the Western States by the locust invasion of 1874, and that in many sections the ground was known to be filled with eggs—that, in other words, the earth was sown with the seeds of future destruction—it is surprising that the Legislatures of those States did not make some effort to avert future injury by offering a liberal price per bushel for the eggs. A few thousand dollars taken out of the State treasury for this purpose would be well spent, and be distributed among the very people most in need of assistance.

"3. *Destruction of the Unfledged Young.*—As I have stated in the articles already alluded to, heavy rolling, where the surface of the soil is sufficiently firm, destroys the larger portion of them, but is most advantageously employed when the insects are most sluggish. They drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. But the experience of the present year convinces me that by far the most effectual way for man to protect his crops and do battle to these young locust armies—especially where, as in West Missouri, this spring, there was no hay or straw to burn—is by ditching. A ditch two feet wide and two feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the hoppers will accumulate, and may be buried. We hear much talk about the powerlessness of man before this mighty locust plague; but I am quite confident that here we have a remedy that is at once thorough and effectual, whereby the people of some of the States, at least, may avert in future such evil as that which befel them this spring. There have been a number of partial attempts at ditching by simply turning a couple of furrows with the plough. Even these will often divert the encroaching insects from their course; but they can never be relied on, and you may rest assured that whenever you hear a man declare that ditching is no protection, he refers to such slovenly half-made ditches. No instance has come to my knowledge where a ditch, such as I first described, has failed to effectually keep off the insects. Made around a field about hatching time, no hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the inclosure, they are easily driven into the ditches dug in different parts of the field.

"There are various other ways of catching and destroying the young locusts, as driving them into converging barriers by means of ropes dragged on the ground, with a person at each end, and then crushing them with shovels or burning them by means of torches made of rags and dipped in coal oil and attached to sticks; catching them with nets, &c.; but nothing

equals ditching. As for protecting plants by the application of powders and liquids, I have come to the conclusion that it is out of the question.

"If the eggs are duly destroyed, there will be no trouble from the young locusts; but where these once abound, pecuniary inducement to collect and kill them should be offered by the State. It is one of the best means of giving aid and employment to the sufferers, who cannot pursue their ordinary avocations till the plague measurably leaves or is banished.

"In this connection I would also urge the employment of military force, a large amount of which, in times of peace, could be ordered into the field at short notice.

"To many, the idea of employing soldiers to assist the agriculturist in battling with this pest may seem amusing and farcical enough, but though the men might not find glory in the fight, the war—unlike most other wars—could only be fraught with good consequences to mankind. In Algeria, the custom prevails of sending the soldiers against these insects. While recently in the south of France, I found, to my great satisfaction, that at Arles, Bouche du Rhone, where the unfledged locusts (*Caloptenus Italicus*, a species closely allied to the Rocky Mountain locust) were doing great harm, the soldiers had been sent in force to battle with them, and were then and there waging a vigorous war against the tiny foes. A few regiments, armed with no more deadly weapon than the common spade, sent out to the suffering parts of Missouri, Kansas and Nebraska last spring, might, in a few weeks, have entirely routed this pygmean army, and materially assisted the farmer in his ditching operations.

"A few other suggestions, and I will dismiss this part of the subject. Hogs and poultry of every description delight to feed on the young hoppers, and will flourish where these abound when nothing else does. It will be well, in the event of a future invasion, for the people in the invaded districts to provide themselves with as large a quantity as possible of this kind of stock. Where no general and systematic efforts were made to destroy either the eggs or the young locusts, and it is found that, as spring opens, these young hatch out in threatening numbers, the intelligent farmer will delay the planting of everything that he cannot protect by ditching, until the very last moment, or till toward the end of June—using his team and time solely in the preparation of his land. In this way he will not only save his seed and the labour of planting, and, perhaps, replanting, but he will materially assist in weakening the devouring armies. Men planted this spring and worked with a will and energy born of necessity, only to see their crops finally taken, their seed gone, and their teams and themselves worn out. The locusts finally devoured every green thing, until, finding nothing more, they began to fall upon each other and to perish. This critical period in their history would have been brought about much earlier if they had not had the cultivated crops to feed upon; and if by concert of action this system of non-planting could at first have been adopted over large areas, the insects would have been much sooner starved out and obliged to congregate in the pastures, prairies and timber. Moreover, the time required for early planting and cultivating, if devoted to destroying the insects after the bulk of them hatch out toward the end of April, would virtually annihilate them.

"4. *Destruction of Winged Insects.*—Man is comparatively powerless before the vast swarms that wing their way from their native breeding places, and this part of the subject may be passed over in this connection.

"5. *Prevention.*—What I have so far said is, perhaps, of more interest to the farmer than to the members of this association; but in dealing with the fifth mode of counteracting the injuries of the Rocky Mountain locust, I appeal more especially to your wisdom and judgment. Prevention, in dealing with insect ravages, is always better than cure. 'A little fire is quickly trodden out, which, being suffered, rivers cannot quench.' The proper way to deal with this insect is to attack it in its native breeding places.

"In my seventh Report I have shown that the insect is not autochthonous in much of the more fertile country it devastates, and that it never extends east of the 17th meridian. I have also given reasons for believing that the swarms from which we most suffer originate in the Rocky Mountain regions of Dakota, Wyoming, Montana and British America. Our efforts should be directed to its restriction within its natural limits.

"In conclusion, the most important results are likely to flow from a thorough study of the Rocky Mountain locust in its native haunts and breeding places. By learning just when and how to strike the insect, so as to prevent its undue multiplication there—whether by some more extensive system of irrigation, based on improved knowledge of the topography and water supply of the country, or by other means of destroying the eggs—we

may hope to prevent it can never be acquired and should receive the question of saving to it filched from the product three years to many in commonwealth on the tract of country extendment the ravages of

We have quoted is just as applicable to United States and the

As a result of the the American Association memorial to the Congress many most influential

The text of the Should the Congress we trust they will, it appoint a similar Commission concern vast areas of the locust, it is evident Mountains lying between the north as well, of the insect, or at any limits of our country entomologist to the settlement discovered that the loc any special locality of expenditure of public and strive by every means would be a thousand in Manitoba, and by the settlement of the Province not unite in the endeavor of little avail. Just as those about him allow cannot hope to free themselves of the United States be wise to lose no time indigenous to British America towards the accomplishment

Since the above vote of the United States it has been received a reference was made to the Hessian fly, &c. have suffered a loss that hardly cover the loss in Minnesota \$80,000 was

The Bill authorizing the National Academy of Agriculture, to serve five years' term, including expenses, &c. T injurious to the great chinch-bug, Hessian fly to Congress at least one

may hope to prevent the fertile States to the east from future calamity. This knowledge can never be acquired by any single individual. The subject is of national importance, and should receive the consideration of the National Government. It is not merely the question of saving to the nation, in future, such vast sums of money as this insect has filched from the producers of some of the Western States (amounting during the past three years to many millions of dollars); it is a question affecting the welfare of the whole commonwealth on the other side of the Mississippi, and the ultimate settlement of a vast tract of country extending from the base of the Rocky Mountains eastward, to which settlement the ravages of the locust in question offer the most serious obstacle."

We have quoted somewhat fully from Prof. Riley's paper, as almost every word of it is just as applicable to the Dominion of Canada and the Province of Manitoba as to the United States and the State of Missouri.

As a result of the papers of Messrs. LeConte and Riley, the standing Committee of the American Association authorized the circulation, for the signatures of members, of a memorial to the Congress of the United States; we understand that it was signed by many most influential and distinguished members.

The text of the memorial will be found in the introductory portion of this report.

Should the Congress of the United States accede to the prayer of this memorial, as we trust they will, it is earnestly to be hoped that the Legislature of the Dominion will appoint a similar Commission, to co-operate with that of our neighbours in all matters that concern vast areas of the continent, and not merely particular localities. In the case of the locust, it is evident that an exploration of the British American portion of the Rocky Mountains lying between the 49th and 51st parallels of latitude, if not somewhat further to the north as well, is urgently needed with a view to the discovery of the native haunts of the insect, or at any rate to the settlement of the question whether it breeds within the limits of our country or not. Much indeed might be done by the addition of a competent entomologist to the staff of the various surveying parties that are from time to time sent out for the settlement of boundaries, and the surveying of railway routes. Should it be discovered that the locusts do deposit their eggs and come to maturity year after year in any special locality on the eastern slope of the Rocky Mountains, then it would be a wise expenditure of public money to send a properly equipped party to the haunt of the enemy, and strive by every means to accomplish his extermination. The expenses of such a force would be a thousand times repaid by the saving of the crops and fruits of the farmers of Manitoba, and by the removal of what is felt by many to be a serious drawback to the settlement of the Province. Should our neighbours, however, south of the 49th parallel, not unite in the endeavour to keep the enemy in control, any labour on our part would be of little avail. Just as a farmer cannot hope to exterminate the thistles from his fields, if those about him allow the weed to scatter its seeds with every wind that blows; so we cannot hope to free our own territory from recurring plagues of locusts, if the Government of the United States do not join with us in the work. In any case, however, it will be wise to lose no time in discovering, by careful exploration, whether the insect is indigenous to British America or not. The settlement of this point will be one great step towards the accomplishment of an efficient protection against future invasions.

Since the above was written we learn that a Bill has been introduced into the Senate of the United States by the Hon. Mr. Ingalls, for the Protection of Agriculture, and that it has been received and referred to a Committee. In the introduction of the Bill especial reference was made to the depredations of locusts, chinch-bugs, army-worms, cotton-worms, the Hessian fly, &c. It was stated that the farmers of the United States are estimated to have suffered a loss last year of \$200,000,000 by these insects, and that \$40,000,000 would hardly cover the loss by locusts alone; it was further declared that in seven counties of Minnesota \$80,000 were expended in destroying 60,000 bushels of locusts.

The Bill authorizes the Secretary of the Interior to appoint, upon the nomination of the National Academy of Sciences, a Commission, to consist of three eminent entomologists, to serve five years, at a salary of \$5,000 per annum each, and to be allowed travelling expenses, &c. They are to devote themselves to the investigation of insects most injurious to the great staples, especially the Rocky Mountain locust, the army-worm, chinch-bug, Hessian fly and cotton-worm. The results of their labours are to be reported to Congress at least once a year.

It is evident that the memorial of the American Association, referred to above, has already produced an effect upon the Legislature of the United States. We have little doubt that the Bill, with perhaps some slight modifications, will be passed by Congress; and we have equally little doubt that, if the work is entrusted to the right men, we shall soon observe some very important results, that will speedily repay the nation many times over for any expenditure that may be incurred. We trust now that the matter will be brought before the consideration of the Legislature of the Dominion, in order that there may be the fullest co-operation with the work on the other side of the line.

#### LOCUSTS AS AN ARTICLE OF FOOD.

The use of locusts as an article of food was referred to in our last Report, where, after mentioning various instances in which different species of the insect have been made use of in this way in many parts of the world, we stated that "it remains to be proved that a nutritious article of food may not be obtained from the Rocky Mountain locust (*Caloptenus spretus*); certainly it is an experiment worth trying; if successful we should have a double benefit—the lessening of the numbers of the locusts and the supply of food wherewith to meet the famine that they have produced." We are glad to find that our friend, Professor Riley, who has had excellent opportunities for the purpose, has made the experiment with decided success. From his paper on the subject, read before the American Association, we make the following extracts:—

"Whenever the occasion presented, I partook of locusts prepared in different ways, and one day I ate of no other kind of food, and must have consumed, in one form and another, the substance of several thousand half-grown locusts. Commencing the experiments with some misgivings, and fully expecting to have to overcome disagreeable flavour, I was soon most agreeably surprised to find that the insects were quite palatable, in whatever way prepared. The flavour of the raw locust is most strong and disagreeable; but that of the cooked insects is agreeable, and sufficiently mild to be easily neutralized by anything with which they may be mixed, and to admit of easy disguise, according to taste or fancy. But the great point I would make in their favour is, that they need no elaborate preparation or seasoning. They require no disguise, and herein lies their value in exceptional emergencies; for when people are driven to the point of starvation by these ravenous pests, it follows that all other food is either very scarce or unattainable. A broth, made by boiling the unfledged *Calopteni* for two hours in the proper quantity of water, and seasoned with nothing in the world but pepper and salt, is quite palatable, and can scarcely be distinguished from beef broth, though it has a slight flavour peculiar to it and not easily described. The addition of a little butter improves it, and the flavour can, of course, be modified with mint, sage and other spices, *ad libitum*. Fried or roasted in nothing but their own oil, with the addition of a little salt, they are by no means unpleasant eating, and have quite a nutty flavour. In fact it is a flavour, like most peculiar and not unpleasant flavours, that one can soon learn to get fond of. Prepared in this manner, ground and compressed, they would doubtless keep for a long time. Yet their consumption in large quantities in this form would not, I think, prove as wholesome as when made into soup or broth; for I found the chitinous covering and the corneous parts, especially the spines on the tibiae, dry and chippy, and somewhat irritating to the throat. This objection would not apply with the same force to the mature individuals, especially of larger species, where the heads, legs and wings are carefully separated before cooking; and, in fact, some of the mature insects prepared in this way, then boiled and afterward stewed with a few vegetables and a little butter, pepper, salt and vinegar, made an excellent fricassee.

"Lest it be presumed that these opinions result from an unnatural palate, or from mere individual taste, let me add that I took pains to get the opinions of many other persons. Indeed, I shall not soon forget the experience of my first culinary effort in this line—so fraught with fear and so forcibly illustrating the power of example in overcoming prejudice. This attempt was made at an hotel. At first it was impossible to get any assistance from the followers of the *ars coquinaria*. They could not have more flatly refused to touch, taste or handle, had it been a question of cooking vipers. Nor love nor money could induce them to do either, and in this respect the folks of the kitchen were all

alike, without distinction and operations once gent ladies were so and pleasant odour gradually vanished cook—a stout and dishes were neatly and many expressions this same cook was how, finally, a prod meal. The soup so enough to hold the locusts with or without baked locusts and distinguished prophet his diet in the wild School, who made slowly for three or it made an excellent Johanot, who is s

"I sent a bus known caterers of which was really d who tried it. Sha pages are devoted sprinkled with salt that this locust sou highly esteemed by bill of fare every d on a brisk fire, hav whole being occasi fried brown, or a p a broth by placing broth is passed thr of fried ones with persons, including *Entomologique de F* was expected, and others fried in but

Mr. Riley con own personal exper than many animals particularly, becau according to the n no chemical analy ered from the fact and the further fac grow fat upon the

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alike, without distinction of colour. There was no other resource than to turn cook myself and operations once commenced, the interest and aid of a brother naturalist and two intelli- gent ladies were soon enlisted. It was most amusing to note how, as the rather savoury and pleasant odour went up from the cooking dishes, the expression of horror and disgust gradually vanished from the faces of the curious lookers-on, and how, at last, the head cook—a stout and jolly negress—took part in the operations ; how, when the different dishes were neatly served upon the table and were freely partaken of with evident relish and many expressions of surprise and satisfaction by the ladies and gentlemen interested, this same cook was actually induced to try them and soon grew eloquent in their favour ; how, finally, a prominent banker, as also one of the editors of the town, joined in the meal. The soup soon vanished and banished silly prejudice ; then cakes with batter enough to hold the locusts together disappeared and were pronounced good ; then baked locusts with or without condiments ; and when the meal was completed with dessert of baked locusts and honey *à la* John the Baptist, the opinion was unanimous that that distinguished prophet no longer deserved our sympathy, and that he had not fared badly on his diet in the wilderness. Prof. H. H. Straight, of the Warrensburg (Mo.) Normal School, who made some experiments for me in this line, wrote : ‘ We boiled them rather slowly for three or four hours, seasoned the fluid with a little butter, salt and pepper and it made an *excellent* soup, *actually* ; would like to have it even in prosperous times. Mrs. Johonnot, who is sick, and Prof. Johonnot pronounced it excellent.’

“ I sent a bushel of the scalded insects to Mr. Jno. Bonnet, one of the oldest and best known caterers of St. Louis. Master of the mysteries of the cuisine, he made a soup which was really delicious and was so pronounced by dozens of prominent St. Louisans who tried it. Shaw, in his *Travels in Barbary* (Oxford, England, 1738), in which two pages are devoted to a description of the ravages of locusts, mentions that they are sprinkled with salt and fried, when they taste like craw-fish ; and Mr. Bonnet declared that this locust soup reminded him of nothing so much as crawfish bisque, which is so highly esteemed by connoisseurs. He also declared that he would gladly have it on his bill of fare every day if he could get the insects. His method of preparation was to boil on a brisk fire, having previously seasoned them with salt, pepper and grated nutmeg, the whole being occasionally stirred. When cooked they are pounded in a mortar with bread fried brown, or a puree of rice. They are then replaced in the saucepan and thickened to a broth by placing on a warm part of the stove, but not allowed to boil. For use, the broth is passed through a strainer and a few croutons are added. I have had a small box of fried ones with me for the past two months, and they have been tasted by numerous persons, including the members of the London Entomological Society and of the *Société Entomologique de France*. Without exception they have been pronounced far better than was expected, and those fried in their own oil with a little salt are yet good and fresh ; others fried in butter have become slightly rancid—a fault of the butter.”

Mr. Riley concludes his interesting account by saying, “ I can safely assert from my own personal experience, that our Rocky Mountain locust is more palatable when cooked than many animals which we habitually use on our tables. I mention the species more particularly, because the flavour will doubtless differ according to the species, or even according to the nature of the vegetation the insects were nourished on. I have made no chemical analysis of this locust food, but that it is highly nourishing may be gathered from the fact that all animals fed upon the insects thrive when they are abundant ; and the further fact that our locust-eating Indians, and all other locust-eating people, grow fat upon them.

“ Locusts will hardly come into general use for food except where they are annually abundant, and our western farmers who occasionally suffer from them will not easily be brought to a due appreciation of them for this purpose. Prejudiced against them ; fighting to overcome them, killing them in large quantities, until the stench from their decomposing bodies becomes at times most offensive—they find little that is attractive in the pests. For these reasons, as long as other food is attainable, the locust will be apt to be rejected by most persons. Yet the fact remains that they do make very good food. When freshly caught in large quantities, the mangled mass presents a not very appetizing appearance, and emits a strong, and not over-pleasing odour ; but rinsed and scalded, they turn a brownish red, look much more inviting, and give no disagreeable smell.

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“ The experiments here recorded have given rise to many sensational newspaper paragraphs, and I consider the matter of sufficient importance to record the actual facts, which are here given for the first time.

“ Like or dislike of many kinds of food are very much matters of individual taste, or national custom. Every nation has some special and favorite dish, which the people of other nations will scarcely touch, while the very animal that is highly esteemed in one part of a country is not unfrequently rejected as poisonous in another section. We use many things to-day that were considered worthless or even poisonous by our forefathers. Prejudice wields a most powerful influence in all our actions. It is said that the Irish, during the famine of 1857, would rather starve than eat our corn bread; and if what I have written shall in the future induce some of our western people to profit by the hint, and avoid suffering from hunger or actual starvation, I shall not have written in vain.”

Like the mysterious individual who first tasted oysters, and introduced them to the favourable consideration of the world, we certainly think that Prof. Riley deserves the thanks of the community for his courage in making the experiment of eating locusts, and the zeal with which he carried it out. No doubt our north-western friends, in the Province of Manitoba, especially those of French descent, who are usually more skilled in the arts of cookery than their Anglo-Saxon or Irish neighbours, will ere long look upon Prof. Riley as a public benefactor—one who has introduced a new and estimable addition to the luxuries of the table.

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